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Tecnotest: A screening tool for technological addictions and gambling disorder

Tecnotest: Desarrollo de una herramienta de screening de adicciones tecnológicas y juego

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Abstract

One of the most pressing social and scientific issues, as reflected in the current priority lines of the National Drugs Plan (PNSD), is the development of screening tools for the early detection of addictions, particularly behavioral addictions, due to the impact that these problems are having on the growth of addictions in recent years, especially in adolescents and young people. Goal. The main goal of this research was to develop a screening tool for technological addictions (video games, mobile and social networks) and gambling for early detection in people suffering this kind of behavioral addiction. Procedure. With technologies, in the absence of agreed clinical criteria, those participants who perceived themselves as having problems and, in addition, had received treatment for it, were selected. Regarding gambling, the diagnostic criteria of the DSM-5 were used. The three items that scored the highest Positive Predictive Values (PPV) in each of the four validated tests were selected. These indicators serve to distinguish those who use the technologies and/or gamble in a functional way and do not have any problems from those who already have an addictive problem with video games, mobile, social networks or gambling. Results. This paper shows the finished screening tool with its main psychometric properties, which can be used by professionals working with adolescents in order to detect people who could have some addictive problem, in which case the psychologist can refer them to a specialized healthcare resource.

Keywords: technological addictions, gambling, screening, teenagers, assessment

Resumen

Una de las demandas sociales y científicas más acuciantes, que se plasma en las actuales líneas prioritarias del Plan Nacional sobre Drogas (PNSD) es el desarrollo de herramientas de *screening* para la detección temprana de adicciones, singularmente adicciones sin sustancia, debido al impacto que estas están teniendo en el desarrollo de adicciones desde hace unos años, especialmente en adolescentes y jóvenes. Objetivo. El objetivo principal de esta investigación fue el desarrollo de una herramienta de *screening* de adicciones tecnológicas (videojuegos, móvil y redes sociales) y al juego para vincular la detección temprana con la intervención y la prevención en el campo de las adicciones conductuales. Método. *Participantes.* Participaron en el estudio 1.813 estudiantes de entre 11 y 19 años de 13 comunidades autónomas. *Instrumentos.* Se desarrolló una encuesta con cuatro pruebas validadas sobre adicciones tecnológicas y al juego. *Procedimiento.* Para la construcción de la herramienta de *screening* se seleccionaron los tres elementos que obtuvieron mayor Valor Predictivo Positivo (VPP) de cada una de las cuatro pruebas validadas para diferenciar entre quienes utilizaban las tecnologías y/o jugaban de un modo social y no tenían ningún problema de aquellos que ya tenían un problema adictivo. Resultados. Se obtuvo una herramienta de uso de las tecnologías y juego que consta de 24 ítems (12 ítems de cribado de las cuatro tecnologías y 12 de uso de las mismas) con sus principales propiedades psicométricas (fiabilidad, estructura factorial). Discusión. La escala tiene unas adecuadas propiedades psicométricas y es congruente teóricamente. Se presenta la herramienta definitiva de *screening*, la cual queda a disposición de las/os psicólogas/os para la detección temprana de personas que puedan padecer alguna de estas adicciones, en cuyo caso podrían ser derivados a los recursos sanitarios especializados.

Palabras clave: adicciones tecnológicas, adicción al juego, screening, adolescentes, evaluación

The term addiction refers not only to disorders resulting from the use of toxic substances, but also certain behaviours with a tendency to become addictive, just like substance use (Chóliz, Echeburúa & Labrador, 2012; Echeburúa, 1999; Jiménez-Murcia & Farré, 2015). This has been recognized by both the APA in the DSM-5 diagnostic manual for mental illnesses (APA, 2013) and by the WHO in the most recent ICD-11 (WHO, 2018). As far as DSM-5 is concerned, only gambling disorder is included in the category "Substance-related and other addictive disorders", while online gaming disorder appears in Section III as a psychological problem requiring further study for its eventual classification in the category of addictive disorders, something that seems plausible given that there is evidence on the subject (Ferguson, Coulson & Barnett, 2011; Martín-Fernández et al., 2017) and that, in fact, the diagnostic criteria that appear in the DSM-5 for video gaming disorder are practically the same as those for gambling disorder. The WHO indeed already includes video gaming disorder within the same classification of addictive disorders, while in addition distinguishing in both gambling and video gaming disorders between the subcategories of predominantly online and those offline or unspecified.

With regard to mobile phones and social networks, irrespective of whether they are mental disorders as classified in the APA and WHO manuals, there is clinical and scientific evidence and a broad social consensus about of the existence of addictive psychological problems linked to the use of ICTs (Block, 2008; Chóliz, 2010; Echeburúa, Labrador & Becoña, 2009; Petry & O'Brien, 2013). Whether they are considered mental disorders or psychological problems is currently the subject of debate (Carlisle, Carlisle, Polychronopoulos, Goodman-Scott & Kirk-Jenkins, 2016; Kuss & Griffiths, 2017; Northrup, Lapierre, Kirk & Rae, 2015), but there is no doubt that there are people who, in their use of technologies, display the main characteristics of what is defined as addiction (tolerance, presence of withdrawal syndrome, difficulty in controlling behaviour, obsessive use, etc). The main technology addictions are the Internet/social networks (Tsai & Lin, 2003; Young, 1998) and mobile phones (Billieux, Van der Linden, d´Acremont, Ceschi & Zermatten, 2007; Chóliz, 2010), as well as video games (Griffiths, Kuss & King 2012; Kuss & Griffiths, 2012), already mentioned above and considered a mental disorder, especially by the WHO.

The reasons why ICTs may be linked to addictions depend both on their structural characteristics and on the conditions in which their use is becoming prevalent. Indeed, as ICT development advances and excessive use and being permanently online are induced, there are a great many people who develop problems similar to the symptoms caused by substance related addictive disorders such as: a) the need for increasing use of technology to achieve the same benefits as at the beginning (tolerance); b) negative emotional reactions when the technology cannot be used or when a considerable time passes without being able to use it (withdrawal syndrome); c) excessive use of technologies that interferes with all aspects of a person's life; d) difficulties in quitting technology despite being aware of the negative consequences of this behaviour; e) mood modification as a learned escape strategy for coping with the difficulties inherent in one's life (Baggio et al., 2018; Griffiths, 1995; Stepien, 2014).

Technology can also exacerbate other addictions, however, as is the case with online gambling as a type of gambling disorder. In this case, the characteristics of Internet gaming would exacerbate the effects of an activity – gambling – that is already addictive in itself. Furthermore, not only is online gambling very attractive to the player, but there are currently structural and environmental variables which favour excessive gambling and gambling addiction (Chóliz & Marcos, 2018; Griffiths, 2003). Some of the most relevant are: Widespread *availability*, easy *accessibility* or almost *instant* reward, at the click of a button (Welte, Barnes, Wieczorek, Tidwell & Hoffman, 2007). In addition to these characteristics, there is the *intimacy* in which it is played and the *comfort* of not having to go to a casino to play, which eliminates the barriers and *social restrictions* present in face-to-face interaction. Addictive behaviour can thus develop easily and with few constraints, with an addictive potential greater than traditional gambling (Chóliz, Marcos & Lázaro-Mateo, 2019; Griffiths, 2003, 2012; Griffiths, Parke, Wood & Parke, 2006; Monaghan, 2009; Petry, 2006). New forms of gambling through technologies are aimed at young people and adolescents, who are the most frequent users and, furthermore, especially vulnerable to the onset and maintenance of any addiction (Gladwin, Figner, Crone & Wiers, 2011).

We are thus at a time when technological addictions have become a psychological problem of an addictive nature to which health professionals need to pay the necessary attention, both in helping people who have this problem, as well as those who are vulnerable to it by providing the preventive resources required. To do this, the problem must necessarily be identifiable in its early stages so that appropriate preventive action may be taken; moreover, in cases where technology addiction has set in, the subjects must be referred to the corresponding resource for adequate evidence-based treatment that can reverse the psychological problem in time. Early detection of pathologies makes interventions more effective and more serious disorders preventable.

The main aim of this research is the development of a screening tool for technology and gambling addiction that teachers, educators and clinicians can use for the early detection of technological and gambling addictions. This scale uses the main items that discriminate between

the functional use of technologies and the presence of an addictive disorder to any of them, hidden in a generic scale of technology use. The specific objectives are to analyze the differences in gambling addiction, risky gambling and technology addiction (video games, mobile phones and social networks) according to sex and age group (underage adolescents and 18- to 19-year-olds).

Method

Participants

The questionnaire was completed by 2,529 students from 13 autonomous communities in Spain. A total of 1,923 adolescents between the ages of 11 and 19 were selected for the study, of which 110 participants were eliminated for responding with an impossible gaming pattern, claiming to play all games (both face-to-face and online), or scoring the maximum score on all NODS items, an extremely unlikely eventuality given the way the items are expressed. The final sample was made up of 1,813 adolescents, of which 928 (51.2%) were female and 885 (48.8%) were male. In terms of age, 1,638 (90.3%) were minors and 175 (9.7%) were aged 18 or 19 years. Regarding the type of school, 1,043 (58.5%) went to public and 770 (42.5%) to private schools.

Measuring instruments

A battery of empirically validated items related to the problem of technology addictions was administered:

Test of Mobile Dependence (TMD)

The TMD (Chóliz, 2012) assesses addiction to instant messaging (WhatsApp, Telegram, etc.). A Cronbach's alpha internal consistency index of .94 was obtained in the sample under study. Its factorial structure comprises 22 items grouped into four factors: Tolerance and withdrawal, control difficulties, abuse and associated problems, and spending.

Internet Addiction Test (AdiTec-I)

The AdiTec-I (Chóliz, Marco & Chóliz, 2016) assesses addiction to virtual social networks (Facebook, Instagram, Twitter, etc.). In the sample applied, a Cronbach's alpha internal consistency index of .94 was obtained. Its factorial structure is made up of 23 items grouped into four factors: abuse, withdrawal, perturbation and lack of control, and avoidance.

Test of Dependence on Video games (TDV).

The TDV (Chóliz & Marco, 2011) assesses addiction to video games. The sample yielded a Cronbach's *alpha* internal consistency index of .95. Its factorial structure is made up of 25 items grouped into 4 factors: Compulsive gambling, withdrawal, tolerance and interference with other activities, and associated problems and avoidance.

Gambling Addiction Test (NODS)

The NODS (Gerstein et al., 1999), consists of 17 items from a semi-structured interview for the diagnosis of gambling disorder based on DSM-IV-TR criteria (APA, 2000). Scores range from 0 to 9. The NODS was adapted to the current DSM-5 by eliminating the criteria of obtaining money illegally to continue playing.

Additional items for technology addictions

 Additional items for mobile use, social networks and video games were added. The added items refer to new modes of use linked to ICT developments and are used as possible screening indicators if they are predictive.

Sociodemographic variables

Seven items corresponding to the descriptive data of the sample were added: Sex, age, school, current school year, educational stage, population and province.

Clinical indicators

In the absence of external addiction criteria for technology addictions (video games, mobile phones, social networks), two questions were introduced after the respective questionnaires (TDV, TMD, ADITEC-I) to establish a clinical group: a) "Do you think you have a problem due to the excessive use of… (video games, mobile phones, social networks)?" and b) "Have you received advice or help for the excessive use of… (video games, mobile phones, social networks)?".

Procedure

An online survey was designed which included the three diagnostic questionnaires on technological addictions and the questionnaire for assessing gambling disorder, as well as the additional items on technology use. The survey was hosted on an Internet domain (http://www.tecnotest.es) and was answered by adolescents during school hours in different schools in 13 autonomous communities. School staff supervised the appropriate implementation of the survey, helping adolescents to resolve any possible doubts they might have. The assessment of each technology was preceded by a short introductory text, in which anecdotes and curiosities were told about them to prevent the survey becoming tedious and items becoming confused. To avoid biases in the responses, such as irradiation, the order of the different technology and gambling sections was mixed.

The anonymity and voluntary nature of the participants was respected at all times. Parental authorization was provided to schools for underage students. The data collection methodology was approved by the Ethics Committee of the University of Valencia with the procedure number: *H1550813462400*.

The screening questionnaire was constructed following the stages described by Muñiz and Fonseca-Pedrero

(2019) for test development, given the need to develop a tool that allows technology and gambling addictions to be detected by professionals from various disciplines. Unlike questionnaires built from scratch, the items selected for a first analysis were part of diagnostic questionnaires which have already been published and which have good psychometric properties. A pilot study was carried out to verify that the survey could be answered without difficulty or fatigue, and that the order of administration of the questionnaires was counterbalanced. After the statistical analyses, the definitive questionnaire was obtained by selecting the items with the highest predictive value. Finally, psychometric analyses were carried out to describe the factorial structure and the reliability of the tool in a way similar to other game questionnaires (Grande-Gosende, Martínez-Loredo & Fernández-Hermida, 2019).

Analysis

Different data analyses were carried out depending on the aims of the study.

Psychometric analysis of the instruments used to construct the scale

Internal consistency analyses were performed and the omega internal consistency coefficient (McDonald, 1999) was calculated for the NODS, TDV, TMD and ADITEC-I scales.

Correlation analysis

The Pearson correlation coefficient between each of NODS, TDV, TMD and ADITEC-I scales was analyzed.

Difference of means

Analysis of the difference of means of the scores obtained on the technology addiction scales (TDV, TMD and ADITEC-I) were carried out as dependent variables, based on the following independent variables: a) *Sex*; b) *Age*. Following the recommendations of Sanders and Williams (2019), two age groups were established: Adolescents aged between 11 and 17 years (minors) and 18- to 19-year-olds; c) *Established external criteria*: a) clinical group (people who acknowledged having a technology addiction problem with video games, mobile phones and social networks and had received help for it) and b) control group (users who did not report needing help with technology use).

Difference analysis in percentage of participants with gambling problems

Pathological gambling and risky gambling were established as dependent variables. The independent variables were: a) *Sex* and b) *Age group* (minors vs. young adults). In the case of gambling addiction, no external criterion was established since the NODS is a diagnostic questionnaire for pathological gambling. A *pathological gambling* diagnosis is considered

when the four DSM-5 criteria for gambling disorder are met (tolerance, withdrawal syndrome, distress when attempting to quit gambling, gambling to recover losses, etc.) (APA, 2013), while the presence of one to three criteria was considered *risky gambling*.

Sensitivity and specificity analysis of the items

The Positive Predictive Value (PPV) of the items on the diagnostic scales and other addiction criteria was calculated for each of the technologies with the aim of discriminating users who have an addiction problem (to gambling or technologies) from those who do not. The procedure in Johnson et al. (1997) was followed to establish the PPV. The Negative Predictive Value (NPV) was also calculated. The three items with the highest NPV were selected to pad out the use of technologies and games questionnaire in order to mask the screening items.

Psychometric analysis of the TecnoTest scale

The factorial structure of the scale was calculated, as well as its reliability, using the *omega* internal consistency coefficient, which is the most indicated for Likert response questionnaires (Gadermann, Guhn & Zumbo, 2012).

For data analysis, version 20 of the *IBM SPSS Statistics* program was used.

Results

Reliability analysis

Regarding scale reliability, the coefficients of internal consistency, Cronbach's *alpha* and McDonald's *omega* were as follows: NODS ($\alpha = .96$; $\omega = .92$), TDV ($\alpha = .97$; $\omega = .95$), TMD ($\alpha = .93$; $\omega = .94$) and ADITEC-I ($\alpha = .96$; $\omega = .94$).

Correlations between scales

The correlations between the questionnaires on technology addictions and gambling are presented in Table 1.

Table 1
Pearson correlations between scales

	NODS	TMD	TDV	ADITEC-I
NODS	--	.11**	.14**	.11**
TMD		--	.12**	.84**
TDV			--	.11**
ADITEC-I				--

**p < .01.

Means difference analysis of addictions

Gambling addiction

Problems caused by gambling (pathological gambling and high-risk gambling) are reflected in categorical variables (percentage of cases), for which the Chi square test was used

to contrast hypotheses. The differences based on sex and age in problems caused by gambling are described in Table 2.

Table 2
Percentage of pathological gambling and risky gambling according to sex and age

	Pathological Gambling		Risky Gambling	
	N	%	N	%
Male	93	9.9	191	20.4
Female	54	5.6	109	11.2
11-17 years	139	8.1	270	30
18-19 years	8	4.3	30	16.3

Statistically significant differences were found between men and women in the frequency of both pathological gambling ($X^2 = 12.82$; $p < .001$, *Phi* = .08), and risky gambling ($X^2 = 30.30$; $p < .001$; *Phi* = .12). Statistically significant differences were found between minors and young adults in pathological gambling ($X^2 = 3.24$; $p < .05$; *Phi* = .04).

Technology addictions

Regarding the scores obtained in the questionnaires on technology addictions (video games, mobile phones and social networks), the assumption of homoscedasticity was verified with the Levene test, which was significant for all technologies. A non-parametric hypothesis contrast test was thus applied, specifically the Mann-Whitney U test for independent samples. Descriptive data are presented in Table 3.

Table 3
Scores on the TMD, TDV and ADITEC-I scales according to sex and age

	TDV		TDM		ADITEC-I	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Male	35.24	24.09	21.70	17.01	22.72	23.70
Female	11.01	16.32	30.75	18.56	35.33	25.97
11-17 years	23.83	24.13	25.93	18.37	28.77	25.78
18-19 years	14.21	18.44	29.89	18.12	32.58	24.36

Table 4
NODS items with the highest PPV and NPV

	Sensitivity	Specificity	PPV	NPV
Have you lied to family or friends several times about how much you play or how much money you have lost?	.495	.995	.991	.663
Have you ever borrowed money from relatives or others because of serious financial problems due to gambling?	.484	.991	.981	.657
Have there ever been periods when you needed to bet increasing amounts of money to feel the same excitement?	.538	.989	.980	.682
Have there ever been periods of two weeks or more when you were thinking about gambling for a long time, or planning to gamble?	.835	.872	.867	.841
Have you ever tried to stop gambling or control what you are gambling?	.758	.838	.824	.776
While gambling, have you tried to stop or give up gambling, without succeeding?	.725	.928	.910	.772

Table 5
TDV items with the highest PPV and NPV

	Sensitivity	Specificity	PPV	NPV
I play video games a lot longer now than when I started.	.824	.649	.701	.786
Once I have started, I find it very difficult to stop playing, even if I have to because my parents or friends are calling me or I have to go somewhere.	.800	.790	.792	.798
I have stopped going out with friends or doing things with them because now we arrange to meet online and play.	.563	.936	.898	.682
When I'm playing, I lose track of time.	.895	.662	.726	.863
The first thing I do when I get home after class or work is play my video games.	.588	.911	.868	.689
I have pretended to be sick to avoid going to class or doing homework to be able to play.	.318	.956	.880	.584

Table 6
TMD items with the highest PPV and NPV

	Sensitivity	Specificity	PPV	NPV
People have told me or warned me about using WhatsApp too much.	.565	.865	.807	.665
I have argued with a relative for spending too much on things related to mobile.	.370	.898	.784	.588
I spend more time than I would like using my mobile.	.947	.579	.692	.917
I went to bed later or slept less because of receiving or sending messages.	.760	.567	.637	.703
When I get bored, I open WhatsApp or any other message program.	.808	.435	.589	.694
I can't just use the messaging applications (Whatsapp, Line, Telegram, etc.) like I used to; I need to use them more and more.	.500	.857	.778	.632

Table 7
ADITEC-I items with higher PPV and NPV

	Sensitivity	Specificity	PPV	NPV
When I'm on social media, I lose track of time.	.667	.661	.663	.665
I feel a constant need to update my status or profile photo on my social networks.	.375	.903	.795	.591
It is important for me to get "likes" in my status or photos because I feel bad if I don't.	.542	.856	.790	.651
I think I use social media too much.	.808	.618	.679	.763
I generally spend more time on social media than I originally planned.	.750	.657	.686	.724
I've lost control of social media.	.522	.877	.809	.647

Table 8
Descriptive statistics of the TecnoTest

Item	Mean	SD	Skew	Kurtosis
1	.12	.32	2.35	3.54
2	.02	.13	7.72	57.70
3	.12	.33	2.28	3.21
4	.13	.33	2.23	2.99
5	.12	.32	2.36	3.55
6	.06	.25	3.53	1.50
7	.08	.27	3.11	7.69
8	.05	.21	4.24	16.03
9	.40	.49	.41	-1.84
10	.25	.44	1.13	-.72
11	.29	.45	.94	-1.11
12	.02	.14	6.69	42.85
13	.39	.49	.46	-1.79
14	.10	.30	2.61	4.84
15	.16	.36	1.89	1.59
16	.02	.13	7.46	53.65
17	.52	.50	-.09	-1.99
18	.04	.20	4.72	2.28
19	.03	.17	5.64	29.84
20	.10	.29	2.75	5.54
21	.29	.45	.94	-1.11
22	.32	.47	.77	-1.42
23	.25	.43	1.17	-.63
24	.04	.20	4.48	18.05

Men scored significantly higher than women on the Video Game Dependence Test ($\mathbb{Z}_{(1, 1903)}$ = -23.65; $p < .001$; $\eta^2 = .27$), while women presented higher scores on the Test of Mobile Dependence ($\mathbb{Z}_{(1, 1903)}$ = -11.05; $p < .001$; $\eta^2 = .07$) and in the Social Media Dependency Test ($\mathbb{Z}_{(1, 1903)}$ = -11.61; $p < .001$; $\eta^2 = .07$). Regarding differences between the age groups, minors obtained higher scores on the TDV ($\mathbb{Z}_{(1,1903)}$ = -5.15; $p < .001$; $\eta^2 = .01$), while adolescents aged 18 and 19 years scored highest on mobile dependence ($\mathbb{Z}_{(1, 1903)}$ = -3.02; $p < .01$; $\eta^2 = .01$) and social networks ($\mathbb{Z}_{(1, 1903)}$ = -2.59; $p < .01$; $\eta^2 = .01$).

Sensitivity and specificity analysis

Screening for gambling addiction
The results obtained regarding the sensitivity, specificity and PPV and NPV ratios for each item are shown in Table 7. The three items with the highest PPV and NPV scores are presented in Table 4.

Screening for dependence on video games
The results obtained regarding the sensitivity, specificity and PPV and NPV ratios for each item are shown in Table

Table 9
Factor loads of the TecnoTest factor items

	FI	FII	FIII	FIV
9. I usually turn off or silence my mobile when I go to bed so as not to use it in bed.	.847			
21. When I use social networks, I am aware of the time I am spending on them.	.841			
22. When it comes to using social media, I only use it for what I need.	.834			
11. I am able to control the amount of time I spend on social media.	.825			
13. I am usually able to control myself when it comes to the amount of time I spend on the mobile.	.798			
17. I can overcome boredom without using my mobile.	.745			
3. People have told me or warned me about using my mobile phone too much.	.685			
20. I have argued with a family member for spending too much on things related to the mobile.	.563			
4. I can't just use the messaging applications (Whatsapp, Line, Telegram, etc.) like I used to; I need to use them more and more.	.558			
15. I can easily quit the video game if something comes up that I have to do.		.805		
10. I play about the same amount of time now as when I started playing video games.		.768		
23. When I am playing, I am aware of the time I am spending on the video game.		.758		
8. I have stopped going out with friends or doing things with them because now we arrange to meet online and play video games.		.630		
6. The first thing I do when I get home after class or work is play my video games.		.583		
19. I have pretended to be sick to avoid going to class or doing homework in order to play my video games.		.456		
24. I can stop playing or gambling without feeling bad about it.			.805	
16. I have borrowed money from family members or others at some point because of serious financial problems due to gambling.			.757	
18. I have been able to stop playing whenever I have wanted to.			.641	
12. There have been periods when I needed to bet increasing amounts of money to feel the same excitement.			.602	
1. I don't normally worry about gambling nor do I think about gambling or betting.			.503	
2. I have repeatedly lied to my family or friends about how much money I have gambled or lost through gambling or betting.			.461	
7. I feel a constant need to update my status or profile photo on my social networks.				.771
15. It is important for me to get "likes" in my status or photos because I feel bad if I don't.				.686
14. I've lost control of social media.				.606

8. The three items with the highest PPV and NPV scores are presented in Table 5.

Screening for mobile dependence

The results obtained regarding the sensitivity, specificity and PPV and NPV ratios for each item are shown in Table 9. The three items with the highest PPV and NPV scores are presented in Table 6.

Screening for dependence on social networks

The results obtained regarding the sensitivity, specificity and PPV and NPV ratios for each item are shown in Table 10. The three items with the highest PPV and NPV scores are presented in Table 7.

The final TecnoTest scale has a total of 24 items, with 12 items for addiction screening, corresponding to those with

the highest PPV and 12 normal items with the purpose of masking the screening items.

Table 8 shows the main descriptives of the scale.

Psychometric analysis of the TecnoTest

Once the TecnoTest scale was constructed, psychometric analysis was performed, specifically on its factorial structure and internal consistency.

Factorial analysis of the scale

The KMO indicator (Kaiser-Meyer-Olkin) and Barlett's test of sphericity showed good suitability for factor analysis. (KMO= .826; $\chi^2_{(276)}$ = 3238.87; $p < .001$). Factor analyses were carried out with the Varimax rotation and principal component factor extraction method. All items obtained a corrected discrimination index greater than

.5. Factor analysis yielded four factors. The first, which explains 27.24% of the variance, comprises items 3, 4, 9, 11, 13, 17, 20, 21 and 22. It contains all the items on mobile addiction, as well as three of the largest social media NPVs. The internal consistency indices were α = .92; ω = .92. The second factor explains 12.09% of the variance and comprises items 6, 8, 10, 15, 19 and 23. It contains the six video game addiction items and yielded internal consistency indices of α = .81; ω = .83. The third factor explains 10.46% of the variance and comprises the six gambling addiction items: 1, 2, 12, 16, 18 and 24. The internal consistency indices were α = .66; ω = .80. The fourth factor, explaining 6.18% of the variance, is made up of items 5, 7 and 14, which are the three items with the highest PPV of addiction to social networks. The internal consistency indices were α = .72; ω = .73.

Table 9 shows the factor loadings of each of the TecnoTest items.

Table 10 shows the correlations between the different factors.

Table 10
Correlations between the TecnoTest factors

	FI	FII	FIII	FIV
Factor I. Mobile addiction	-	.13	.19	.54
Factor II. Video game addiction			.23	.27
Factor III. Gambling addiction				.17
Factor IV. Social media addiction				-

Discussion

Gambling and technology addiction are the latest addictions in adolescence and require precision tools for assessment to enable preventive intervention in the early stages. The main aim of this study was therefore to construct a screening tool that would allow the early detection of adolescents with technology and gambling addictions and have the ability to discriminate those who use technologies in a functionally appropriate manner or play in a non-pathological way from those who have developed an addictive disorder or are at risk of doing so. To this end, analyses of the predictive values of all items on validated diagnostic scales were performed to obtain the Positive Predictive Value (PPV) and Negative Predictive Value (NPV) coefficients of all items used to measure the addictions under study. This is the normal procedure used by other researchers when creating scales to screen for gambling addiction (Chóliz, Echeburúa & Ferre, 2017; Fernández-Montalvo, Echeburúa & Báez, 1995; Volberg, Munck & Petry, 2011). The intention is to select the items with the greatest predictive power for detecting people with addiction problems to some of the technologies or games and to reject those which, despite their use, probably do not predict well.

The final instrument, called Tecnotest, comprises 24 items, 12 of which (three for each of the addictions analyzed) have the highest PPV and are used for screening, while the other 12 (three for each of the four addictions) with the highest NPV are used as filling to mask the test objective. So that the questionnaire would not have a negative character and to avoid social desirability, these items with higher negative predictive value (NPV) were inverted.

The items found to have higher PPV in detecting each of the addictions are characteristic of some of the addiction criteria. In the case of gambling addiction, the items with the highest PPV refer to the criteria of: a) tolerance; b) lying about the degree of involvement in gambling and c) trusting that others will solve the problems caused by gambling. Subjects appear to have reached a point where they need to gamble more and more to achieve the desired effects, causing inevitable losses since the game is organized so that the company running it wins in the long run, not the players. They admit to themselves that their pattern of gambling is dysfunctional, recognizing that they lie about their gambling, but they are not aware that they should stop, and they need others to finance their gambling, which is the only way they have learned to pay off the debts they incur.

With regard to video game addiction, the items with the highest PPV refer to the following DSM-5 criteria for Internet Gaming Disorder: a) spending time on video games, which become the dominant everyday activity; b) loss of interest in previous hobbies and entertainment; and c) jeopardizing or losing a significant relationship, job, or educational or employment opportunity due to participation in video games. In other words, video games become the most important thing in the adolescent's life, above and beyond their responsibilities and previous hobbies. Their lives revolve around video games, to which they dedicate all their time, even if it is detrimental to their personal adjustment and social adaptation.

Regarding addiction to mobile phones, the main criteria are: a) associated problems and spending; b) tolerance and c) withdrawal. Dependence on mobile phones is characterized by the need to use instant messaging applications more frequently (and probably urgently), which interferes with other tasks and activities and involves excessive spending, to the point of incurring the disapproval of family or friends.

Finally, with regard to social network addiction, the dimensions reflected by the items on the scale are: a) excessive use; b) presence of withdrawal syndrome and c) lack of control. The most discriminating items of social network addiction refer to the excessive use of social networks, the result of an uncontrollable need to obtain social approval to feel good. This makes it very difficult to stop using them, reflecting a loss of control over them.

The scale shows adequate factorial structure since the factorial loads of the items group them into the four anticipated factors: addiction to mobiles, video games,

gambling and social networks. Each of the four factors contains the three items with the highest PPV that were selected as discriminating for each of the addictions, so we can conclude that coherent factorial structure is maintained. However, Factor I, corresponding to mobiles, also contains the filler items (those with the highest NPV) for social networks, which shows that both addictions (mobile and social networks) share common elements in their use. The fact that the items with the highest PPV selected for social network screening constitute a separate factor is an indicator that mobile phone and social network addictions are probably epistemologically distinct, although the use of mobiles and social networks share common actions or elements.

The limited relationship between the factors, other than between mobile and social network addiction, is corroborated by the fact that the scores on the diagnostic tests of technology addictions of the initial survey show little correlation, except for the case of TMD and AdiTec-I. This would corroborate the hypothesis that comorbidity between behavioural addictions is not frequent, since they all involve a high degree of absorption and a limiting of action in other behaviours, so that the person focuses almost exclusively on the activity they are dependent on. For this reason, it is difficult for addictions that require different resources and psychological processes to be shared, such as gambling, video games or the use of mobile phones. In the research presented here, the correlation between the scores on the diagnostic questionnaires is very low, a finding that is in line with those obtained by other authors, indicating that there is no relationship between gambling disorder and other technology addictions (Delfabbro, Lambos, King & Puglies, 2009; Forrest, King & Delfabbro, 2006; King, Ejova & Delfabbro, 2012). The only exception may be between mobile phones and social networks, insofar as they not only share devices, but also involve similar activities; mobile phones are characterized by instant communication with one or more people, and social networks also involve communication and sharing experiences, although its defining characteristic is participation in a virtual community. These would be the only behavioural addictions to show a certain degree of comorbidity, while the rest of the combinations (gambling, video games and mobile/social networks) do not seem to share comorbidity.

Finally, and although the objective of the research was not to assess the incidence of technology addictions and gambling, the use of diagnostic tests to obtain the items making up the screening questionnaire has allowed us to analyze technology and gambling addictions in the participants. The results have been consistent with the scientific literature, both in the case of gambling and technology addictions. Men show a higher percentage of gambling disorder and risky gambling, with statistically significant differences, since gambling, especially online, is mainly a male activity. This, together with the fact that online gambling is more addictive than traditional gambling, makes teenage boys more vulnerable to gambling addiction (Chóliz et al., 2019; Wardle et al., 2010).

These differences are also present in the case of video games. The greater incidence of video game addiction is reflected both in the TDV scores and in the percentage of men in the clinical group. The fact that men have a greater problem with video games than women is congruent with the scientific literature (Desai, Krishnan-Sarin, Cavallo & Potenza, 2010; Ko, Yen, Chen, Chen & Yen, 2005). However, in the case of mobile phones and social networks, it is women who have higher prevalence rates of addiction than men, which is again consistent with results from other researchers (Billieux, Van der Linden & Rochat, 2008). In this case, however, it cannot be a result of the fact that women are more exposed to mobile phones and social networks since both girls and boys use mobile phones daily and have profiles on social networks. It is more likely due to the role that ICTs have in interpersonal communication and even the establishment of links through them, with social interaction and cooperation as the most relevant activities for personal adjustment, while men use technologies mainly to demonstrate skill, compete and win (Andreassen et al., 2016). The fact that the use of technologies motivates women and men differently and that this is a relevant variable in the issue of addictions is, without doubt, a substantial difference with regard to the analysis of technology addictions from a gender perspective.

The present work has a series of limitations that must be taken into account. The first is a consequence of the current state of epistemological imprecision regarding addiction to mobile phones and social networks since, although they display the main diagnostic criteria of behavioural addiction, it is still to be clarified whether they are mental disorders, which is how they are diagnosed with DSM-5 and ICD-11 or psychological problems which, although they can be considered dysfunctional and maladaptive, may not be appropriately classified as mental disorders (González & Pérez-Álvarez, 2007). Likewise, according to the results of the present study, it seems that both share central characteristics, which would make differential diagnosis difficult, something that is essential when establishing an accurate diagnosis. It would be necessary to be able to define what psychological process or processes underlie both addictions or cause them. The path of these addictions is probably similar to that of video game disorder, currently found in Section III of the DSM-5, referring to "Conditions that need further study", although the current ICD-11 already considers it as a mental disorder independent of gambling disorder, these being the only behavioural addictions recognized by the WHO as a mental disorder.

Regarding age distribution, most participants are aged between 14 and 16 years, although the age range of the study is 11 to 19 years. We understand, therefore, that the differences between age groups should be viewed with caution. The sample could have been reduced to that age range so that the resulting questionnaire was used only in early adolescence, but we consider it appropriate to expand below and above that range to select from early adolescence, since all of them already use the technologies. The study of these addictions in adults is also useful since all limitations to the use of technologies and especially gambling disappear.

The screening tool presented here aims to be useful for professionals as an instrument with which to detect adolescents who may have a problem of addiction to some of the technologies (mobile, social networks, video games) or gambling. It is not so much a diagnostic test, but a screening test, the main objective of which is to guide preventive or therapeutic action if necessary, that is, to link assessment tools with intervention techniques with evidence-based efficacy (Chóliz & Marcos, 2020).

Ethics Committee Approval

All procedures in this study involving human participants were performed in accordance with the standards of the Ethics Committee of the University of Valencia and the Declaration of Helsinki of 1964 and subsequent modifications. This work was approved by the Ethics Committee of the University of Valencia, procedure number: *H1550813462400*.

Conflict of interests

The authors declare that they have no conflicts of interest. The authors adhere to the Auckland Code of Ethics for Gambling Research (2018).

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ANNEXES

TecnoTest

This is a questionnaire about technology use (videogames, mobile phones and social networks) and gambling. Please indicate if the following statements have applied to you **DURING THE PAST YEAR.** There are no true or false, good or bad answers. Please answer honestly. Thank you for your collaboration.

Sex: Age:

		YES	NO
1	I don't normally worry about gambling nor do I think about gambling or betting.	O	O
2	I have repeatedly lied to my family or friends about how much money I have gambled or lost through gambling or betting.	O	O
3	People have told me or warned me about using my mobile phone too much.	O	O
4	I can't just use the messaging applications (Whatsapp, Line, Telegram, etc.) like I used to; I need to use them more and more.	O	O
5	It is important for me to get "likes" in my status or photos because I feel bad if I don't.	O	O
6	The first thing I do when I get home after class or work is play my video games.	O	O
7	I feel a constant need to update my status or profile photo on my social networks.	O	O
8	I have stopped going out with friends or doing things with them because now we arrange to meet online and play video games.	O	O
9	I usually turn off or silence my mobile when I go to bed so as not to use it in bed.	O	O
10	I play about the same amount of time now as when I started playing video games.	O	O
11	I am able to control the amount of time I spend on social media.	O	O
12	There have been periods when I needed to bet increasing amounts of money to feel the same excitement.	O	O
13	I can usually control myself when it comes to the amount of time I spend on the mobile.	O	O
14	I've lost control of social media.	O	O
15	I can easily quit the video game if something comes up that I have to do.	O	O
16	I have borrowed money from family members or others at some point because of serious financial problems due to gambling.	O	O
17	I can handle boredom without using my mobile.	O	O
18	I have been able to stop playing whenever I have wanted to.	O	O
19	I have pretended to be sick to avoid going to class or doing homework in order to play my video games.	O	O
20	I have argued with a relative about spending too much on things related to mobile phones.	O	O
21	When I use social networks, I am aware of the time I am spending on them.	O	O
22	When it comes to using social media, I only use it for what I need.	O	O
23	When I play, I am aware of the time I am spending on the video game.	O	O
24	I can stop playing or gambling without feeling bad about it.	O	O