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Measuring Digital Financial Literacy: Scale Development and Validation

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Abstract

Digital financial literacy is projected to become an increasingly significant part of education in the digital age, both in India and around the world. To create programs to raise the level of financial literacy among people in the digital age, it is essential to measure the level of digital financial literacy among various societal segments. The study aims to provide a validated tool for measuring the digital financial literacy of individuals in developing countries, like India and also to analyze the significance of its key dimensions. Also, the level of DFL among respondents in the National Capital Territory (India) was measured. The study adopted the widely used scale development paradigm provided by Churchill (1979). The empirical data was collected using two online surveys with 145 (N1) and 323 (N2) sample sizes, which were analyzed with factor analysis using International Business Machines (IBM) Statistical Package for Social Sciences (SPSS) and IBM SPSS Analysis of Moment Structures (AMOS) statistical software. The proposed digital financial literacy scale consists of twenty-two statements under five key aspects of digital financial literacy, which are: Digital Financial Risk and Control; Basic Digital Financial Knowledge; Advanced Digital Financial Knowledge; Digital Financial Attitude, and Digital Financial Behavior. The proposed Digital Financial Literacy Scale demonstrated sound psychometric properties, encouraging its future usage for assessing the digital financial literacy of individuals. Furthermore, it can help organizations and concerned authorities compare individuals' digital financial literacy levels pre- and post-implementation of Digital Financial Literacy Awareness campaigns.

Keywords: Digital Financial Risk and Control; Basic Digital Financial Knowledge; Advanced Digital Financial Knowledge; Digital Financial Attitude, Digital Financial Behavior; Scales' Validation

JEL Classifications: O33; O35; G21; G51; G53

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1. Introduction

The digital revolution is still going on, and everyone is starting to feel its repercussions. Over the past ten years, a growing trend in digital financial products and services has been noticed. Digital Financial Services (DFS) have gained popularity across the globe and are currently thought to be the most promising method for facilitating financial inclusion and enabling financial access (GPFI, 2016; Lyons, Kass-Hanna, & Greenlee, 2020; OECD/INFE 2018). A large range of DFS have been designed, launched, and are being utilized by customers in India, supporting both the efforts of the Indian government and the mindset of the general public towards the adoption of new technology. DFS implies access to and use of financial services through the digital platform at any time. Thus, DFS has been widely used in recent times, and DFS integrates the economy by introducing revolutionary digital financial products and services such as virtual banking, Application Programme Interfaces (APIs), alternative credit scoring mechanisms, digital lending, and so on (OECD, 2018). Given the prevalence of DFS, it is vital to raise the level of concern among people in order for them to attain financial well-being (Zhang, 2021). This points towards the growing need for raising the level of digital financial awareness among people.

Digital Financial Literacy (DFL) is on the rise thanks to the Fintech movement and the existence of mobile phones across more than 67 percentage of the world's population. A promising strategy for achieving inclusive finance is digital finance (He & Li, 2020). The World Bank's recent demand for Universal Financial Access (UFA) by 2020 demonstrates the importance of financial inclusion on a global scale. According to study findings, fostering inclusion and financial resilience requires both financial and digital literacy as essential components (Kass-Hanna, Lyons, & Liu, 2022). Although the OECD 2017 has highlighted several characteristics of DFL, there is still no agreed definition. DFL is an essential requirement for the effective usage of digital financial services and DFL is an important component of education in this digital age (Morgan et al., 2020). The digital version of the standard Financial Literacy is referred to as DFL (Prasad et al., 2018; Setiawan et al., 2020). When evaluating the implications of digitalization, digital and financial literacy should be taken into account simultaneously since growing access to digital finance through digital literacy without financial literacy might be risky (Prete, 2022). Kumar et al. (2019) focused on young financial inclusion awareness and chose digital banking as the optimal method for promoting DFL. Financial inclusion is improved via DFL. They also discovered that, due to security concerns, youth lacked confidence in the use of digital technologies in financial transactions.

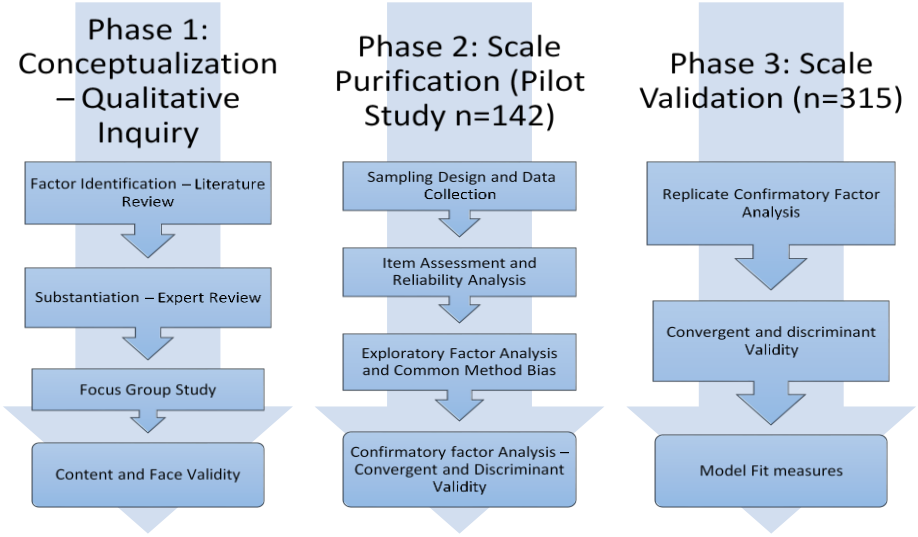
Given the studies reviewed, it is found that the field of Digital Financial Literacy is new in literature (Alliance for Financial Inclusion, 2021) and needs to be explored because of its immense potential in the digital age. There is a great need to define and develop a validated measure to assess the digital financial literacy (Morgan et al., 2019). More international studies are required to understand the effects of the financial services industry's rising digitization (Seldal & Nyhus, 2022; Kass-Hanna, Lyons, & Liu, 2022), which further emphasizes the significance of assessing financial literacy in the digital age. Tian (2022) suggested the residents themselves should speed up the cultivation of digital financial literacy, which is of vital significance for lowering household leverage ratio and systemic financial risks. However, no study has suggested a psychometrically validated scale to gauge one's level of DFL. People must possess the knowledge and abilities necessary to conduct digital financial transactions and use digital devices like mobile phones, smart phones, and tablets in order to successfully participate in the digital

economy (Carlin et al., 2019; Vogels & Anderson, 2019; Kass-Hanna, Lyons & Liu, 2022). Additionally, it is crucial to continuously track people's levels of digital financial awareness as well as the variables that influence them in order to design digital financial education programs. Therefore, it is important for the government, educational institutions, and financial organizations to highlight and promote digital financial education to all societal segments. This aids policymakers and organizations in recognizing current gaps and taking the necessary actions to close them. To fill this void, the present study aims to propose a validated scale for measuring the DFL level of individuals in developing countries like India and also analyze the significance of its key dimensions. Also, the level of DFL among respondents in the National Capital Territory (India) was measured.

2. Scale development Methodology and analysis

The study adopted the widely-used scale development paradigm provided by Churchill (1979). Phase 1 is a qualitative inquiry in which items were identified through previous studies and discussion with academic experts; Phase 2 is scale refinement, which includes a pilot study, and item analysis using EFA and CFA; and Phase 3 is scale validation and final study. Figure 1 illustrates the process.

Figure 1: Methodology for scale development



Source: Churchill (1979)

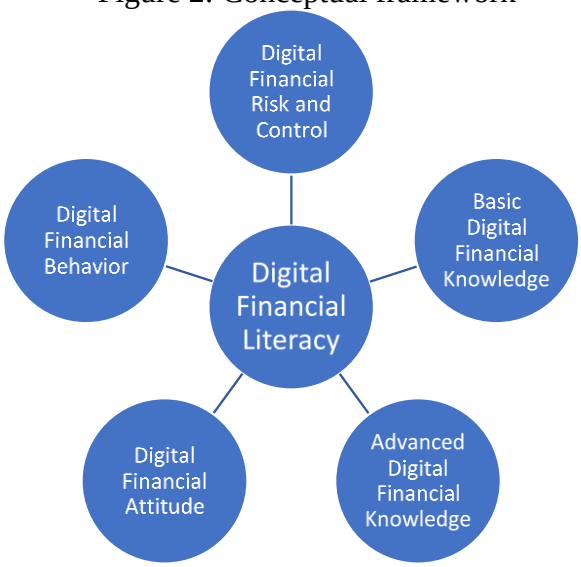
2.1 Phase 1: Conceptualization – qualitative inquiry

2.1.1. Factor Identification- Literature review

The term Digital Financial Literacy (DFL) is a multifaceted term that includes both digital literacy and financial literacy (Morgan et al., 2019). The three major elements of financial literacy that are defined in the OECD notion of DFL are digital financial knowledge, digital financial attitude, and digital financial behavior (OECD, 2022). As per Rajdev et al. (2020), the three criteria for evaluating DFL are knowledge of digital financial goods and services, awareness of digital financial risk and its management, and knowledge of consumer rights and dispute resolution procedures. DFL combines money management, financial education, and digital literacy. The experiences of AFI network members demonstrate that the concept of DFL includes awareness of DFS and the competency to independently use relevant DFS; awareness of relevant DFS-related risks

and the competency to prevent these risks when using DFS; and awareness of related consumer protection and redress mechanisms, and the competency to seek the same when necessary. DFL is defined by Bangko Sentral ng Pilipinas (BSP) as the ability of a customer to use a variety of DFS with awareness and complete faith in their benefit (Cacnio & Mina, 2021). Its components include knowledge of DFS, awareness of DFS risks, control of digital financial risk, and understanding of redress procedures. "Knowledge of digital financial goods and services, awareness of digital financial hazards, knowledge of digital financial risk control, and knowledge of consumer rights and redress processes" are the four aspects Morgan et al. (2019) proposed for assessing DFL. Literature reviews found limited empirical work reported on DFL due to its recent beginnings. From the significant studies, five key dimensions of DFL were identified. The dimensional framework for the DFL is presented in Figure 2. From literature reviews, 29 statements under the four key dimensions of DFL were identified, as shown in Appendix 1.

Figure 2: Conceptual framework



Source: AFI network (2020); Bangko Dentral ng Pilipinas (BSP); Morgan & Trinh (2019)

2.1.2. Content and Face Validity

Examining an instrument's content validity determines whether it adequately captures each pertinent aspect of the concept it seeks to assess. The degree to which a test is seen as covering the idea it is supposed to examine is referred to as face validity. It relates to how a test seems to test takers in terms of transparency or relevancy. For ensuring content and face validity, the instrument was subject to expert opinion individually and a focus group study as scholar research committee discussion.

Most of the financial literacy studies have either used a five-scale Likert scale (Paraboni et al., 2020; Rieger, 2020; Dam & Hotwani, 2018) or a seven-scale Likert scale (Stella et al., 2020; Rojas-Vargas & Vega-Mendez, 2020). Expert responses were collected on a five-point Likert scale for pre-testing the draft questionnaire (see Appendix 1) with 29 items (from strongly disagree to strongly agree). The preliminary questionnaire was examined by 16 experts from the banking industry, taxation department, information technology sector, finance managers, educators, and senior researchers to determine its validity and help avoid redundancy. Expert opinion on the pool of items was collected individually and in the form of a scholar research committee discussion (focus group study). So, after removing irrelevant items, we were able to

collect 25 items for DFL measurement (see Appendix 1 for details). Experts' suggestions like rewording of statements to make them easier and more understandable, including better examples, etc. were incorporated, and necessary modifications were made to the draft questionnaire.

2.2. Phase 2: Scale purification

This phase deals with grouping similar items into factors to get the latent constructs using Exploratory Factor Analysis (EFA). For this, first the data was collected by administrating an online questionnaire consisting of 25 DFL questions for the pilot study, i.e., scale purification sample (N1=145), then the pilot data was examined for normality, and internal consistency, and suitability for factor analysis. Then, finally, after exploring factors using EFA, they were confirmed with another independent sample, i.e., purification sample (N2=323), using Confirmatory Factor Analysis (purification).

2.2.1. Sampling Design, Data collection and Data screening

The online questionnaire was piloted using judgmental sampling mixed with snowball sampling. The respondents were all in the age group of 18 to 50 years and were all users of digital platforms, like mobile, laptop, desktop, etc., along with using internet services, living in the National Capital Territory of India. This was made possible by administrating a Google Forms consisting of 25 questions related to DFL as a research tool. Respondents were further asked to share the online questionnaire among their contacts belonging to the age group of 18 to 50 years. The question statements, along with their sources, are depicted in Appendix 1. Gorsuch (1983) and Kline (1979) recommended "100 to be a minimum sample size for factor analysis and SEM." A total of 145 respondents answered at the time of the pilot study. The online questionnaire was sent to the major cities of India's National Capital Territory; 145 replies were obtained, with 135 valid responses being used for further analysis. Out of 135 respondents, there were 64 male respondents (47.40 percent) and 71 female respondents (52.60 percent). Age wise, there were 55 respondents from the age group of (18-30), 42 respondents from the age group of (30-40), and 38 respondents from the age group of (40-50).

Using skewness and kurtosis measurements, the pilot data was examined to verify its normalcy. When using SEM, skewness values should be between 3 and + 3, and kurtosis values should be between 10 and + 10 (Brown, 2006). Data with skewness in the range of 2 to +2 and kurtosis in the range of 7 to +7 are deemed acceptable for data to be considered normal, according to Hair et al. (2006) and Bryne (2010). The descriptive statistics of all items from Samples 1 (purification) and 2 (validation) are shown in Tables 1 and 9, respectively, supporting the non-departure from a normal distribution.

Table 1: Descriptive Statistics – Sample 1

	N	Minimum	Maximum	Mean		Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Std. Error	Statistic	Std. Error
Basic_1	135	2.00	5.00	4.5407	.05832	.67761	-1.318	.209	1.028	.414
Basic_2	135	1.00	5.00	4.2370	.08159	.94795	-1.080	.209	.393	.414
Basic_3	135	3.00	5.00	4.7630	.04362	.50678	-2.079	.209	3.569	.414
Basic_4	135	2.00	5.00	4.7185	.04778	.55519	-2.130	.209	4.928	.414
Adv_1	135	1.00	5.00	3.2444	.11871	1.37931	-.104	.209	-1.175	.414
Adv_2	135	1.00	5.00	2.9926	.12329	1.43254	.029	.209	-1.291	.414
Adv_3	135	1.00	5.00	2.3481	.13313	1.54687	.701	.209	-1.093	.414
Adv_4	135	1.00	5.00	3.6963	.11092	1.28872	-.646	.209	-.734	.414
Beh_1	135	1.00	5.00	3.4000	.08490	.98648	.023	.209	-.046	.414
Beh_2	135	1.00	5.00	3.5556	.08257	.95937	-.238	.209	-.219	.414
Beh_3	135	1.00	5.00	3.6000	.08293	.96351	-.441	.209	.081	.414
Q14	135	1.00	5.00	4.3630	.07255	.84295	-1.228	.209	1.143	.414
Q15	135	1.00	5.00	3.7407	.10028	1.16519	-.599	.209	-.531	.414
DFRC_1	135	1.00	5.00	3.7778	.09732	1.13076	-.683	.209	-.266	.414
DFRC_2	135	1.00	5.00	3.9704	.08918	1.03622	-.553	.209	-.783	.414
DFRC_3	135	1.00	5.00	3.7259	.09719	1.12919	-.451	.209	-.720	.414
DFRC_4	135	1.00	5.00	3.4963	.09514	1.10544	-.344	.209	-.452	.414
DFRC_5	135	1.00	5.00	3.7852	.08884	1.03221	-.549	.209	-.148	.414
DFRC_6	135	1.00	5.00	4.0074	.08765	1.01846	-.789	.209	-.122	.414
DFRC_7	135	1.00	5.00	3.9630	.08036	.93368	-.540	.209	-.363	.414
Basic_5	135	2.00	5.00	4.5037	.06471	.75185	-1.349	.209	.902	.414
Att_1	135	1.00	5.00	3.2074	.11182	1.29923	-.249	.209	-.951	.414
Att_2	135	1.00	5.00	2.8815	.11030	1.28163	.074	.209	-1.029	.414
Att_3	135	1.00	5.00	2.5630	.11595	1.34723	.412	.209	-.988	.414
Att_4	135	1.00	5.00	2.7481	.10657	1.23819	.181	.209	-.913	.414
Valid N (listwise)	135									

Source: SPSS Output

2.2.2. Item assessment and reliability analysis

Internal consistency was measured using three methods: correlations among various items, Cronbach's alpha, and corrected item-total correlations. Tables 2 and 3 show Cronbach's alpha and corrected item-total correlations of Sample 1 (N1=135) and Sample 2 (N2= 300), respectively. Appendix 3 and 4 show the correlation matrix for both t samples of the study. All the items in the study had correlation values of more than 0.1948, so no item was excluded at this stage. Moreover, item-correlated values show good discrimination among the items. The entire collection of statements had a Cronbach's alpha value of 0.881 for Sample 1, indicating highly reliable data (see Table 2). The values of Cronbach's Alpha greater than 0.60 are acceptable, as per Nunnally & Bernstein (1994).

Table 2: Reliability Statistics

	N of Items	Cronbach's Alpha
Sample 1	25	.881
Sample 2	23	.864

Source: SPSS Output

Table 3: Scale item measurement properties

Items	Mean		EFA item loading		Corrected item total correlation		CFA item loading		Square multiple correlation	
	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
Basic_1	4.541	4.170	0.736	0.752	0.438	0.572	0.679	0.802	0.462	0.643
Basic_2	4.237	4.107	0.724	0.745	0.501	0.668	0.760	0.861	0.577	0.742
Basic_3	4.763	4.603	0.823	0.742	0.432	0.521	D	D	D	D
Basic_4	4.719	4.523	0.701	0.789	0.397	0.511	0.640	0.663	0.410	0.440
Basic_5	4.504	4.340	0.568	0.620	0.509	0.617	0.659	0.702	0.434	0.492
Adv_1	3.244	3.287	0.765	0.773	0.558	0.572	0.720	0.794	0.531	0.631
Adv_2	2.993	2.950	0.807	0.835	0.574	0.528	0.729	0.772	0.774	0.596
Adv_3	2.348	2.510	0.783	0.780	0.443	0.363	0.880	0.635	0.486	0.404
Adv_4	3.696	3.583	0.537	0.624	0.633	0.621	0.697	0.757	0.421	0.579
Att_1	3.207	3.187	0.709	0.674	0.227	0.055	0.615	0.444	0.378	0.197
Att_2	2.882	2.957	0.821	0.831	0.253	0.067	0.775	0.685	0.600	0.469
Att_3	2.563	2.767	0.787	0.830	0.142	0.036	0.695	0.849	0.483	0.721
Att_4	2.748	2.850	0.766	0.795	0.333	-0.037	0.668	0.769	0.447	0.591
Beh_1	3.400	3.333	0.662	0.783	0.335	0.357	0.487	0.657	0.238	0.431
Beh_2	3.556	3.580	0.852	0.889	0.336	0.260	0.837	0.851	0.700	0.724
Beh_3	3.600	3.547	0.846	0.897	0.281	0.328	0.837	0.937	0.701	0.879
DFRC_1	3.778	3.867	0.675	0.720	0.635	0.673	0.739	0.793	0.547	0.628
DFRC_2	3.970	3.930	0.691	0.666	0.708	0.707	0.792	0.841	0.628	0.707
DFRC_3	3.726	3.723	0.805	0.779	0.665	0.641	0.816	0.787	0.665	0.619
DFRC_4	3.496	3.580	0.775	0.790	0.535	0.546	0.691	0.691	0.477	0.478
DFRC_5	3.785	3.737	0.741	0.773	0.671	0.727	0.785	0.855	0.617	0.730
DFRC_6	4.007	3.897	0.580	0.714	0.514	0.624	0.606	0.736	0.368	0.542
DFRC_7	3.778	3.870	0.556	0.694	0.605	0.666	0.689	0.745	0.475	0.555

Note: D refers to deleted items i.e. Basic_3, Q14 and Q15 were deleted. Q14 and Q15 were removed due to weak Cronbach alpha values and lower Standardized weights while Basic_3 was removed in order to increase confidence in the reliability and validity of the Questionnaire.
Source: Author's Calculation

2.2.3. EFA and Common Method Bias

2.2.3.1. Kaiser–Meyer– Olkin (KMO) and Bartlett's test of sphericity

Prior to doing the exploratory factor analysis, the Kaiser- Meyer-Olkin test of sampling adequacy (KMO) was used to determine whether the sample size was adequate. For a better factor analysis, the value of KMO must be at least 0.60 and above (Patyal and Koilakuntla 2015). The factor analysis and the adequacy of sample size in this study were supported by the KMO values of 0.831 for Sample 1 and 0.894 for Sample 2, both of which were significant (Tabachnick and Linda, 2012). Furthermore, factor analysis is suitable because Bartlett's test of sphericity was significant for both samples (see Table 4).

Table 4: KMO and Bartlett's test

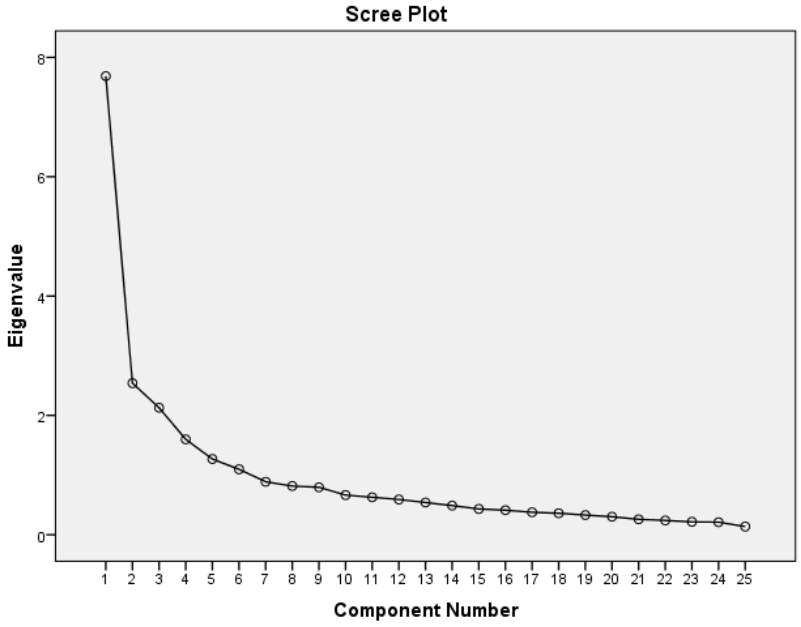
Statistics		**S1**	**S2**
Kaiser-Mayer-Olkin Measure of Sampling Adequacy.		0.831	0.894
	Approx. Chi-Square	1580.346	4108.874
	df	300	253
	Sig.	0.000	0.000
Cronbach's Alpha		0.881	0.864
Mean		91.84	82.89
Variance		193.72	157.36

Source: SPSS Output

2.2.3.2. Exploratory Factor Analysis (EFA)

The Exploratory Factor Analysis, which was used to extract the factor from Sample 1, was Principal Component Analysis (PCA) with varimax rotation. The Kaiser's criterion was chosen to determine the number of factors (see Figure 3 scree plot). Loadings of DFL questions can be seen loaded on six-factor components (Table 6a). The resulting six factors explained 65.274 percent of the items (see Table 5a). The Cronbach's alpha of the sixth factor consisting of two items (Q14 and Q15) was found to be less than 0.60, so these items (Q14 and Q15), i.e., sixth factor, were removed. Further, it was checked that a five-factor solution explains 63.84 percent of the variation (see Table 5b). The five-factor solution showed reliability; therefore, it was accepted. All items satisfied the minimum threshold limit of factor loading, cross-loading, and Eigenvalue, and their pattern is depicted in Table 6b.

Figure 3: Screen Plot



Source: SPSS Output

An item's representation of a factor is measured by the loadings, and a higher loading denotes a stronger relationship between the item and the factor. A minimum cut-off criterion for the deletion of the items were factor loadings (<0.50) (Karatepe, Yavas, & Babakus, 2005) and cross loadings (>0.40) (Hair et al., 2006).

Table 5a: Total Variance Explained (six factor solution)

Component	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.686	30.744	30.744	4.125	16.501	16.501
2	2.541	10.163	40.907	3.223	12.892	29.393
3	2.128	8.513	49.420	2.689	10.758	40.150
4	1.598	6.393	55.813	2.492	9.967	50.117
5	1.269	5.075	60.888	2.143	8.571	58.688
6	1.096	4.386	65.274	1.646	6.586	65.274

Extraction Method: Principal Component Analysis.
Source: SPSS Output

Table 5b: Total Variance Explained (five factor solution)

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.227	31.420	31.420	7.227	31.420	31.420	4.264	18.537	18.537
2	2.536	11.028	42.448	2.536	11.028	42.448	3.275	14.240	32.777
3	2.111	9.178	51.626	2.111	9.178	51.626	2.539	11.041	43.818
4	1.589	6.907	58.533	1.589	6.907	58.533	2.488	10.817	54.635
5	1.221	5.308	63.840	1.221	5.308	63.840	2.117	9.205	63.840

Extraction Method: Principal Component Analysis.
Source: SPSS Output

Table 6a: Rotated Component Matrix Sample - 1

Items	Component					
	1	2	3	4	5	6
Basic_1		0.736				
Basic_2		0.724				
Basic_3		0.823				
Basic_4		0.701				
Adv_1			0.765			
Adv_2			0.807			
Adv_3			0.783			
Adv_4			0.537			
Beh_1					0.662	
Beh_2					0.852	
Beh_3					0.846	
Q15			0.435			0.592
DFRC_1	0.675					
DFRC_2	0.691					
DFRC_3	0.805					
DFRC_4	0.775					
DFRC_5	0.741					
DFRC_6	0.580					
DFRC_7	0.556					
Basic_5		0.568				
Att_1				0.709		
Att_2				0.821		
Att_3				0.787		
Att_4				0.766		
Q14						0.791

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 6 iterations.

Source: SPSS Output

Table 6b: Rotated Component Matrix Sample - 1

	Component				
	1	2	3	4	5
Basic_1		.717			
Basic_2		.707			
Basic_3		.807			
Basic_4		.732			
Adv_1			.779		
Adv_2			.821		
Adv_3			.776		
Adv_4			.538		
Beh_1					.684
Beh_2					.851
Beh_3					.839
DFRC_1	.672				
DFRC_2	.707				
DFRC_3	.798				
DFRC_4	.777				
DFRC_5	.776				
DFRC_6	.593				
DFRC_7	.621	.412			
Basic_5		.606			
Att_1				.710	
Att_2				.819	
Att_3				.788	
Att_4				.764	

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 6 iterations.
Source: SPSS Output

2.2.3.3. Common Method Bias (CMB)

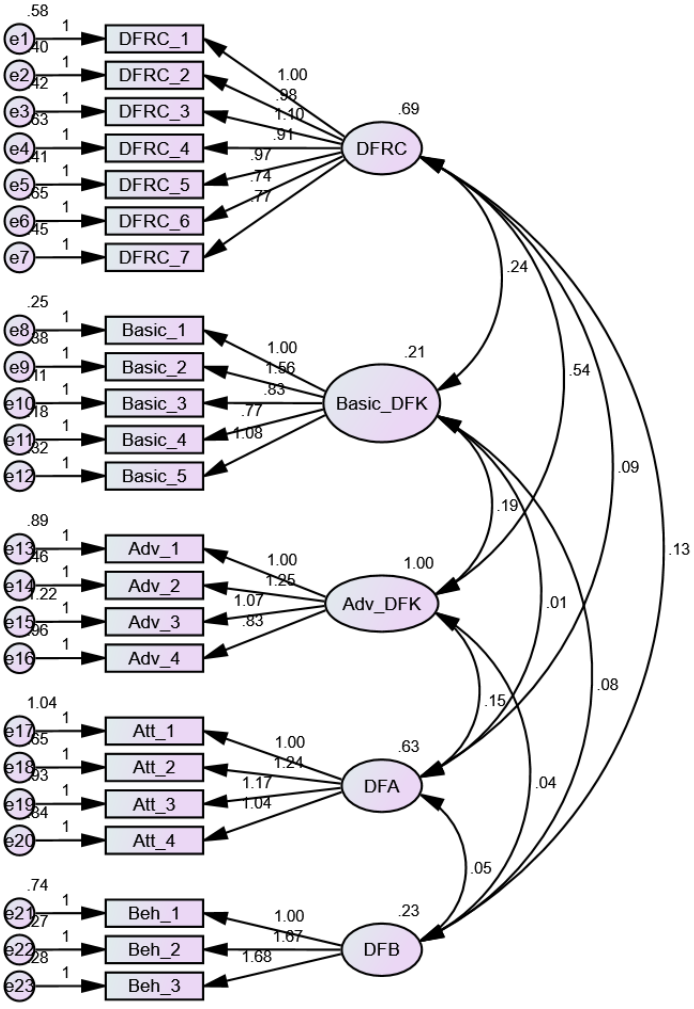
Common method bias is the term used to describe a bias in replies that may have been introduced by variables other than the questionnaire. Podsakoff et al. (2003) suggested using Harmon's one-factor test to assess CMB. The results showed that a single component only accounts for 20 percent of the total variation, proving that CMB is not present (Patyal & Koilakuntla, 2015).

2.2.4. Confirmatory Factor Analysis (CFA)

CFA determines the factor structure of the dataset. In the EFA, the factor structure was explored (how the variables relate and group based on inter-variable correlations), whereas in the CFA, the factor structure extracted in the EFA was confirmed. The measurement model was evaluated by examining the goodness-of-fit indices, factor loadings, and standardised residual covariance matrixes (Patyal & Koilakuntla, 2015). After EFA, CFA was performed on the items in Sample 1 (Pilot study) using AMOS Version 23.0 (see Figure 4). Model fit refers to how well our proposed model (in this case, the model of the factor structure) accounts for the correlations between variables in the dataset. The absolute fit indices [normed chi-square (x2/df), goodness-of-fit index

(GFI), standardised root mean square residual (SRMR) and incremental fit indices [comparative fit index (CFI), Tucker Lewis index (TLI), incremental fit index (IFI)] were measured for CFA model fitness. The model fit indices of the Sample 1 model were found as $\chi 2$ (df) = 321.787 (220), p = 0.000, normed $\chi 2$ = 1.463, CFI = 0.923, PCLOSE = 0.150, RMSEA = 0.059, and SRMR = 0.078 (see Table 11). Hence, it's an acceptable model (Hair et al., 2006).

Figure 4: CFA Sample-1



Source: AMOS Output

The reliability of items from Sample 1 was assessed using Cronbach's alpha, Composite reliability (CR), Average variance extracted (AVE), Maximum shared variance (MSV), and Maximum Reliability (MaxR(H)). The values of Cronbach's alpha greater than 0.60 are acceptable, as per Nunnally & Bernstein (1994). According to Hair et al. (2006), a composite reliability (CR) value greater than 0.7 is desirable. The Average variance extracted (AVE) for each construct should be >0.50" as per Fornell & Larcker (1981). The respective reliability statistics are reported in Table 7. The squared values of AVE were all greater than the squared correlation of the same latent variable, as shown in Table 8, implying acceptable discriminant validity according to Fornell & Larcker (1981). Therefore, the scale items showed acceptable model fit measures, reliability, and validity statistics using Sample 1.

Table 7: Reliability statistics

Constructs	Cronbach's Alpha		Composite reliability (CR)		Average variance extracted (AVE)		Maximum shared variance (MSV)		Maximum Reliability (MaxR(H))	
	S1	**S2**	**S1**	**S2**	**S1**	**S2**	**S1**	**S2**	**S1**	**S2**
1. Digital Financial Risk and Control	0.889	0.914	0.89	0.915	0.539	0.608	0.424	0.51	0.899	0.922
2. Basic Digital Financial Knowledge	0.807	0.864	0.827	0.845	0.49	0.579	0.411	0.51	0.833	0.865
3. Advanced Digital Financial Knowledge	0.821	0.844	0.83	0.83	0.553	0.551	0.424	0.485	0.862	0.839
4. Digital Financial Attitude	0.78	0.797	0.784	0.789	0.477	0.495	0.034	0.028	0.794	0.838
5. Digital Financial Behavior	0.751	0.854	0.774	0.861	0.546	0.678	0.12	0.114	0.833	0.914

Source: Author's Calculation

Table 8: Divergent Validity

Constructs	S1					S2				
	DFRC	**Basic_ DFK**	**Adv_ DFK**	**DFA**	**DFB**	**DFRC**	**Basic_ DFK**	**Adv_ DFK**	**DFA**	**DFB**
DFRC	**0.734**					**0.780**				
Basic_ DFK	0.641	**0.700**				0.714	**0.761**			
Adv_DFK	0.651	0.408	**0.744**			0.697	0.630	**0.742**		
DFA	0.137	0.017	0.183	**0.691**		-0.152	-0.094	-0.168	**0.703**	
DFB	0.337	0.347	0.078	0.141	**0.739**	0.338	0.324	0.148	-0.121	**0.823**

Source: Author's Calculation

2.3. Phase 3: Scale validation

The study replicated CFA on an independent sample, i.e., Sample 2 of a sample size of 323 respondents belonging to the age group of 18-50 years who use digital platforms for financial transactions, with 300 of them being deemed to be usable. The second sample questionnaire with the remaining 23 items was administrated. Out of 300 respondents, there were 154 male respondents (51.30 percent) and 146 female respondents (48.70 percent). Age-wise, there were 120 respondents from the age group of 18-30, 84 respondents from the age group of 30-40, and 98 respondents from the age group of 40-50 . Sample 2, which was screened to assess the univariate normality and linearity in SPSS, the results of descriptive statistics are presented in Table 9. Then it was subsequently checked for its reliability (see Table 7), validity (see Table 8), and model fit (see Table 11) to finally validate the conceptual framework developed under the scale purification stage. The second study, using Sample 2, validated the factor structure of Sample 1.

Table 9: Descriptive Statistics Sample 2

	N	Minimum	Maximum	Mean		Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Std. Error	Statistic	Std. Error
Basic_1	300	1	5	4.170	0.058	1.002	-1.189	0.141	1.010	0.281
Basic_2	300	1	5	4.107	0.056	0.969	-0.882	0.141	0.156	0.281
Basic_4	300	1	5	4.523	0.044	0.760	-1.711	0.141	2.811	0.281
Adv_1	300	1	5	3.287	0.075	1.300	-0.067	0.141	-1.089	0.281
Adv_2	300	1	5	2.950	0.080	1.379	0.029	0.141	-1.159	0.281
Adv_3	300	1	5	2.510	0.083	1.429	0.478	0.141	-1.110	0.281
Adv_4	300	1	5	3.583	0.073	1.266	-0.503	0.141	-0.750	0.281
Beh_1	300	1	5	3.333	0.054	0.934	-0.040	0.141	0.407	0.281
Beh_2	300	1	5	3.580	0.056	0.970	-0.449	0.141	0.270	0.281
Beh_3	300	1	5	3.547	0.057	0.992	-0.440	0.141	0.141	0.281
DFRC_1	300	1	5	3.867	0.058	1.009	-0.515	0.141	-0.344	0.281
DFRC_2	300	1	5	3.930	0.057	0.984	-0.410	0.141	-0.723	0.281
DFRC_3	300	1	5	3.723	0.059	1.025	-0.438	0.141	-0.320	0.281
DFRC_4	300	1	5	3.580	0.058	0.997	-0.223	0.141	-0.333	0.281
DFRC_5	300	1	5	3.737	0.057	0.982	-0.369	0.141	-0.407	0.281
DFRC_6	300	1	5	3.897	0.058	1.008	-0.521	0.141	-0.512	0.281
DFRC_7	300	1	5	3.870	0.056	0.974	-0.413	0.141	-0.589	0.281
Basic_5	300	1	5	4.340	0.049	0.849	-1.077	0.141	0.381	0.281
Att_1	300	1	5	3.187	0.076	1.313	-0.188	0.141	-1.010	0.281
Att_2	300	1	5	2.957	0.071	1.225	-0.005	0.141	-0.865	0.281
Att_3	300	1	5	2.767	0.077	1.341	0.215	0.141	-1.037	0.281
Att_4	300	1	5	2.850	0.070	1.213	0.121	0.141	-0.792	0.281
Valid N (listwise)	300									

Source: SPSS Output

2.3.1 Replication of CFA.

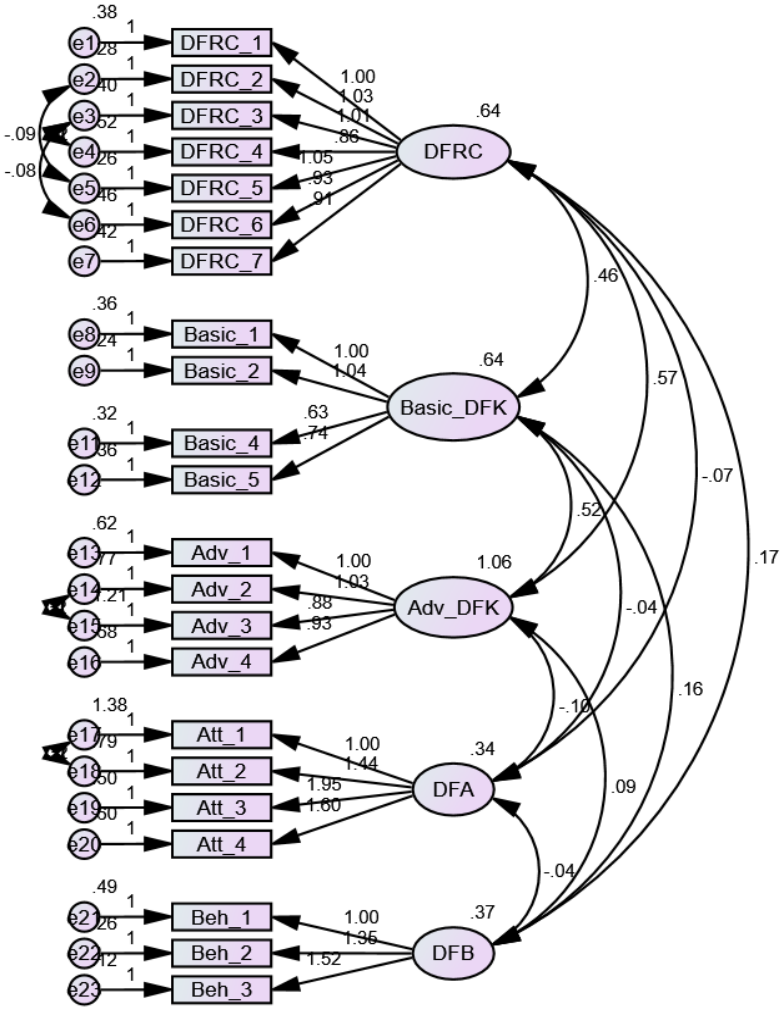
The replicated CFA using Sample 2 is shown in Figure 5. The modification indices generated by AMOS are shown in Table 10. The model was modified by correlating significant measurement errors of the indicators within the same latent variable is acceptable (Kline, 2011). The modified CFA model is shown in Figure 5.

Table 10: Modification Indices

			M.I.	Par Change
e17	<-->	e18	17.609	.260
e16	<-->	e20	17.615	-.206
e14	<-->	e15	11.084	.182
e11	<-->	e12	9.822	.069
e9	<-->	e12	9.001	-.065
e8	<-->	e9	9.511	.068
e7	<-->	e12	16.086	.101
e5	<-->	e23	11.728	-.065
e4	<-->	e19	10.183	.126
e4	<-->	e18	12.614	-.137
e4	<-->	e17	21.401	-.222
e4	<-->	e16	16.236	-.158
e4	<-->	e15	13.698	.165
e3	<-->	e15	10.308	.132
e3	<-->	e7	10.812	-.085
e3	<-->	e6	13.652	-.101
e3	<-->	e4	16.880	.112
e2	<-->	e23	27.626	.104
e2	<-->	e16	9.709	.106
e2	<-->	e5	12.168	-.073
e1	<-->	e5	10.038	-.069
e1	<-->	e2	10.374	.074

Source: AMOS output

Figure 5: CFA Sample - 2



Source: AMOS output

2.3.2. Validity Statistics

In subsequent steps, Sample 2 was used to validate the factor structure of DFL by examining its reliability (see Table 7), validity (see Table 8), and model fit (see Table 11) to finally validate the conceptual framework developed under the scale purification stage. Convergent validity was achieved when the converging reliability values for all the items were above the threshold of 0.7 and the AVE values were greater than 0.5. To improve the model fit, one item (Basic_3) was deleted due to its large standardised residual, and, finally, twenty two items for five factors were retained. Discriminant validity was established where MSV and the ASV were both lower than the AVE for all the constructs (see Tables 7 and 8). Therefore, the final 22 scale items under five constructs displayed both convergent and discriminant validity.

2.3.3. Model Fit measures

The fit indices of the model with Sample 2 were found as $\chi 2$ (df) = 525.660 (194), p = 0.000, normed $\chi 2$ = 2.710, IFI = 0.904, TLI = 0.888, PClose = 0.045, CF1 = 0.912, RMSEA = 0.076, and SRMR = 0.065. These results suggest the model is acceptable (see Table 11). The resulting scale, consisting of 22 items in five dimensions, displayed sound psychometric properties and, therefore, was trustworthy, displaying both convergent and discriminant validity along with acceptable model fit measures.

Table 11: Model Fit Measures

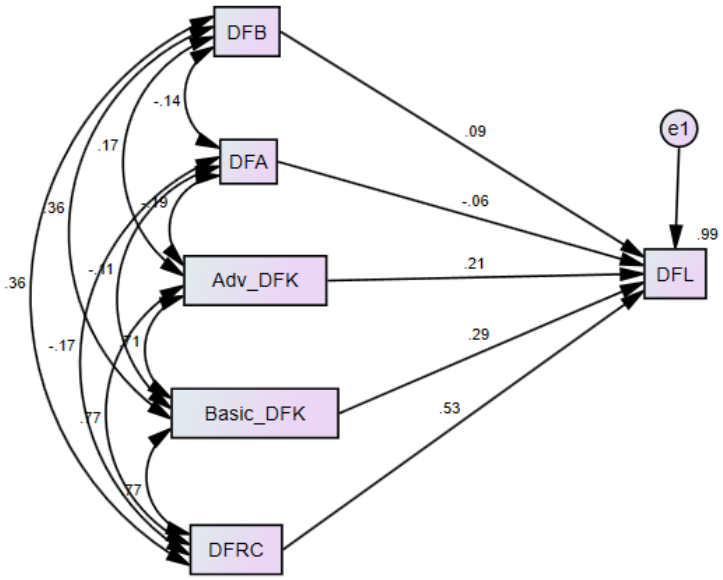
Measure	Estimate (S1)	Interpretation (S1)	Threshold	Estimate (S2)	Interpretation (S2)
CMIN	321.787	-	-	525.660	-
DF	220	-	-	194	-
CMIN/DF	1.463	Excellent	Between 1 and 3	2.710	Excellent
CFI	0.923	Acceptable	>0.95	0.912	Acceptable
SRMR	0.078	Excellent	<0.08	0.065	Excellent
RMSEA	0.059	Excellent	<0.06	0.076	Acceptable
PClose	0.150	Excellent	>0.05	0.045	Acceptable

Source: Author's Calculation

3. Path analysis as Structural model

Curve estimation in SPSS was conducted on all the relationships in our model, and it was determined that all the relationships were sufficiently linear to be tested using a covariance-based SEM algorithm, such as AMOS. Therefore, in order to evaluate the impact of each latent lower-order construct on its higher-order construct, Digital Financial Literacy (DFL), the scale was also subjected to path analysis as a covariance-based Structural Equation Modelling (SEM) in AMOS using composite variables from the Sample 2 dataset. The data for each latent construct was imputed, and the imputed scores were utilized to analyze their impact on the DFL-calculated average scores.

Figure 6: SEM



Source: AMOS output

Figure 6 shows the standardized regression weights of the path from the respective latent construct to DFL, the correlation coefficient between latent constructs, and the square multiple correlation value of DFL. It can be seen that Digital financial attitude (DFA) has a negative correlation with other latent constructs and has a significant negative effect on the overall DFL. The rest of all the latent constucts have a significant correlation with other latent constructs and a significant positive impact on the overall DFL.

Table 12: Path analysis

Path	Beta values	SE	c. r.	P value	Supported	R^2	VIF	f^2
Adv_DFK -> DFL	.212	.011	20.913	0.000	Yes	0.989	2.852	1.345
Basic_DFK -> DFL	.286	.013	28.240	0.000	Yes		2.862	2.499
DFA -> DFL	-.061	.012	-9.969	0.000	Yes		1.060	0.266
DFB -> DFL	.086	.011	12.798	0.000	Yes		1.253	0.537
DFRC -> DFL	.529	.014	47.475	0.000	Yes		2.466	7.068

Source: Author's Calculation

Table 12 displays the findings of the structural model study, which are succinctly stated as follows:

1) There are no collinearity difficulties amongst the constructs because the Variance Inflation Factor (VIF) coefficients are less than 3.0 (2.852, 2.862, 1.060, 1.253, and 2.466).

2) Latent factors and DFL significantly correlate:

• Basic Digital Financial Knowledge (Basic DFK) and DFL have a substantial direct positive link ($\beta = 0.286$, $t = 28.240$, $p = 0.000$).

• Advanced Digital Financial Knowledge (Adv DFK) and DFL have a substantial direct positive link ($\beta = 0.212$, $t = 20.913$, $p = 0.000$).

• Digital Financial Attitude and DFL have a substantial direct negative connection ($\beta = -0.061$, $t = -9.960$, $p = 0.000$).

• Digital Financial Behavior (DFB) and DFL have a substantial direct positive link ($\beta = 0.086$, $t = 12.798$, $p = 0.000$).

• Digital Financial Risk Control (DFRC) and DFL have a substantial direct positive link ($\beta = 0.529$, $t = 47.375$, $p = 0.000$).

3) The R-square value (0.989) means that 98.90 percent of the total variation in the DFL scores was explained by the five dimensions taken in this study, indicating a high explanatory power of the model.

4) Based on the results of Cohens' f2 effect size (1.345, 2.499, 0.266, 0.537 and 7.068), only digital financial attitude has a medium effect size (f2 = 0.266), and the rest of the other factors have substantially large effect sizes (greater than 0.35). Table 13 shows the effect size of each latent construct.

Table 13: Cohen's Effect size

Independent Variable	R_E^2	$(R_I^2 - R_E^2)$	$(R_I^2 - R_E^2)/(1 - R_I^2)$	Effect size
Adv DFK	0.948	0.029	1.345	Strong
Basic DFK	0.923	0.054	2.499	Strong
DFA	0.972	0.005	0.266	Moderate
DFB	0.966	0.011	0.537	Strong
DFRC	0.824	0.154	7.068	Strong

Source: Author's Calculation

4. Measuring Digital Financial Literacy

The study conducted an assessment of the digital financial literacy (DFL) of the final sample of respondents (N2=300) using the OECD (2022) scoring method. The scoring method involved assigning a value of "1" to favorable responses and a value of "0" to unfavorable responses, resulting in a maximum score of 25 and a minimum score of zero. These scores were then converted into percentages. The results indicated that the overall DFL score of the sample was 55.94 percent, which was deemed unsatisfactory given the study's focus on the metropolitan area of a developing nation such as India, where there is adequate infrastructure for digital financial services and information technology. These findings suggest that despite the presence of adequate infrastructure, there is a need to improve the digital financial literacy of individuals in the area.

5. Discussion and Conclusion

Financial literacy is now acknowledged as a crucial component of effective financial inclusion and has taken center stage on many nations' policy agendas (OECD/INFE, 2015). Digital Financial Literacy (DFL) is an essential requirement for the effective usage of digital financial services, and DFL is an important component of education in this digital age (Morgan et al., 2020). Given the research examined, it is concluded that the area of "Digital Financial Literacy" has not yet been studied in the literature (Alliance for Financial Inclusion, 2021), despite having enormous promise in the digital era. The goal of the current study is to offer a credible and validated measure for assessing people's DFL. The study employed Churchill's widely-accepted scale development paradigm (1979). Phase 1 is a qualitative investigation in which topics were chosen following a survey of the literature and consultation with academic authorities; Phase 2 is scale refinement, which includes a pilot study and item analysis using EFA and CFA; and Phase 3 is scale validation and final study.

Empirical research was carried out on the pool of statements measuring the DFL of individuals collected from the available limited literature using two independent samples (N1-Pilot sample for purification and N2-Final independent sample for validation). Two online surveys through Google Forms were performed with 165 (N1) and 323 (N2) respondents. Further, the collected data from Sample 1 was analyzed with exploratory and confirmatory factor analysis using the statistical software IBM SPSS and AMOS for its reliability and validity. Further, Sample 2 data set was utilized by employing CFA to validate the factor structure explored by Sample 1.

The study finally proposed a reliable and validated Digital Financial Literacy (DFL) scale with twenty-two statements measuring the five key dimensions of DFL, which are:

1. Digital Financial Risk and Control (DFRC): Digital Financial Risk and Control deals with Digital Financial Services users' comprehension of how to protect themselves from the dangers that come with their use. Consumers must be aware of the dangers associated with using DFS and how to guard against them (Morgan et al., 2019). There are several hazards to online fraud and computer security, and DFS users need to be aware of them. The risks that DFS users can encounter include phishing, pharming, spyware, SIM card swaps, profiling, and hacking, to name just a few. Customers of DFS should be familiar with any contract terms before signing them online. DFS users should be informed of their obligations and rights, as well as how to file a complaint if their

personal information is exploited. Awareness of relevant DFS-related risks and the competency to prevent these risks when using DFS; and awareness of related consumer protection and redress mechanisms and the competency to seek the same when necessary are the important aspects in measuring DFL (Alliance for Financial Inclusion, 2021). Awareness of DFS risks, digital financial risk control, and understanding of redress procedures are important dimensions of DFL ((Cacnio & Mina, 2021).

2. Basic Digital Financial Knowledge (BDFK): Basic Digital Financial Knowledge refers to the understanding of the usage of basic digital financial services covering online money transfer methods, e-wallets, smart cards, mobile banking, net banking, etc. Financial literacy was divided into two categories by Lusardi & Mitchell (2011) as basic and advanced. Basic literacy is the level of literacy that is necessary for all people, regardless of background, to function in daily life. People need to be aware that the internet offers basic financial services and goods. A customer should be able to decide on the best product or service by having a fundamental grasp of digital financial goods and services, including their basic functionalities (Morgan et al., 2019). Basic digital financial knowledge covers awareness about IMPS, RTGS, NEFT, AePS, and BHIM-based money transfers; electronic wallets like Paytm, PayPal, PayU Money, GooglePay, AmazonPay, PhonePe; understanding of debit cards, credit card, ATM cards, RuPay cards, etc.; the difference between mobile banking and internet banking; understanding of the digital financial contract, etc. Digital financial knowledge is a key part of DFL, according to OECD (2022).

3. Advanced Digital Financial Knowledge (ADFK): Advanced Digital Financial Knowledge refers to the understanding of the usage of advanced digital financial services covering asset management (including internet banking, robo advisors, cryptocurrencies, and personal financial management), alternative finance (including crowdsourcing and peer-to-peer (P2P) lending), as well as digital insurers like Acko General Insurance, PolicyBazaar, Mantra Labs, and others. Financial literacy was divided into two categories by Lusardi (2008) as basic and advanced. Advanced financial literacy is concerned with securities, bonds, and funds, as well as the impact of interest rates on those securities, pricing for those assets, and problems relating to the risk-return relationship. Internet resources and social media platforms with an online mode are emerging information sources in the information age. The fundamental understanding of digital financial goods and services is captured by knowledge about them. It involves knowing how to use electronic payment methods, manage your assets, use alternative forms of financing, use online insurance services, etc. Thus, basic and advanced digital financial knowledge is a necessary component of individuals' digital financial literacy. To utilise DFS, you must have a basic understanding of how to use a mobile device and the Internet. However, having a higher degree of digital literacy gives you more autonomy and self-assurance while using these services, which may encourage you to use them more frequently (Kass-Hanna, Lyons & Liu, 2022).

4. Digital Financial Attitude (DFA): Digital Financial Attitude refers to the risk perception of people towards using DFS and their perceived level of safety in online financial transactions. A persons' behavior toward developing financial literacy and improving financial understanding might be influenced by their attitude toward money and finances. Digital Financial Service users should safeguard their personal identification numbers, passwords, and other personal financial data, etc., while conducting digital financial transactions. Digital financial attitude is a key part of DFL, according to OECD (2022). The attitude towards digital financial risks among people is displayed by their perceptions regarding risk intensity and level of safety in online financial transactions. The perception of DFS users about risk intensity can be positive, neutral, or negative.

5. Digital Financial Behavior (DFB): Digital Financial Behavior refers to the behavior of individuals towards online purchasing, online money transfers, and other digital financial transactions. Financial behaviour and habits are the most significantly impacted by digitalization (Garai-Fodor et al., 2022). Before buying online, individuals should pay attention to the legality of fintech providers, read the terms and conditions of the online buying contracts, never share personal financial data publicly online, keep changing their passwords from time to time, etc. If digital financial behavior is sound, then it will have a positive influence on the DFL, and vice versa. Digital financial behaviour is a key part of DFL, according to OECD, (2022).

Furthermore, the path analysis as a covariance-based structural model of DFL using its composite variables was analyzed using AMOS. It was found that there is a statistically significant direct positive relationship between Digital Financial Risk and Control, Basic Digital Financial Knowledge, Advanced Digital Financial Knowledge, and Digital Financial Behavior on the one hand and overall DFL on the other hand. But it was also noted that there exists a direct and significant negative relationship between Digital Financial Attitude and DFL pointing towards the negative attitude of people in National Capital Territory of India towards digital financial services and their usage. The overall DFL score of the final sample of 300 respondents was 55.94 percent, which was deemed unsatisfactory given the study's focus on the metropolitan area of a developing nation such as India, where there is adequate infrastructure for digital financial services and information technology. Therefore, the study's findings highlight the need for initiatives aimed at improving digital financial literacy, particularly in developing countries where digital financial services are becoming more prevalent. This need for initiatives aimed at improving digital financial literacy is also supported by the findings by Prasad, Meghwal, & Dayama (2018) that have highlighted the importance of digital financial transactions and the need for empowering the population in terms of DFL.

6. Implications and Limitation

The demand for more progressive financial literacy efforts that can keep up with the quickly evolving digital economy is increased by the current and predicted expansion in digital financial services (OECD, 2017, 2018). Measuring and promoting the Digital Financial Literacy (DFL) of individuals belonging to different sections of society is a prerequisite for formulating adequate strategies and programs that can aid in promoting the DFL of individuals in society. Researchers, government authorities, and concerned financial and educational organizations can easily access the proposed scale for measuring the DFL of individuals.

Financial institutions need to keep track of investors' awareness and investment preferences due to the shift in investor preferences from traditional financial products to new and innovative digital financial products so that new and suitable digital financial products and services can be developed to meet investors' needs. Research on internet-age financial behaviour and DFL is significant both conceptually and practically, as it may improve the efficiency of financial institutions as well as financial management in general (Bakhtina, 2019). Additionally, in order to foster mutually beneficial DFL and responsible financial behaviour, cooperation is required from a number of stakeholders, including the central banks of each country, academics, practitioners, digital financial institutions, and social components of the community (Asyik & Wahidahwati, 2022). The proposed scale can also help organizations and concerned authorities measure and compare individuals' DFL levels pre-and post-implementation of DFL awareness

campaigns and assist them in establishing benchmarks for these aspects, which can serve as a kind of feedback evaluation.

The results of path analysis as structural model results throw light on the direct, significantly negative impact of an individual's digital financial attitude on the overall DFL level of individuals as it's negatively correlated with other dimensions of the DFL. Those concerned with promoting the DFL level of individuals should pay special attention to understanding and influencing the digital financial attitude of individuals in a manner that encourages their DFL in a positive manner. While other aspects of DFL like Digital Financial Risk and Control, Basic Digital Financial Knowledge, Advanced Digital Financial Knowledge, and Digital Financial Behavior displayed a direct strong positive influence on the overall DFL level of individuals in the National Capital Territory of India.

The DFL score of the respondents was 55.94 percent, which deemed unsatisfactory given the study's focus on the metropolitan area of a developing nation such as India, where there is adequate infrastructure for digital financial services and information technology. Therefore, the study's findings highlight the need for initiatives aimed at improving digital financial literacy, particularly in developing countries where digital financial services are becoming more prevalent. These initiatives could involve targeted educational programs, awareness campaigns, and the development of user-friendly digital financial services to help individuals understand and navigate these services more easily.

The study was carried out in India, and the findings need to be validated in other nations due to cultural differences and divergence. Judgmental sampling along with the snowball technique was employed, the limitations of which still apply. The proposed DFL scale will assist in determining an individual's degree of DFL, which is a requirement for developing state and federal policies and initiatives to promote DFL among various societal segments. In this digital age and in light of the financial and physical difficulties brought on by the coronavirus pandemic, it is imperative for people to be digitally financially equipped.

Data Availability Statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Appendix

Appendix 1. Preliminary Questionnaire (Before Pre-testing)

Dimensions of DFL	Statements	Source
Digital financial behavior	1. I share the passwords and PINs of my bank account with my close friends. * 2. Before buying a financial product online, I check if the provider is regulated in my country. (Beh_1) 3. I share information about my personal finances publicly online (e.g., on social media). (Beh_2) 4. I regularly change the passwords on websites that I use for online shopping and personal finance. (Beh_3)	OECD (2022)
Knowledge of digital financial products and services	5. I have an understanding of digital payment products such as IMPS/RTGS/NEFT/AePS/BHIM based money transfers. (Basic_1) 6. I have an understanding of mobile wallets like Paytm, PayPal, PayU money. (Basic_2) 7. I have an understanding of debit/credit/ATM/RuPay cards etc. (Basic_ 4) 8. I have an understanding of the crypto currency (eg Bitcoin) (Adv_1) 9. I have an understanding of the following digital personal financial management platforms, such as DigiBoxx, Clearfunds, Grow, Kuvera, Scripbox, Orowealth, Wealthy, Mint, Zoho Books, QuickBooks, etc. (Adv_2) 10. I have an understanding of the following digital alternatives that connect borrowers to lenders, such as i-Lend, Lendbox, Faircent, i2ifunding, LenDenClub, etc. (Adv_3) 11. I have an understanding of the following digital insurers, such as Acko General Insurance, PolicyBazaar, Mantra Labs, etc. (Adv_4) 12. I have an understanding of "mobile banking" and "internet banking". (Basic_5) 13. A digital financial contract requires the signature of a paper contract to be considered valid. ** (Basic_3)	Setiawan M., et al. (2020); Shen, Y., et al. (2018); Tony, N., & Desai, K. (2020); Banik P. & Datta R. N. (2020); Morgan, P. et al. (2019); Rahayu, R., et al. (2022); Lyons & Kass-Hanna, (2021); ^ OECD (2022) OECD (2022)

Dimensions of DFL	Statements	Source
	14. The personal data that I share publicly online may be used to target me with personalised commercial or financial offers. (DFRC_4)	
Awareness/Attitude toward digital financial risks	15. I would not feel secure conducting financial transactions via the digital finance platforms.# (Att_1)	Wu, X. Q. (2019); Banik P. & Datta R. N. (2020)
	16. I am worried that others might be able to access my personal finance account on the digital finance platform. *	
	17. I may lose money due to my careless mistakes on the digital finance platform.# (Att_3)	
	18. I may lose money due to system processing errorsin digital finance.# (Att_4)	
	19. I think that it is safe to shop online using public Wi-Fi networks (DFRC_7)	OECD (2022)
	20. It is important to pay attention to the security of a website before making a transaction online (DFRC_5)	
	21. I think it is not important to read the terms and conditions when buying something online.# (Att_2)	
	22. I am aware of the potential financial risk of using fintech, such as the existence of online fraud and cyber security risks such as malware locking your computer, phishing where a hacker pretends to be an institution in order to get personal data of the user, spyware, hacking, etc. *	Setiawan M., et al. (2020); Shen, Y., et al. (2018); Tony, N., & Desai, K. (2020); Banik P. & Datta R. N. (2020);
	23. I am able to protect my personal identification number (PIN) and other personal information while using a digital platform.** (Q15)	Morgan, P. et al. (2019); Rahayu, R., et al. (2022); Lyons & Kass-Hanna, (2021)
Knowledge of consumer rights and redress procedures	24. I have an understanding of the customer rights and protections involved in using a digital financial platform. (DFRC_1)	Setiawan M., et al. (2020); Shen, Y., et al. (2018); Tony, N., & Desai, K. (2020); Banik P. & Datta R. N. (2020); Morgan, P. et al. (2019); Rahayu, R., et al. (2022);
	25. I have an understanding of security measures like firewall application, anti-virus software, regular updates of Windows and software etc. (DFRC_2)	
	26. I have an understanding of the procedure to complain about defective services from digital financial providers or Fintech as well as the procedure to report cybercrimes, etc. (DFRC_3)	

Dimensions of DFL	Statements	Source
		Lyons & Kass-Hanna, (2021)
Knowledge of digital financial risk control	27. I am able to manage the cost of using digital financial transactions while using a digital platform. **(Q14) 28. I ensure safety when using digital technology to avoid spamming, phishing, hacking, etc. while using a digital platform. (DFRC_6) 29. I have control over various financial activities like insurance premium payments, investing in shares, etc. using digital platforms by evaluating the spending on the platforms. *	Setiawan M., et al. (2020); Shen, Y., et al. (2018); Tony, N., & Desai, K. (2020); Banik P. & Datta R. N. (2020); Morgan, P. et al. (2019); Rahayu, R., et al. (2022); Lyons & Kass-Hanna, (2021)

*Note: Asterisk mark * marked items were removed in Pre-testing; ** marked items were removed during data analysis to improve reliability and validity of the scale items; # marked items are reverse coded.*

Appendix 2. Proposed DFL Questionnaire (with item codes)

Statements measuring Digital Financial Risk and Control are as follow:-

1. I have an understanding of the customer rights and protections involved in using digital financial platforms. (DFRC_1)
2. I have an understanding of security measures like firewall application, anti-virus software, regular updates of Windowsand software etc. (DFRC_2)
3. I have an understanding of the procedure to complain about defective services from digital financial providers or Fintech as well as the procedure to report cybercrimes, etc. (DFRC_3)
4. The personal data that I share publicly online may be used to target me with personalized commercial or financial offers. (DFRC_4)
5. It is important to pay attention to the security of a website before making a transaction online. (DFRC_5)
6. I ensure safety when using digital technology to avoid spamming, phishing, hacking, etc. while using digital platforms. (DFRC_6)
7. It is not safe to use public Wi-Fi networks for digital financial transactions. (DFRC_7)

Statements measuring Basic Digital Financial Knowledge are as follows:-

8. I have an understanding of digital payment products such as IMPS/RTGS/NEFT/AePS/BHIM based money transfers. (Basic_1)
9. I have an understanding of electronic wallets like Paytm, PayPal, PayU Money, GooglePay, AmazonPay, PhonePe, etc. (Basic_2)
10. I have an understanding of the debit/credit/ATM/RuPay cards etc. (Basic_4)
11. I have an understanding of "mobile banking" and "internet banking". (Basic_5)

Statements measuring Digital Financial Attitude are as follows:-

12. I would not feel secure conducting financial transactions on digital financial platforms like Paytm, GooglePay, IMPS, RTGS, Net banking, PolicyBajar, etc.[#] (Att_1)

13. I think it is not important to read the terms and conditions when buying something online.[#] (Att_2)
14. I may lose money due to my careless mistakes on digital financial platforms.[#] (Att_3)
15. I may lose money due to system processing or technical errors on the digital finance platforms.[#] (Att_4)

Statements measuring Advanced Digital Financial Knowledge are as follows:-

16. I have an understanding of crypto currency (e.g., Bitcoin, Litecoin). (Adv_1)
17. I have an understanding of digital personal financial management apps such as DigiBoxx, Clearfunds, Grow, Kuvera, Scripbox, Orowealth, Wealthy, Mint, Zoho Books, QuickBooks, etc. (Adv_2)
18. I have an understanding of peer-to-peer lending, in which a person can give loan to another person through platforms such as i-Lend, Lendbox, Faircent, i2ifunding, LenDenClub, etc. (Adv_3)
19. I have an understanding of digital insurers such as Acko General Insurance, PolicyBazaar, Mantra Labs, Go Digit General Insurance, etc. (Adv_4)

Statements measuring Digital Financial Behavior are as follows:-

20. Before buying a financial product online, I check if the provider is regulated in my country. (Beh_1)
21. I share information about my personal finances publicly online (e.g., on social media). (Beh_2)
22. I regularly change the passwords on websites that I use for online shopping and personal finance. (Beh_3)

Note: [#] marked statements are reverse-coded.

Appendix 3. Correlation matrix of the Pilot study (Sample 1)

	Basic_1	**Basic_2**	**Basic_3**	**Basic_4**	**Adv_1**	**Adv_2**	**Adv_3**	**Adv_4**	**Beh_1**	**Beh_2**	**Beh_3**	**DFRC_1**
Basic_1	1.000	.592**	.560**	.401**	.200*	.208*	0.135	.423**	0.139	.246**	.239**	.320**
Basic_2	.592**	1.000	.540**	.526**	.314**	.246**	0.072	.453**	.241**	.223**	.301**	.447**
Basic_3	.560**	.540**	1.000	.561**	.218*	.186*	0.073	.369**	0.154	0.159	.205*	.360**
Basic_4	.401**	.526**	.561**	1.000	.336**	.230**	0.149	.278**	0.149	0.162	0.163	.285**
Adv_1	.200*	.314**	.218*	.336**	1.000	.655**	.454**	.505**	.226**	0.082	0.064	.374**
Adv_2	.208*	.246**	.186*	.230**	.655**	1.000	.633**	.532**	.193*	0.022	-0.001	.423**
Adv_3	0.135	0.072	0.073	0.149	.454**	.633**	1.000	.390**	0.098	0.009	-0.078	.423**
Adv_4	.423**	.453**	.369**	.278**	.505**	.532**	.390**	1.000	.193*	.199*	.175*	.438**
Beh_1	0.139	.241**	0.154	0.149	.226**	.193*	0.098	.193*	1.000	.404**	.398**	.311**
Beh_2	.246**	.223**	0.159	0.162	0.082	0.022	0.009	.199*	.404**	1.000	.707**	.188*
Beh_3	.239**	.301**	.205*	0.163	0.064	-0.001	-0.078	.175*	.398**	.707**	1.000	.190*
DFRC_1	.320**	.447**	.360**	.285**	.374**	.423**	.423**	.438**	.311**	.188*	.190*	1.000
DFRC_2	.355**	.487**	.386**	.265**	.387**	.441**	.227**	.547**	.304**	.248**	.380**	.570**
DFRC_3	.287**	.423**	.348**	.255**	.336**	.395**	.374**	.452**	.240**	.209*	.245**	.689**
DFRC_4	.258**	.346**	.245**	.170*	.297**	.441**	.331**	.348**	.177*	0.085	0.110	.482**
DFRC_5	.262**	.409**	.272**	.338**	.320**	.426**	.312**	.501**	.257**	.189*	0.141	.573**
DFRC_6	.341**	.522**	.381**	.318**	.272**	.270**	.170*	.384**	.373**	.234**	0.167	.429**
DFRC_7	.381**	.458**	.420**	.390**	.347**	.389**	.247**	.474**	.207*	.227**	0.124	.451**
Basic_5	.404**	.441**	.493**	.422**	.237**	0.162	0.064	.378**	0.156	.238**	.291**	.290**
Att_1	-0.058	0.045	-0.009	0.021	0.100	0.099	0.096	0.108	0.018	0.076	0.067	0.011
Att_2	0.026	0.028	-0.015	0.008	0.152	0.074	0.137	0.088	-0.030	0.109	0.104	0.126
Att_3	-0.120	-0.111	-0.100	-0.078	0.106	0.003	0.104	0.080	-0.102	0.030	0.060	-0.026
Att_4	0.105	0.086	0.087	0.093	0.119	0.150	0.136	.173*	0.013	0.098	0.117	0.106

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix 3. Correlation matrix of the Pilot study (Sample 1) cont.

	DFRC_2	DFRC_3	DFRC_4	DFRC_5	DFRC_6	DFRC_7	Basic_5	Att_1	Att_2	Att_3	Att_4
Basic_1	.355**	.287**	.258**	.262**	.341**	.381**	.404**	-0.058	0.026	-0.120	0.105
Basic_2	.487**	.423**	.346**	.409**	.522**	.458**	.441**	0.045	0.028	-0.111	0.086
Basic_3	.386**	.348**	.245**	.272**	.381**	.420**	.493**	-0.009	-0.015	-0.100	0.087
Basic_4	.265**	.255**	.170*	.338**	.318**	.390**	.422**	0.021	0.008	-0.078	0.093
Adv_1	.387**	.336**	.297**	.320**	.272**	.347**	.237**	0.100	0.152	0.106	0.119
Adv_2	.441**	.395**	.441**	.426**	.270**	.389**	0.162	0.099	0.074	0.003	0.150
Adv_3	.227**	.374**	.331**	.312**	.170*	.247**	0.064	0.096	0.137	0.104	0.136
Adv_4	.547**	.452**	.348**	.501**	.384**	.474**	.378**	0.108	0.088	0.080	.173*
Beh_1	.304**	.240**	.177*	.257**	.373**	.207*	0.156	0.018	-0.030	-0.102	0.013
Beh_2	.248**	.209*	0.085	.189*	.234**	.227**	.238**	0.076	0.109	0.030	0.098
Beh_3	.380**	.245**	0.110	0.141	0.167	0.124	.291**	0.067	0.104	0.060	0.117
DFRC_1	.570**	.689**	.482**	.573**	.429**	.451**	.290**	0.011	0.126	-0.026	0.106
DFRC_2	1.000	.707**	.526**	.573**	.518**	.517**	.476**	.184*	0.123	0.023	0.133
DFRC_3	.707**	1.000	.606**	.656**	.428**	.500**	.383**	0.122	0.107	0.070	0.149
DFRC_4	.526**	.606**	1.000	.544**	.405**	.518**	.219*	0.022	-0.026	-0.040	0.164
DFRC_5	.573**	.656**	.544**	1.000	.531**	.634**	.397**	0.089	0.108	0.051	0.121
DFRC_6	.518**	.428**	.405**	.531**	1.000	.526**	.349**	0.090	0.026	-.172*	0.042
DFRC_7	.517**	.500**	.518**	.634**	.526**	1.000	.482**	0.019	-0.016	-0.073	0.111
Basic_5	.476**	.383**	.219*	.397**	.349**	.482**	1.000	0.035	0.021	-0.109	0.110
Att_1	.184*	0.122	0.022	0.089	0.090	0.019	0.035	1.000	.526**	.320**	.424**
Att_2	0.123	0.107	-0.026	0.108	0.026	-0.016	0.021	.526**	1.000	.560**	.467**
Att_3	0.023	0.070	-0.040	0.051	-.172*	-0.073	-0.109	.320**	.560**	1.000	.551**
Att_4	0.133	0.149	0.164	0.121	0.042	0.111	0.110	.424**	.467**	.551**	1.000

*Note: N = 135. ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).*

Appendix 4. Correlation matrix of the Validation study (Sample 2)

	Basic_1	**Basic_2**	**Basic_4**	**Adv_1**	**Adv_2**	**Adv_3**	**Adv_4**	**Beh_1**	**Beh_2**	**Beh_3**	**DFRC_1**
Basic_1	1.000	.732**	.520**	.339**	.312**	.181**	.535**	.252**	.167**	.264**	.407**
Basic_2	.732**	1.000	.524**	.469**	.400**	.164**	.533**	.285**	.223**	.284**	.424**
Basic_4	.520**	.524**	1.000	.302**	.212**	.154**	.344**	.200**	.140*	.180**	.345**
Adv_1	.339**	.469**	.302**	1.000	.667**	.509**	.556**	.167**	0.071	0.110	.434**
Adv_2	.312**	.400**	.212**	.667**	1.000	.632**	.553**	.122*	-0.007	0.042	.363**
Adv_3	.181**	.164**	.154**	.509**	.632**	1.000	.470**	0.040	-0.028	-0.027	.360**
Adv_4	.535**	.533**	.344**	.556**	.553**	.470**	1.000	.256**	.207**	.293**	.499**
Beh_1	.252**	.285**	.200**	.167**	.122*	0.040	.256**	1.000	.505**	.542**	.296**
Beh_2	.167**	.223**	.140*	0.071	-0.007	-0.028	.207**	.505**	1.000	.773**	.230**
Beh_3	.264**	.284**	.180**	0.110	0.042	-0.027	.293**	.542**	.773**	1.000	.310**
DFRC_1	.407**	.424**	.345**	.434**	.363**	.360**	.499**	.296**	.230**	.310**	1.000
DFRC_2	.495**	.494**	.384**	.434**	.366**	.279**	.561**	.280**	.251**	.420**	.700**
DFRC_3	.351**	.402**	.298**	.387**	.391**	.373**	.439**	.234**	.202**	.302**	.679**
DFRC_4	.334**	.334**	.217**	.345**	.432**	.396**	.350**	0.072	0.017	0.086	.534**
DFRC_5	.401**	.500**	.361**	.416**	.467**	.315**	.556**	.256**	.153**	.185**	.598**
DFRC_6	.406**	.496**	.336**	.342**	.312**	.173**	.422**	.255**	.180**	.211**	.584**
DFRC_7	.396**	.431**	.385**	.387**	.395**	.271**	.488**	.225**	.195**	.223**	.537**
Basic_5	.526**	.528**	.499**	.324**	.214**	0.109	.443**	.174**	.164**	.266**	.460**
Att_1	0.008	0.029	0.052	-0.056	-0.050	-.129*	-0.029	0.020	-0.005	-0.050	-0.077
Att_2	-0.042	-0.017	0.013	-0.024	-0.073	-.218**	-0.101	0.029	-0.049	-0.080	-0.106
Att_3	-0.099	-0.084	-.144*	-0.055	-0.085	-.159**	-.145*	-0.048	-.134*	-0.101	-.144*
Att_4	-.158**	-0.071	-0.084	-0.061	-0.104	-.174**	-.267**	-.114*	-.123*	-.192**	-.205**

*Note: N = 300. ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).*

Appendix 4. Correlation matrix of the Validation study (Sample 2) cont.

	DFRC_2	DFRC_3	DFRC_4	DFRC_5	DFRC_6	DFRC_7	Basic_5	Att_1	Att_2	Att_3	Att_4
Basic_1	.495**	.351**	.334**	.401**	.406**	.396**	.526**	0.008	-0.042	-0.099	-.158**
Basic_2	.494**	.402**	.334**	.500**	.496**	.431**	.528**	0.029	-0.017	-0.084	-0.071
Basic_4	.384**	.298**	.217**	.361**	.336**	.385**	.499**	0.052	0.013	-.144*	-0.084
Adv_1	.434**	.387**	.345**	.416**	.342**	.387**	.324**	-0.056	-0.024	-0.055	-0.061
Adv_2	.366**	.391**	.432**	.467**	.312**	.395**	.214**	-0.050	-0.073	-0.085	-0.104
Adv_3	.279**	.373**	.396**	.315**	.173**	.271**	0.109	-.129*	-.218**	-.159**	-.174**
Adv_4	.561**	.439**	.350**	.556**	.422**	.488**	.443**	-0.029	-0.101	-.145*	-.267**
Beh_1	.280**	.234**	0.072	.256**	.255**	.225**	.174**	0.020	0.029	-0.048	-.114*
Beh_2	.251**	.202**	0.017	.153**	.180**	.195**	.164**	-0.005	-0.049	-.134*	-.123*
Beh_3	.420**	.302**	0.086	.185**	.211**	.223**	.266**	-0.050	-0.080	-0.101	-.192**
DFRC_1	.700**	.679**	.534**	.598**	.584**	.537**	.460**	-0.077	-0.106	-.144*	-.205**
DFRC_2	1.000	.685**	.508**	.602**	.571**	.579**	.552**	0.022	-0.088	-.176**	-.228**
DFRC_3	.685**	1.000	.654**	.654**	.509**	.532**	.458**	-0.093	-.135*	-0.099	-.185**
DFRC_4	.508**	.654**	1.000	.621**	.476**	.519**	.309**	-.195**	-.164**	-0.037	-.129*
DFRC_5	.602**	.654**	.621**	1.000	.670**	.675**	.500**	-0.007	-0.018	-0.055	-.124*
DFRC_6	.571**	.509**	.476**	.670**	1.000	.612**	.480**	0.051	0.032	-0.084	-0.100
DFRC_7	.579**	.532**	.519**	.675**	.612**	1.000	.560**	0.081	-0.028	-0.062	-.125*
Basic_5	.552**	.458**	.309**	.500**	.480**	.560**	1.000	0.069	0.063	-0.040	-0.052
Att_1	0.022	-0.093	-.195**	-0.007	0.051	0.081	0.069	1.000	.498**	.339**	.372**
Att_2	-0.088	-.135*	-.164**	-0.018	0.032	-0.028	0.063	.498**	1.000	.589**	.504**
Att_3	-.176**	-0.099	-0.037	-0.055	-0.084	-0.062	-0.040	.339**	.589**	1.000	.655**
Att_4	-.228**	-.185**	-.129*	-.124*	-0.100	-.125*	-0.052	.372**	.504**	.655**	1.000

*Note: N = 300. ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).*