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Psychometric properties of the Technology Device Interference Scale (TDIS) and Technology Interference in Life Examples Scale (TILES) in Spanish-speaking couples' Relationships

Pilar Berzosa-Grande[1], Vanessa Caba-Machado[2], Gemma Mestre-Bach[2], Giulia Testa[2], Frank García-Castrillón[1], Raquel Rivas-Díez[1], Juan Carlos Fernández-Rodríguez[1], and Eduardo González-Fraile[1,*]

[1] *Faculty of Health Sciences, International University of La Rioja, UNIR, Logroño, Spain*
[2] *Instituto de Transferencia e Innovación (ITEI), International University of La Rioja, UNIR, Logroño, Spain*

Título: Propiedades psicométricas de la Escala de Interferencia de Dispositivos Tecnológicos (TDIS) y de la Escala de Interferencia de la Tecnología en Ejemplos de Vida (TILES) en relaciones de pareja hispanohablantes.
Resumen: *Antecedentes*: La tecnoferencia se refiere a las interrupciones causadas por dispositivos tecnológicos durante las interacciones personales. Si bien este fenómeno está muy extendido, existe una escasez de herramientas validadas en español. La Escala de Interferencia de Dispositivos Tecnológicos (TDIS) y la Escala de Interferencia de la Tecnología en Ejemplos de Vida (TILES) evalúan la tecnoferencia en las relaciones de pareja. *Métodos*: Estudio observacional para evaluar sus propiedades psicométricas. 997 adultos españoles con relaciones estables completaron ambas escalas (TDIS, TILES) y la Escala de Ajuste Diádico (DAS). *Resultados*: La TDIS y la TILES mostraron una consistencia interna satisfactoria (α = .73 a .91). Se confirmó su estructura unidimensional, con análisis de invarianza que respaldan el uso en función del sexo y la edad para la TILES, e invarianza escalar parcial para la TDIS. El análisis de la TDIS reveló diferencias significativas en cuanto a la edad y el género de los participantes; sin embargo, en el caso de la TILES, estas diferencias se limitaron únicamente a la edad. Se calcularon percentiles de la puntuación total. Los niveles más altos de tecnoferencia se asociaron con una menor calidad de la relación. *Conclusiones*: TDIS y TILES son instrumentos válidos y fiables que permiten medir eficazmente el impacto de la tecnoferencia en las relaciones de pareja en poblaciones hispanohablantes.
Palabras clave: Tecnoferencia. Relaciones de pareja. Propiedades psicométricas. Validación en español.

Abstract: *Background:* Technoference is the disruptions caused by technological devices during personal interactions. Although this phenomenon is widespread, there is a lack of validated tools in Spanish. The Technology Device Interference Scale (TDIS) and the Technology Interference in Life Examples Scale (TILES) assess technoference in couples' relationships. *Methods:* An observational study to evaluate their psychometric properties. 997 Spanish adults in long-term relationships completed both scales (TDIS, TILES) and the Dyadic Adjustment Scale (DAS). *Results:* TDIS and TILES showed satisfactory internal consistency (α = .73 to .91). Their unidimensional structure was confirmed, with invariance analyses supporting use across sex and age for TILES, and partial scalar invariance for TDIS. The TDIS analysis revealed significant differences regarding the age and gender of participants; however, in the case of TILES, these differences were confined to age only. Percentiles of the total score were calculated. Higher levels of technoference were associated with a lower relationship quality. *Conclusions:* TDIS and TILES are valid and reliable instruments that can effectively measure the impact of technoference on couple relationships in Spanish-speaking populations.
Keywords: Technoference. Couple relationships. Psychometric properties. Spanish validation.

Introduction

In recent years, research has shown a particular interest in the potential impact of technological expansion on social interactions. The widespread availability of technology (e.g., internet and cell phones) has created opportunities for external influences (e.g., coworkers, friends, job responsibilities, etc.) to disrupt the development of relationships (Murray & Campbell, 2015). In this context, the term "technoference" has been coined. This construct is a fusion of "technology" and "interference". It denotes an individual's subjective perception regarding the extent to which their interlocutor's utilization of technology (e.g., smartphones, television, computers, and tablets) interferes with the quality of time they spend together (McDaniel & Coyne, 2016a, 2016b). Technoference seems to be a growing phenomenon, mainly due to environmental factors such as the COVID-19 pandemic (Zoppolat et al., 2022), and the rapid development/accessibility to technology.

This phenomenon may affect both intra and interpersonal levels (Hipp & Carlson, 2021; McDaniel & Coyne, 2016a, 2016b; McDaniel et al., 2018) and has been suggested to interfere with close relationships (Sbarra et al., 2019). Within the specific context of romantic relationships, it has been observed that when one partner becomes distracted by technology in the presence of the other, it can disrupt the quality of couple interactions, leading to relationship and intimacy conflicts and lower levels of relationship, sexual, and life satisfaction (Amichai-Hamburger & Etgar, 2016; Çakır & Köseliören, 2022; Halpern & Katz, 2017; Hipp & Carlson, 2021; McDaniel & Coyne, 2016a; McDaniel et al., 2018; Mushquash et al., 2022).

The negative consequences of technoference may be attributed to the perception that the device is valued more than the partner, which can lead to a sense of exclusion (Hales et al., 2018). Additionally, considering the constant analysis of rewards and costs experienced within romantic relationships, technoference may diminish rewards and increase costs, ultimately deteriorating relationship quality

*** Correspondence address [Dirección para correspondencia]:**
Eduardo González-Fraile. Faculty of Health Sciences, International University of La Rioja, UNIR, Logroño (Spain).
E-mail: Eduardo.gonzalez@unir.net
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(McDaniel et al., 2021). In this regard, technoference in couple interactions, particularly among couples with children, may also be associated with different children's problems, such as smartphone dependency of children (Shao et al., 2022), child social competence (Merkaš et al., 2021), and variation in the child's externalized and internalized behaviour (Mackay et al., 2022; McDaniel & Radesky, 2018; Sundqvist et al., 2020).

Despite the growing interest in this phenomenon, assessing technoference remains challenging. Its recent conceptualisation has resulted in heterogeneity among studies measuring it (Dixon et al., 2023). Certain studies have used a few items to assess technoference (Glassman et al., 2021). Other studies have used instruments that evaluate phubbing as the snubbing of others for phone use as a proxy for technoference, which can lead to confusion as these are two distinct, although interrelated constructs (Roberts & David, 2016). Lastly, some authors have attempted to develop instruments to assess technoference. McDaniel and Coyne (2016a) developed the Technology Device Interference Scale (TDIS) to determine the perception of how frequently technology (e.g., cell phones/smartphones, TV, computers/laptops, and iPads or other tablets) interrupts interactions with the partner and the Technology Interference in Life Examples Scale (TILES) to assess how the person perceives technology to interfere with their relationship in everyday situations (e.g., typical meals, conversations, leisure time with a partner). Both are brief scales with higher scores indicating more frequent interference in a couple's relationship and interactions. Although these two scales have been extensively used, there is a lack of knowledge about their psychometric properties in non-English speaking populations. Given the increasing use of technology in Spanish-speaking countries and the importance of assessing its impact on relationships, there is a clear need to test these scales in the Spanish context.

The primary objective of this study is to assess the psychometric properties of the TDIS and TILES within a sample of Spanish-speaking couples. By doing so, we aim to provide reliable and valid instruments for measuring technoference in Spanish-speaking populations, facilitating further research and clinical interventions focused on technology's impact on relationship quality.

Material and methods

Transparency and openness

We are committed to transparency and openness in this research. This study was registered on the Open Science Framework (OSF). All databases used in this study are publicly available on the OSF repository (https://osf.io/bq654/?view_only=44b14c2495f1464d943e55ccfa438602). Following ethical guidelines, the data has been anonymized to ensure participant privacy.

Participants

The study involved adult men and women over 18 living with their partners in Spain. Recruitment occurred from February to June 2022. 997 individuals responded to the survey.

Data was collected from 15 of Spain's 17 autonomous communities. Women comprised most participants (72.17%), with an average age of 45.04 (*SD* = 10.72). Concerning participant ages, the distribution was as follows: 313 (32.23%) aged <40 years, 599 (61.68%) aged 40-60 years, and 59 (6.07%) aged above 60 years. Most participants had higher education (87.61%), were married (68.62%), employed (84.08%), and reported high job satisfaction. Regarding their relationships, the average duration was 19.12 years, with 15.09 years spent cohabiting (*SD* = 10.89). About 74% had children, averaging 1.95 (*SD* = 0.88). Overall, family satisfaction was high, with an average score of 8.49 (*SD* = 1.39).

Instruments

Technoference

TDIS (McDaniel & Coyne, 2016a): This scale consists of 4 questions assessing how frequently technology devices (like mobile phones, TVs, computers, and tablets) interrupt couple interactions. Responses are given on a six-point Likert scale ranging from 0 ("Never") to 5 ("All the time"). The total score, varying from 0 to 20, is the sum of all responses. A higher score suggests more frequent disruptions in relationships. Cronbach's alpha in the original study was .67, while in the present study it was .73.

TILES (McDaniel & Coyne, 2016a): This 5-item scale evaluates how often a person encounters technology-related interruptions in daily interactions with their partner. It uses an eight-point Likert scale for responses, from 0 ("Never") to 7 ("10 or more times a day"). The total score ranges from 0 to 35, with higher scores indicating more frequent disturbances in partner interactions. The Cronbach's alpha for the TILES Scale in this study was .87, while in the original study it was .85.

Both scales were translated into Spanish using back-translation following the International Test Commission's guidelines (2017) (Gregoire, 2018) and established practices for adapting surveys (Muñiz & Fonseca-Pedrero, 2019). Two independent Spanish native translators translated the original tool into Spanish. Then, the authors and translators assessed the consistency between the English and Spanish versions and thoroughly examined each item. The Spanish version was subsequently retranslated into English by a different translator, a native English speaker. The research team compared the original and retranslated English versions to confirm semantic and conceptual consistency. The final translation was administered to 10 people to confirm its comprehension and usability.

Quality of relationships

We used the Dyadic Adjustment Scale (DAS) (Spanier, 1976) to assess the relationship quality. It encompasses four distinct subscales: relationship satisfaction, intimacy, affective expression, and cohesion. Together, these subscales contribute to an overall Dyadic Adjustment score. The DAS comprises 32 items, each rated on a Likert scale based on their frequency or intensity in the participant's life. The scoring system uses standardized scales suitable for both general and clinical populations. Raw scores are converted to standardized scores as per the guidelines in the reference manual, with higher scores indicating better relationship adjustment. This scale presented high reliability for the original (Cronbach's alpha: .96), and the Spanish version (Cronbach's alpha = .86) (Cano-Prous et al., 2014; Spanier, 1976). In this study, reliability scores were lower (α relationship satisfaction = .76; α intimacy = .78; α affective expression = .78; and α cohesion = .82).

Procedure

The study gathered data through the Labvanced online platform (Finger et al., 2017). Participant recruitment was done individually via online postings on social media platforms like LinkedIn, Meta, WhatsApp, and email. We utilized our personal and professional networks to promote survey participation and disseminate further information about the study (snowball sampling strategy). Throughout this process, we adhered to a "No Tracking Policy", ensuring we did not store any IP addresses, cookies, or other personal data to track participants. No third-party tracking software was used either. All collected data were made anonymous to the greatest extent possible. Since no identifying information was collected, participants were not required to sign an informed consent form. At the start of the questionnaire, participants were presented with detailed information about the study, including its context, objectives, methodology, selection criteria, risks and benefits, data handling, and contact details, with a strong focus on ensuring anonymity and voluntary participation.

All experimental procedures complied with the Declaration of Helsinki guidelines and received approval from the Ethics Committee of the International University of La Rioja, Spain (Internal Code: 001/2022).

Data Analysis

Descriptive statistics for the TDIS and TILES were computed. This involved calculating the arithmetic mean, standard deviation, item-total correlation, skewness, and kurtosis. Each item's psychometric characteristics were analyzed to assess internal validity. Moreover, Cronbach's alpha coefficient (Cronbach, 1951), the Ordinal alpha coefficient (Oliden & Zumbo, 2008), and McDonald's Omega (McDonald, 2013) were calculated to assess the instrument's internal consistency.

The normalized estimate of multivariate kurtosis was examined (Mardia, 1970), revealing non-normality in the sample's multivariate distribution. However, to examine the structure of the TDIS and TILES, the Maximum Likelihood Estimator (ML) was used because it performed well when the sample size was equal to or greater than 500, with the rejection rate higher than nominal at smaller sample sizes (Hu et al., 1992).

CFA models were evaluated using multiple fit indices: Comparative Fit Index (CFI) and the Tucker-Lewis index (TLI), where values $\geq .90$ suggest an adequate fit. It was also used the Root Mean Squared Error of Approximation (RMSEA) with values $\leq .08$, and the Standardized Root-Mean-Square Residual (SRMR), where values $\leq .08$ and $\leq .10$ denote an adequate fit.

By default, multigroup measurement invariance across sex and age was assessed with an ML estimator, using three incremental levels: configural invariance, metric invariance and scalar invariance. The models were compared through the difference in the values of CFI (ΔCFI). The values of $\Delta CFI < .01$ allow us to establish the invariance of the scale (Chen, 2007).

Comparison analyses were performed by age (less than 40 years, between 40-60 years, and higher than 60 years) and gender. Quantitative data regarding means and standard deviations (*SD*) were presented. Student's *t*-test for independent samples was used to evaluate the mean differences across two-category qualitative variables, and ANOVA comparisons for scenarios involving more than two categories. Further, pairwise post hoc comparisons were conducted using the Bonferroni test. In addition, Cohen's d and h^2 were used to provide the effect sizes.

The total TDIS and TILES sum score was calculated to determine the percentiles. These percentiles were calculated concerning gender and age, with age being divided into three groups: less than 40, 40-60, and more than 60 years.

Finally, Structural Equation Modeling (SEM) was used to examine the direct effects of TDIS and TILES on the Dyadic Adjustment Scale (DAS). Although TDIS and TILES are theoretically and empirically related, they were modelled as separate predictors in the SEM due to their conceptual distinctiveness. TDIS reflects the disruptive nature of technology on couple interactions, whereas TILES represents a more internalized or passive use of technology as a coping mechanism. To ensure that multicollinearity was not a concern, we conducted collinearity diagnostics. Both the Variance Inflation Factor (VIF) and Tolerance were 1.000, indicating no multicollinearity. Furthermore, the correlation between TDIS and TILES in the SEM was $r = .67$, below the recommended threshold of .85 (Kline, 2012), supporting their statistical distinction.

Data were analysed with Jamovi (Version 2.6.44), SPSS (Version 29) and AMOS (Version 29).

Results

Descriptive analyses, reliability and validity

Table 1 shows different descriptive (mean, standard deviation, skewness, kurtosis) and psychometric values (item total correlation and Cronbach's alpha) for each item of both scales (TDIS and TILES). The higher mean score (2.30) of the TDIS was found in item 1 (interruptions caused by using a smartphone) and the lowest in item 4 (*M* = .87) related to interruptions caused by the use of the tablet. In the TILES, higher scores were detected for items related to device notifications and mealtime (*M* = 2.67 and 2.29, respectively). Skewness and kurtosis values indicated a leptokurtic distribution and an asymmetrically negative curve. The item-total correlations of all items showed good indexes (ranging from .68 to .87).

According to the typical cutoff point, the reliability (Cronbach's alpha coefficient, ordinal alpha coefficient, and McDonald's Omega) of the TDIS and the TILES were acceptable.

Table 1
Internal validity indicators and reliability for the two scales (TDIS and TILES) (n = 974)

Item	Description	Mean *(SD)*	*I-T*	α *(if item deleted)*	*Skew*	*Kurt*	Reliability		
							Alpha	Omega	Ordinal
	Technology Device Interference Scale (TDIS).	6.12 (3.43)					.737	.738	.836
1	Interruptions caused by cell phone/Smartphone	2.30 (1.18)	.75	.671	.172	-.195			
2	Interruptions caused by television	1.59 (1.16)	.75	.671	.462	-.216			
3	Interruptions caused by computer or laptop	1.37 (1.15)	.77	.648	.696	.07			
4	Interruptions caused by Ipad or tablet	0.87 (1.11)	.68	.715	1.39	1.77			
	Technology Interference in Life Examples Scale (TILES).	11.18 (8.27)					.873	.87	.914
1	During a typical mealtime that my partner and I spend together, my partner pulls out and checks his/her phone or mobile device.	2.00 (2.14)	.80	.857	.250	-1.25			
2	My partner sends texts or emails to others during our face-to-face conversations.	1.72 (1.94)	.84	.836	.98	-.254			
3	When my partner's phone or mobile device rings or beeps, he/she pulls it out even if we are in the middle of a conversation.	2.29 (2.03)	.87	.826	.701	-.676			
4	During leisure time that my partner and I are able to spend together, my partner gets on his/her phone, mobile device, or tablet.	2.67 (2.05)	.87	.830	.460	-1.05			
5	My partner gets distracted from our conversation by the TV.	1.84 81.98)	.72	.880	.993	-0.128			

Note. I-T = item-total correlation, α = Cronbach's alpha, *Kurt = Kurtosis, and Skew = Skewness.*

Regarding validity, the confirmatory factor analysis (CFA) of the TDIS showed the following fit indices: $\chi^2(1)$ = 4.170, p < .05, CFI = .996, TLI = .977, RMSEA = .057, 90% CI [.009, .118], SRMR = .0111, and factor loadings were significant and ranged between .43 and .73. Moreover, the CFA of the TILES was: $\chi^2(3)$ = 5.23, *p* > .05, CFI = .999, TLI = .997, RMSEA = .028, 90% CI [.000, .066], SRMR = .0080, and factor loading were significant and ranged between .59 and .87.

Sex and age invariance of the scales of TDIS and TILES

Table 2 shows the goodness-of-fit indexes for each scale across groups defined by sex and age. It also presents the measurement invariance models of each scale for these groups. The goodness-of-fit indexes show adequate values, suggesting that the model is relevant for males, females, and the different age groups.

The measurement invariance of the TDIS across sex was evaluated using a hierarchical approach. The configural model demonstrated good fit, and metric invariance was supported (ΔCFI = .009). However, imposing scalar invariance constraints led to a deterioration in model fit (ΔCFI = .025). Subsequently, partial scalar invariance was tested by releasing the intercepts of items 1 and 3. This adjustment resulted in an improved model (ΔCFI = .010).

Invariance of the TDIS across age groups was also assessed. The configural model (Model 1) showed good fit (CFI = .944; RMSEA = .065). Metric invariance was supported (ΔCFI = .007). However, the scalar invariance model showed a significant decrease in model fit (ΔCFI = .037), suggesting that full scalar invariance could not be assumed. Partial scalar invariance was tested by releasing the intercepts of items 2 and 3, which resulted in a ΔCFI < .010, supporting partial scalar invariance.

For the TILES measure, evidence supported configural, metric, and scalar invariance across both sex (men and women) and age groups (under 40 years, 40–60 years, and over 60 years). Changes in fit indices (CFI, RMSEA) across models were minimal and within recommended thresholds, indicating that full measurement invariance was achieved.

Table 2
Confirmatory factor analysis and invariance tests for sex and age for the scales of TDIS and TILES

Model	χ^2	*df*	RMSEA (IC 90%)	CFI	SRMR	TLI	AM	$\Delta\chi^2$	Δdf	ΔRMSEA	ΔCFI
TDIS											
1. Male	7.012	1	.149 (.061; .261)	.976	.0263	.858	-	-	-	-	-
2. Female	.837	1	.000 (.000; .097)	1.0	.0060	1.00	-	-	-	-	-
M1	7.861*	2	.055 (019; .098)	.993	.0263	.958	-	-	-	-	-
M2	18.266*	5	.052 (.028; .079)	.984	.0466	.962	M2vsM1	10.405	3	-.003	-.009
M3	43.759**	9	.063 (.045; .082)	.959	.0485	.945	M3vsM2	25.493	4	.011	-.025
M4	29.131**	7	.057 (.037; .079)	.974	.0607	.955	M4vsM2	10.865	2	-.006	.010
<40 years	2.217	1	.062 (.000; .177)	.995	.0159	.970	-	-	-	-	-
40–60 years	.203	1	.000 (.000; .083)	1.00	.0030	1.00	-	-	-	-	-
>60 years	.008	1	.000 (.000; .111)	1.00	.0012	1.00	-	-	-	-	-
M1	61.040**	12	.065 (.049; .082)	9.44	.0204	9.16	-	-	-	-	-
M2	70.147**	15	.062 (.048; .077)	.937	.0373	.924	M2vsM1	9.107	3	-.003	-.007
M3	105.85**	19	.069 (.056; .082)	.900	.0407	.906	M3vsM2	35.703	4	.007	-.037
M4	74.915**	13	.070 (.055, .086)	.929	.0559	.902	M4vsM2	4.768	-2	.008	-.008
TILES											
1. Male	11.95	3	.105 (.048; .171)	.988	.0247	.960	-	-	-	-	-
2. Female	3.509	3	.016 (.000; .067)	1.000	.0075	.999	-	-	-	-	-
M1	15.480*	6	.040 (.016; .066)	.996	.0075	.987	-	-	-	-	-
M2	19.889*	10	.040 (.016; .066)	.996	.0097	.992	M2vsM1	4.409	4	.000	.000
M3	25.959*	15	.027 (.006; .045)	.996	.0097	.994	M3vsM2	6.070	5	-.013	.000
<40 years	4.469	3	.00 (.000; .110)	.998	.0167	.994	-	-	-	-	-
40–60 years	11.456*	3	.069 (.030; .113)	.995	.0154	.982	-	-	-	-	-
>60 years	8.445*	3	.177 (.038; .323)	.996	.0472	.886	-	-	-	-	-
M1	74.371**	26	.044 (.032; .056)	.981	.0185	.978	-	-	-	-	-
M2	76.217**	30	.040 (.029; .051)	.981	.0160	.981	M2vsM1	1.846	4	-.004	.000
M3	107.366**	35	.046 (.036; 056)	.971	.0164	.975	M3vsM2	31.149	5	.006	-.010

Note. χ^2 = Chi-square; df = degrees of freedom, RMSEA = root mean square error of approximation, CFI = comparative fit index, SRMR = standardized root mean square residual, TLI = Tucker-Lewis index, ΔX^2 = Chi-square difference, Δdf= difference in degrees of freedom, ΔRMSEA= difference in root mean square error of approximation,, ΔCFI = difference in comparative fit index, M1 = configural model, M2 = metric invariance, M3 = scalar invariance, M4 = partial scalar invariance. * p < .001.

Differences by gender and age

The TDIS showed statistically significant differences based on gender of the respondent in the overall scores (M_{males} = 5.54 and SD_{males} = 3.16; M_{females} = 6.35 and SD_{females} = 3.51; t = 3.295, p = .001, d = 0.23, 95% CI = [0.09 to 0.37]). Females reported significantly more interruptions in items referring to smartphone, TV, and laptop use (see Table 3).

According to age, the <40 age group showed the highest mean. There were statistically significant differences between the three age groups in the total score ($F_{(2, 968)}$ = 2.93, p =.005, h^2 = 0.06). The differences were found between <40 and 40-60 (p = .04, Cohen's d = -0.17). The correlation between age and TDIS total score was not significant.

Table 3
Differences by gender and age (TDIS and TILES) (n = 974)

Item	Description	Gender				Age				
		Males (N=271)	*Females (N=703)*	*p value*	Cohen's d [95% CI]	< 40 *(N=313)*	40-60 *(N=599)*	> 60 *(N=59)*	*p value*	h²
	Technology Device Interference Scale (TDIS), mean (SD)	5.54 (3.16)	6.35 (3.51)	.001	0.23 [0.09; 0.37]	5.76 (3.19)	6.33 (3.44)	6.20 (4.27)	.005	0.06
1	Interruptions caused by cell phone/Smartphone	2.04 (1.15)	2.39 (1.17)	<.001	0.30 [0.16; 0.44]	2.46 (1.14)	2.25 (1.61)	1.94 (1.30)	.003	0.01
2	Interruptions caused by television	1.42 (1.01)	1.66 (1.19)	.004	0.20 [0.06; 0.34]	1.38 (1.13)	1.69 (1.22)	1.83 (1.37)	<.001	0.01
3	Interruptions caused by computer or laptop	1.20 (0.96)	1.42 (1.21)	.006	0.19 [0.05; 0.33]	1.26 (1.13)	1.43 (1.16)	1.32 (1.12)	.109	<0.01
4	Interruptions caused by Ipad or tablet	0.87 (0.99)	0.86 (1.14)	.917	-0.01 [-0.14; 0.13]	0.64 (0.96)	0.95 (0.15)	1.10 (1.15)	<.001	0.02
	Technology Interference in Life Examples Scale (TILES), mean (SD)	10.91 (8.18)	11.29 (8.30)	.526	0.04 [-0.09; 0.18]	12.53 (8.15)	10.54 (8.18)	10.96 (9.01)	.002	0.01
1	During a typical mealtime that my partner and I spend together, my partner pulls out and checks his/her phone or mobile device.	2.57 (2.08)	2.70 (2.16)	.405	0.05 [-0.08; 0.19]	3.19 (2.07)	2.44 (2.13)	2.30 (2.17)	<.001	0.02
2	My partner sends texts or emails to others during our face-to-face conversations.	1.75 (1.94)	1.71 (1.94)	.733	-0.02 [-0.16; 0.11]	2.15 (1.97)	1.52 (1.88)	1.44 (1.95)	<.001	0.02
3	When my partner's phone or mobile device rings or beeps, he/she pulls it out even if we are in the middle of a conversation.	2.28 (1.97)	2.28 (2.05)	.997	-0.01 [-0.14; 0.13]	2.48 (2.06)	2.21 (2.01)	2.08 (2.07)	.113	<0.01
4	During leisure time that my partner and I are able to spend together, my partner gets on his/her phone, mobile device, or tablet.	2.61 (2.06)	2.68 (2.04)	.654	0.03 [-0.10; 0.17]	2.95 (2.01)	2.53 (2.03)	2.59 (2.28)	.011	<0.01
5	My partner gets distracted from our conversation by the TV.	1.67 (1.85)	1.90 (2.02)	.104	0.11 [-0.09; 0.18]	1.74 (1.91)	1.83 (1.95)	2.54 (2.83)	.055	<0.01

The results from the TILES revealed no statistically significant variances in the aggregate scores when analyzed by the respondent's gender. None of the scale items showed statistically significant differences by gender (p >.05).

There were significant age differences in the total score of the TILES ($F_{(2, 968)} = 6.06$, p =.002, $h^2 = 0.01$). These statistically significant differences were detected between the groups of <40 and 40-60 (p = .001, Cohen's d = .24). The correlation between TILES total score and age was significant (r = -.115, p < .001).

Percentiles

To calculate the percentiles of the TDIS and TILES by adding the scores of both scales.

Table 4 shows the different scores for the percentiles as a function of gender for the age groups (<40, 40-60 and >60).

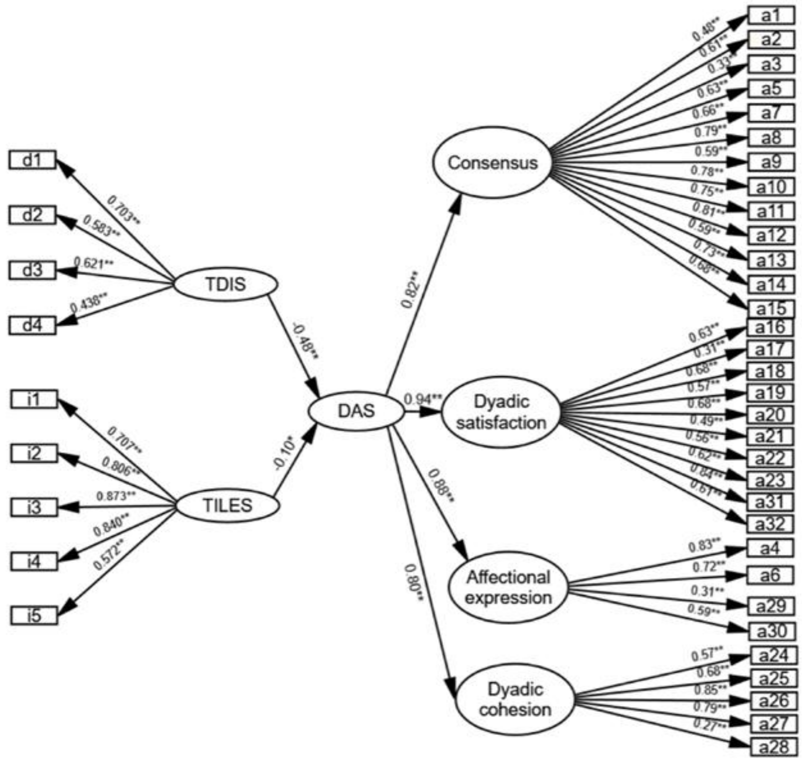
Direct effect of TDIS and TILES on DAS

Figure 1 shows the direct effect of TDIS and TILES on the DAS. This model presented an acceptable fit (χ2(752) = 2586.005, RMSEA = .050 (CI 90% .048-.052), CFI = .909, TLI = .900, SRMR = .091). Furthermore, the results indicated that TDIS had a significant and negative direct effect on DAS (β = -4.138, $p \leq .001$). TILES also had a significant and negative effect on DAS (β = -.102, $p \leq .05$).

Table 4
Scores for the percentiles of the sum score of TDIS and TILES as a function of gender and age (n = 974)

Percentiles	Scores					
	Males			Females		
	< 40 *n* = 57	40-60 *n* = 186	> 60 *n* =28	< 40 *n* = 257	40-60 *n* = 414	> 60 *n* = 32
5	4	3	5	4	4	4
10	6	4	5	6	6	6
15	7	6	5	8	7	7
20	7	7	6	9	8	7
25	9	9	8	11	9	8
30	12	10	9	12	10	9
35	13	11	9	13	12	11
40	15	12	11	15	13	12
45	15	13	11	16	14	14
50	17	14	12	17	15	15
55	18	15	16	19	16	15
60	19	17	17	20	18	18
65	21	20	20	22	19	19
70	23	21	21	14	22	20
75	25	23	23	25	24	22
80	26	26	25	27	26	28
85	28	28	27	29	32	29
90	30	31	28	32	32	35
95	36	33	37	37	37	43
Mean	17.92	16.23	16.29	18.37	17.16	17.90
(SD)	(10.11)	(9.96)	(11.16)	(10.39)	(10.65)	(13.14)

Figure 1
Structural model of TDIS, TILES, and DAS with standardized factorial loadings (n = 974)



Note. DAS: Dyadic Adjustment Scale; TDIS: Technology Device Interference Scale; TILES: Technology Interference in Life Examples Scale.

Discussion

The widespread adoption of smartphones globally has given rise to new challenges, such as technoference, which refers to the interference or disruption caused by technology in face-to-face interactions, particularly in relationships (McDaniel & Coyne, 2016a). Despite the increasing attention given to this phenomenon, its recent conceptualization has led to variations among studies in how it's measured. Additionally, there need to be validated assessment tools for technoference in Spanish-speaking regions, which is essential for ensuring their relevance and effectiveness. Therefore, the present study contributes to its development by conducting this instrumental study.

Descriptive analysis reveals that most participants perceive technological devices as sources of interference during interactions with their partners. According to the **TDIS** results, cell phones/smartphones and TV cause the most significant relationship disruptions, differing slightly from the original study (McDaniel & Coyne, 2016a). This may be due to possible differences in the samples (this study included participants of both genders, whose average age was significantly older than in the original study) or due to chronological factors that need to be considered. Over the past eight years, mobile phone usage has increased, with new social media platforms and functionalities becoming normalized, especially among younger users. Additionally, video-on-demand (VOD) platforms have expanded TV consumption (Cordeiro et al., 2021).

The **TILES** results align with the original study, showing that interference most often occurs during mealtimes (when partners check their phones), while the least interference happens when the TV distracts from conversations. This pattern suggests that technoference is perceived as more disruptive during shared activities that require greater engagement or where there is an expectation of conversation, sharing experiences, or strengthening relationships bonds. The consistency of these results with previous studies reinforces the cross-cultural validity of the TILES scale. Despite possible cultural differences in technology use or social norms around communication, interference patterns remain similar, underlining the universal relevance of technoference as a relational phenomenon.

Gender and age analyses indicate that women and participants aged 40-60 score higher on the **TDIS** scale. However, these differences may reflect either higher interference by their partners or greater sensitivity to technoference behaviors. This may be because women in general may have a higher expectation of communication or emotional connection with their partner as part of family dynamics

(Zmaczyńska-Witek et al., 2019). On the other hand, this age group has incorporated technology into their lives later in life and may have different rules about its appropriate use, being more sensitive to digital interruptions.

Regarding the initial objective of validating the TDIS and TILES scales in the Spanish context and assessing their validity and reliability, it's worth noting that this process adhered to international standards. The scales demonstrated robust validity and reliability values in a sample of Spanish couples, ensuring their suitability for this specific population and marking a significant advancement in this field.

In addition, this study offers a new attempt to establish percentile for classifying the degree of interference within romantic relationships based on age and gender using the sum score of TILES and TDIS. This strategy may interest clinical and research practice, as it allows couples and researchers to know how intrusive these devices are in their relationships and allows them to try to regulate it or develop new effective interventions. However, given the technological advances and social changes that will occur in the coming years, reviewing these percentiles in the medium to long-term future is advisable.

Furthermore, the study's findings revealed the CFA for the Spanish versions of both the TDIS and TILES scales showed adequate model fit, with all factor loadings being significant. The TDIS demonstrated acceptable indices, as did the TILES, confirming the validity of the proposed unidimensional structure for each scale. Furthermore, measurement invariance analyses across sex and age groups were conducted. For the TDIS, configural and metric invariance were supported across both sex and age groups, but full scalar invariance was not achieved. Partial scalar invariance was established by freeing specific item intercepts (items 1 and 3 for sex, and 2 and 3 for age), allowing for valid comparisons between groups. In contrast, the TILES showed strong evidence of full measurement invariance across both sex and age groups, supporting its use for comparing mean scores across these populations. These findings reinforce the robustness of the scales while acknowledging certain limitations in the some of the items functioning across demographic groups, particularly for the TDIS.

Finally, regarding the relationship between technoference (TDIS and TILES) and quality of relationship (DAS), the results show a negative significant direct effect of TDIS and TILES on DAS. Therefore, higher levels of technoference were associated with lower levels of dyadic adjustment in relationships. This result goes in the same direction as previous studies (Coyne et al., 2011; McDaniel & Coyne, 2016a; Wang et al., 2017). The path analysis showed that both TDIS and TILES negatively impacted DAS, though in different ways. TDIS, with a strong negative coefficient (β = -4.138, p $\leq$ .001), indicates that a higher frequency of technoference—interruptions in couple interactions due to technology—correlates with lower relationship quality. This supports previous research linking technological disruptions to decreased relationship quality (McDaniel et al., 2021). Furthermore, TILES (β = - .102, $p \leq .05$), while weaker, also shows an association between how individuals perceive technology-related interruptions in their daily interactions with their partner and lower relationship quality. This suggests that these perceptions may be harming the quality of the relationship more subtly than the frequency. These findings highlight the distinct but complementary roles of TDIS and TILES in affecting relationship dynamics.

Limitations and future research

Although the present study is the first attempt to assess the TDIS and TILES scales psychometric properties in a country different from the original study, its results must be tempered by certain limitations. First, despite the good sample size of the study and due to the convenience sampling, the sample is not fully representative of the population. Most participants were women (72%), with an average age of 45 years and a high level of education. Certain population strata are under-represented (men, people over 60 or with low education). This mainly affects the assessment of participant differences or the establishment of valid cut-off points. Future studies should be carried out using stratified sampling systems. Second, as this scale indirectly assesses such a novel and complex construct as technoference, it is difficult to know how the subjective perception of the participant (greater or lesser sensitivity) modulates the results. It would be desirable to carry out a more complete and longitudinal evaluation. For example, including both couple members, other scales related to technoference, scales related to the use and conflict of electronic devices, and scales that assess the quality of the relationship or marital aspects of the participants. This would have allowed for a more accurate assessment and a deeper understanding of the phenomenon, establishing relationships beyond correlations and generating or confirming more complex explanatory models.

In conclusion, the Technology Device Interference Scale (TDIS) and the Technology Interference in Life Examples Scale (TILES) are valid tools for assessing technoference in Spanish populations. The results provide robust evidence of their validity and reliability. The TDIS and TILES scales are valid and reliable tools for assessing technoference in Spanish populations. CFA confirmed their unidimensional structure, and invariance analyses support their use across sex and age, particularly for TILES. While TDIS showed some limitations in scalar invariance, partial invariance allows for cautious group comparisons. These findings endorse their use in both research and clinical settings, while emphasizing the need to consider demographic differences. Further studies with other languages and additional psychometric studies are warranted, focusing mainly on their psychometric equivalence in representative samples of couples and adjusting to technological and social changes in the future.

Complementary information

Contribution Statement.- PBG: Conceptualization, Investigation, Resources, Project administration. **VCM:** Methodology, Formal analysis, Data curation, Writing – Original draft. **GMB:** Writing – Original draft, Writing - Review & Editing. **GT:** Writing – Original draft, Writing - Review & Editing. **FGC:** Conceptualization, Investigation, Resources, Project administration, Writing - Review & Editing. **RRD:** Conceptualization, Investigation, Resources, Project administration, Writing - Review & Editing. **JCF:** Conceptualization, Investigation, Resources, Project administration, Writing - Review & Editing. **EGF:** Conceptualization, Investigation, Resources, Project administration, Methodology, Formal analysis, Data curation, Writing – Original draft, Writing - Review & Editing.

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