Addictive Behaviors 140 (2023) 107624

Contents lists available at ScienceDirect

Addictive Behaviors

journal homepage: www.elsevier.com/locate/addictbeh

Motives to play videogames across seven countries: Measurement invariance of the Videogaming Motives Questionnaire

Yanina Michelini [a], Manuel I. Ibáñez [b,c], Angelina Pilatti [a], Adrian J. Bravo [d], Francisco J. López-Fernández [b], Generós Ortet [b,c], Laura Mezquita [b,c,*], Cross-Cultural Addictions Study Team (CAST)[1]

[a] Universidad Nacional de Córdoba, Facultad de Psicología, Instituto de Investigaciones Psicológicas, IIPsi, CONICET, Córdoba, Argentina
[b] Department of Basic and Clinical Psychology and Psychobiology, Universitat Jaume I, Castelló de la Plana, Castellón, Spain
[c] Centre for Biomedical Research Network on Mental Health (CIBERSAM), Instituto de Salud Carlos III, Castellón de la Plana, Castellón, Spain
[d] Department of Psychological Sciences, William & Mary, Williamsburg, VA, USA

ARTICLE INFO

Keywords:
Gaming Motives
College Students
Cross-national
Measurement Invariance

ABSTRACT

Introduction. Gaming motives appear to be an important predictor of time spent gaming and disordered gaming. The Videogaming Motives Questionnaire (VMQ) has shown adequate psychometric properties to assess gaming motives among Spanish college students. However, the utility of this measure has not yet been explored in other cultures. This research aimed to examine the structure and measurement invariance of the VMQ across seven countries and gender groups, and to provide criterion-related validity evidence for VMQ scores. **Method.** College students who reported having played videogames in the last year (n = 5192; 59.07 % women) from the US, Canada, South Africa, Spain, Argentina, England, and Uruguay completed an online survey to measure time spent gaming, disordered gaming, and the VMQ. **Results.** Findings support a 24-item 8-intercorrelated factor model structure for the VMQ in the total sample. Our results also support configural, metric, and scalar invariance of the VMQ across gender groups and countries. Students from North America (US and Canada) scored higher on most gaming motives (except recreation and cognitive development) than students from the other countries. The correlations between VMQ and non-VMQ variables were similar across gender and countries, except in England where VMQ correlations with time spent gaming were stronger. **Discussion.** These results suggest that the VMQ is a useful measure for assessing gaming motives across young adults from different countries.

1. Introduction

Videogaming is a highly prevalent activity worldwide (Newzoo, 2021). Around 30 % to 40 % of videogame players are aged 18–34 years (Aldama, 2016; Entertainment Software Association, ESA, 2022; Europe's Video Games Industry, ISFE, 2020) and half are women (ISFE, 2020; ESA, 2022). In the US, 80 % of people aged 18–34 years play videogames>3 h a week. In Canada, women and men (ages 18–34) play an average of 9 and 12 h a week, respectively (Entertainment Software Association of Canada, 2020). Although videogame use is not an issue for most people, for some it may become a problem. A recent *meta*-analysis reported a 3.3 % disordered gaming (i.e., maladaptive pattern of hazardous gaming) prevalence rate, which was moderated by continental region: highest in Asia (6.3 %), followed by North America (3.6 %), Oceania (3 %), Europe (2.7 %) and others (1.9 %) (Kim et al., 2022). Moreover, disordered gaming prevalence rates are higher in young adult

* Corresponding author at: Department of Basic and Clinical Psychology and Psychobiology, Universitat Jaume I, Avenida de Vicent Sos Baynat, s/n, 12071, Castellón de la Plana, Castellón, Spain.
E-mail address: lmezquit@uji.es (L. Mezquita).

[1] This project was completed by the Cross-cultural Addictions Study Team (CAST), which includes the following investigators (in alphabetical order): Adrian J. Bravo, William & Mary (Coordinating PI); Christopher C. Conway, Fordham University; James M. Henson, Old Dominion University; Lee Hogarth, University of Exeter; Manuel I. Ibáñez, Universitat Jaume I de Castelló; Debra Kaminer, University of Cape Town; Matthew Keough, York University; Laura Mezquita, Universitat Jaume I de Castelló; Generós Ortet, Universitat Jaume I de Castelló; Matthew R. Pearson, University of New Mexico; Angelina Pilatti, National University of Cordoba; Mark A. Prince, Colorado State University; Jennifer P. Read, University of Buffalo; Hendrik G. Roozen, University of New Mexico; Paul Ruiz, Universidad de la República.

https://doi.org/10.1016/j.addbeh.2023.107624
Received 6 September 2022; Received in revised form 27 December 2022; Accepted 16 January 2023
Available online 20 January 2023

samples (from 3.4 % to 6.3 %) than in samples of adolescents (3.3 %) or adults (1.9 %) (Kim et al., 2022). Among young adults, college students are a special at-risk subgroup with prevalence rates of 60 % for videogame use (Borges et al., 2019) and 5 % for disordered gaming (Borges et al., 2019; Ohayon & Roberts, 2021). College students' disordered gaming has been related to poorer academic performance (Sarda et al., 2016; Schmitt & Livingston, 2015) and more anxiety and depression symptoms (Pontes et al., 2021; Sánchez-Iglesias et al., 2020). Gaming motives are one of the many factors that may influence videogame use and disordered gaming (de Hesselle et al., 2021; Wang & Cheng, 2022).

Human motivation is the internal process that activates and maintains physical and psychological activity and impacts the direction and strength to move toward our goals (Bäcklund et al., 2022). Motivation has been regarded as a crucial factor for understanding addictive behaviors (Cooper et al., 2016), including those related to videogame use (Bäcklund et al., 2022; Wang & Cheng, 2022). Gaming motives (i.e., reasons for playing videogames) have been related to videogame genre preferences (Kim et al., 2016; López-Fernández et al., 2020; Scharkow et al., 2015), early gaming onset, and higher gaming frequency (Biolcati et al., 2021). Motives for playing videogames have also been associated with spending more time gaming (de Hesselle et al., 2021; López-Fernández et al., 2020) and disordered gaming (Wang & Cheng, 2022). Specifically, social and coping motives are the most strongly related motives to time spent gaming (de Hesselle et al., 2021; Király et al., 2017; López-Fernández et al., 2020; Wu et al., 2017). Meta-analyses have found that escapism/coping motives show the strongest correlation with disordered gaming ($r = 0.40$-0.50), followed by achievement motivation ($r = 0.32$), immersion ($r = 0.22$) and social motivation ($r = 0.20$) (Bäcklund et al., 2022; Wang & Cheng, 2022).

Other studies have found gaming motives to mediate the relation of personality and psychopathological symptoms (e.g., depression or attention problems) with disordered gaming (Biolcati et al., 2021; López-Fernández et al., 2021; Montag et al., 2019; Plante et al., 2019). Taken together, this evidence highlights the relevance of gaming motives in predicting videogames use and disordered gaming. However, to conduct rigorous research into gaming motives, a measure showing adequate psychometric properties is needed.

Although many scales measure gaming motivation (see López-Fernández et al., 2020 for a review), they have their limitations. For instance, many measures present a wide variety in the taxonomy of gaming motives and it is possible to find scales that include different motives within the same label. For example, some studies distinguish skill development from both recreation and competition; while others combine these motives on a unique subscale (i.e., fun/challenge). In other cases, the same motives are named differently (e.g., refer to competition with label achievement) (López-Fernández et al., 2020).

Drawing from these limitations, López-Fernández et al. (2020) developed the Videogaming Motives Questionnaire (VMQ). The VMQ is composed of 24 items (3 per scale) that assess coping (i.e., for stress reduction), social interaction (i.e., to bond with friends and to make new ones), recreation (i.e., for mood enhancement/to spend a more enjoyable and recreational time), cognitive development (i.e., to stimulate intellectual activity), fantasy (i.e., for immersion in the gaming world and the story's in-game characters), competition (i.e., to feel the pleasure of competing and winning against others), customization (i.e., for the creation and design of things in-game), and violent reward (i.e., to feel gratification when faced with in-game violence) motives. The eight subscales show adequate internal consistency (α range from 0.76 to 0.90) and temporal stability (2-week test–retest r between 0.60 and 0.82) in Spain. All the motives exhibit significant associations with hours spent gaming, disordered gaming, and videogame genre preferences.

1.1. Present study

Research into the psychometric properties of the VMQ in non-Spanish samples and/or across countries or languages is limited. This is a problem because comparisons across groups are not well founded until evidence for multicultural and multilanguage measurement equivalence is obtained (International Test Commission, 2015). In this sense, a measure is equivalent when, across languages and cultures of administration, self-report items present the same meaning and responses to the items exhibit loadings in the same set of factors (Byrne, 2008). Taken together, the aims of the present study were: 1) test the 24-item 8-factor VMQ structure among college students from seven countries; 2) examine the measurement invariance of the VMQ across countries and gender (women/men); 3) analyze mean differences in scores for gaming motives by country and gender; and 4) provide criterion-related validity evidence for gaming motives by relating them to time spent gaming and disordered gaming across countries and gender. We hypothesized an adequate structure and measurement invariance of the VMQ across countries and gender (De Grove et al., 2017); higher motives scores in individualistic than in collectivistic countries (Mackinnon et al., 2017) and in men than in women (Laconi et al., 2017); and positive correlations of motives, especially coping, with time spent gaming and disordered gaming (López-Fernández et al., 2020).

2. Material and methods

2.1. Participants and procedures

College students were recruited from universities across the US (five universities across four states: [Colorado, New Mexico, New York, and Virginia]), Canada (two universities from the provinces Ontario and Manitoba), South Africa (one university from Cape Town city), Spain (one university from the autonomous community of Valencia), Argentina (two universities from Córdoba region), England (one university from Exeter city) and Uruguay (one university from Montevideo city). They completed an online survey about the risk and protective factors of addictive behavior outcomes (see Bravo et al., 2021 for more information). In Argentina and Uruguay, participants were recruited by an invitation disseminated across social networks and email listings. The students who completed the survey were included in a raffle of prizes (Argentina: 25 prizes of ≈US$ 10 each; Uruguay: 10 prizes of ≈US$ 20 each). In Spain, students were invited by email. Those who completed the survey received €5. In the US, Canada, South Africa and England, participants were students from Psychology Departments, who received research participation credit for completing the survey. The study protocol was approved by the institutional review boards at the participating universities.

Although 9,171 students completed the larger study, only data from the students who reported playing videogames at least once in the last year ($n = 5280$, 57.57 %) were used. The cases with ≥ 2 missing values in the VMQ or IGDS9-SF were eliminated ($n = 88$). The final sample consisted of 5192 participants (59.07 % women, M(age) = 20.12, $SD = 3.65$). Table 1 details the demographics of the whole sample and across countries and gender.

2.2. Measurement adaptation

To adapt the videogame use and disordered gaming measures to Spanish, four Spanish and Argentinian researchers, who were proficient in English and experts in test adaptation and videogame use, translated them independently. After reaching an agreement for the Spanish-Argentinian and Spanish-Castilian versions, minor changes were made to keep the final version. The Uruguayan version was the same as the Argentinian one. For the VMQ, one bilingual (English-Spanish) and one native Spanish and proficient English researcher adapted the measure independently to English. Then they reached an agreement for the final version. During this procedure, they attempted to maintain the original English wording of the items that came from a previous English scale of

Table 1
Demographic and descriptive statistics of VMQ and non-VMQ constructs for the total sample and across countries and gender.

	Total sample (n = 5192)	US (n = 2449)	CAN (n = 1013)	SAF (n = 391)	SPA (n = 436)	ARG (n = 568)	ENG (n = 256)	URU (n = 79)	Women	Men
Gender *n* (%)										
Women	3067 (59.07)	1314 (53.65)	573 (56.56)	295 (75.45)	257 (58.94)	381 (67.08)	180 (70.31)	67 (84.81)	–	–
Men	2080 (40.06)	1115 (45.53)	425 (41.95)	92 (23.53)	178 (40.83)	185 (32.57)	73 (28.52)	12 (15.19)	–	–
Missing	45 (0.87)	20 (0.82)	15 (1.48)	4 (1.02)	1 (0.23)	2 (0.35)	3 (1.17)	0 (0.00)	–	–
Age *M (SD)*	20.12 (3.65)	19.55 (3.04)	19.82 (3.86)	20.24 (2.23)	20.81 (2.54)	21.99 (4.81)	19.18 (3.30)	26.58 (7.45)	20.18 (3.94)	20.02 (3.18)
Time spent gaming *n* (%)										
≤ 7 h	3580 (68.99)	1644 (67.18)	642 (63.38)	323 (82.61)	295 (67.66)	434 (76.41)	179 (69.92)	63 (79.75)	2510 (80.84)	1090 (51.95)
8–14 h	811 (15.63)	412 (16.84)	176 (17.37)	39 (9.97)	62 (14.22)	80 (14.08)	32 (12.50)	10 (12.66)	351 (11.30)	462 (22.02)
15–20 h	394 (7.59)	210 (8.58)	76 (7.50)	13 (3.32)	45 (10.32)	26 (4.58)	20 (7.81)	4 (5.06)	130 (4.19)	260 (12.39)
21–30 h	236 (4.55)	108 (4.41)	64 (6.32)	10 (2.56)	23 (5.28)	17 (2.99)	14 (5.47)	0 (0.00)	66 (2.13)	168 (8.01)
31–40 h	88 (1.70)	39 (1.59)	23 (2.27)	3 (0.78)	9 (2.06)	7 (1.23)	6 (2.34)	1 (1.27)	25 (0.81)	62 (2.96)
> 40 h	80 (1.54)	34 (1.39)	31 (3.06)	3 (0.77)	2 (0.46)	4 (0.70)	5 (1.95)	1 (1.27)	23 (0.74)	56 (2.67)
IGDS9-SF										
M (SD)	13.25 (5.77)	12.88 (5.48)	14.32 (6.50)	12.96 (5.26)	12.88 (5.53)	13.51 (6.10)	–	–	12.00 (4.69)	15.00 (6.65)
α [95 %CI]	0.89 [0.89, 0.90]	0.89 [0.89, 0.90]	0.90 [0.90, 0.91]	0.87 [0.85, 0.89]	0.89 [0.88, 0.91]	0.89 [0.88, 0.90]	–	–	0.87 [0.87, 0.88]	0.90 [0.89, 0.90]
ω [95 %CI]	0.90 [0.89, 0.90]	0.89 [0.89, 0.90]	0.91 [0.90, 0.92]	0.88 [0.86, 0.90]	0.89 [0.88, 0.91]	0.90 [0.88, 0.91]	–	–	0.88 [0.88, 0.89]	0.90 [0.89, 0.90]

Note. IGDS9-SF = Internet Gaming Disorder Scale; VMQ = Videogame Motives Questionnaire; US = United States; CAN = Canada; SAF = South Africa; SPA = Spain; ARG = Argentina; ENG = England. URU = Uruguay. Men showed higher time spent gaming (χ^2 (5) = 508.62, p <.001) and higher scores in the IGDS9-SF (t (5145) = 19.98, p <.001) than women.

gaming motives (see Supplementary Material to consult the items).

2.3. Measures

2.3.1. Occurrence of videogame use and time spent gaming

Following previous work (Pontes & Griffiths, 2015), to determine the last-year videogame user status we asked: *Have you played a videogame in the past year?* If participants responded "yes", they were branched to an additional question: "In a typical week, how often (i.e., from 1= *<7 h per week* to 5= *>40 h per week*) do you spend playing on computers, consoles and/or other gaming platforms (e.g., handheld devices)?".

2.3.2. Disordered gaming

The 9-item Internet Gaming Disorder Scale – Short-Form (IGDS9-SF; Pontes & Griffiths, 2015) was used to assess how often participants endorsed core DSM-5 criteria for Internet Gaming Disorder on a 5-point scale (i.e., from 1 = *never* to 5 = *very often*). The IGDS9-SD herein showed configural, metric and partial scalar invariances across gender and countries, except for England (see Supplementary Material).

2.3.3. Videogame use motives

The 24-item Videogaming Motives Questionnaire (VMQ; López-Fernández et al., 2020) was used to assess eight gaming motives (3 items per scale) on a 5-point scale (i.e., from 0 = *strongly disagree* to 4 = *strongly agree*). The reliability coefficients for the VMQ and IGDS9-SF are shown in Supplementary Material and Table 1, respectively.

2.4. Statistical analysis

To test the factor structure of the questionnaire, confirmatory factor analyses (CFAs) were conducted using diagonally weighted least squares (WLSMV) (Li, 2016). We applied the following criteria to evaluate the overall model fit: Comparative Fit Index (CFI); Tucker-Lewis Index (TLI); Root Mean Square Error of Approximation (RMSEA). For the CFI and TLI, values of > 0.90 were acceptable and values of > 0.95 were optimal. For the RMSEA, values of < 0.06 were optimal (Marsh et al., 2004). To provide reliability evidence for scores, Cronbach's alpha and McDonald's omega coefficients were calculated. As scales have<10 items, coefficients of ≥ 0.60 were interpreted as acceptable (Loewenthal, 1996).

Multigroup confirmatory factor analyses (MG-CFA) were conducted to determine the measurement invariance of the questionnaire across countries and gender. Specifically, configural (i.e., whether all the items loaded on the proposed factor); metric (i.e., whether item-factor loadings were similar across groups) and scalar (i.e., whether unstandardized item thresholds were similar across groups) invariance were tested. The model comparison criteria of ΔCFI/ΔTFI ≤ 0.01 (Cheung & Rensvold, 2002) and ΔRMSEA ≤ 0.015 (Chen, 2007) were used to indicate a significant decrement in the model fit when testing for measurement invariance. If all three measurement levels were invariant, the mean VMQ scores could be compared across groups. Finally, evidence for criterion-related validity was conducted via bivariate correlation analyses between each VMQ subscale and time spent gaming and disordered gaming per country and gender.

Cases with one missing value (n = 164 [n = 131 with missing value in the VMQ, n = 29 with missing value in the IGDS9-SF, n = 4 with missing value in both scales]) were retained. In the structural equation models, as the WLSMV estimator was use, pairwise deletion was applied, while in the rest of the analysis the mean score of the scale was employed. *Mplus 8.4* (Muthén & Muthén, 1998–2019) was applied to the CFAs and measurement invariance analyses, and *SPSS-23* to the descriptive and correlation analyses.

3. Results

3.1. 1. Structure validity evidence

The CFA results indicated an excellent data fit for a 24-item 8-factor solution on most indices for the total sample, and across gender and six of the seven countries (CFIs ≥ 0.95 and, TLIs ≥ 0.94, RMSEAs ≤ 0.09) (see Supplementary Material). The standardized loadings of the indicator variables on their hypothesized factors were all significant (p <.001) and salient (i.e. ≥ 0.60). The questionnaire structure was not tested in Uruguay because of the small sample size (n = 79) (Kyriazos,

2018). Thus, data from the Uruguay subsample were not included in the measurement invariance testing and posterior analysis.

3.2. Internal consistency

The Cronbach's alphas and the McDonald's omegas for the eight VMQ subscales ranged from 0.64 to 0.91 across samples (see Supplementary Material).

3.3. Measurement invariance testing

When the configural model was tested across gender and countries, adequate fit indices were found (CFIs $\geq$ 0.96, TLIs $\geq$ 0.95, RMSEAs $\leq$ 0.07), which supported the configural invariance. The addition of constraints across the factor loadings and the thresholds across groups showed minimal changes in the CFI, TLI and RMSEA, which suggested metric and scalar invariance (see Table 2).

Consequently, we conducted MANCOVAs to test the mean differences in the VMQ subscales scores per country (age and gender as covariates) and per gender (age as covariate). The results showed significant mean differences per country (Wilks' $\lambda = 0.88$; $F(40.00, 21919.34) = 16.08$, $p < .001$, $\eta^2 = .03$) and gender (Wilks' $\lambda = 0.71$, $F(8.00, 5033.00) = 252.84$, $p < .001$, $\eta^2 = .29$). Table 3 presents the mean scores and the *post hoc* results. The results generally showed higher recreation levels in Argentina and Spain, while US and Canada displayed higher levels for all other gaming motives. Men reported higher mean levels on all motives compared to women.

3.4. Criterion-related validity evidence

Bivariate correlations are presented in Table 4. Across countries and gender, small- and medium-sized significant positive correlations appeared, except for a non-significant association between the customization motive and time spent gaming in the Argentinean subsample. The strongest correlations were observed between coping and disordered gaming scores. Further, we compared the magnitude of the correlations across groups (see Mezquita et al., 2022 for a similar analytic approach). Of the 216 possible comparisons, the average difference in correlations was 0.07 ($SD = 0.05$). We took differences < 1 *SD* as small, 1 *SD* to 2 *SD* as medium, 2 *SD* to 3 *SD* as large, and > 3 *SD* as substantial (see Table 5). Three substantial differences appeared: the positive correlation between cognitive development and time spent gaming was medium-sized in England ($r = 0.41$, $p < .05$), but small-sized in Argentina ($r = 0.17$, $p < .05$); the positive correlation between recreation and disordered gaming was medium-sized in Canada ($r = 0.36$, $p < .05$) and in South Africa ($r = 0.38$, $p < .05$), but small-sized in Spain ($r = 0.13$, $p < .05$).

4. Discussion

Our primary aim was to provide validity and reliability evidence for the VMQ in a large sample of college students from seven countries. We specifically examined the factor structure (aim 1) and the measurement invariance of the 24-item 8-factor VMQ across gender and country (aim 2). We also compared mean scores across groups (aim 3) and examined the criterion validity of the eight motive subscales by correlating them with time spent gaming and disordered gaming across countries and gender (aim 4).

When the VMQ structure was tested in each group separately, we found support for the 8-factor scale structure in both gender groups and in six of the seven examined countries (i.e., US, Canada, South Africa, Spain, Argentina, England). These results replicate findings of the original study on VMQ development and validation (López-Fernández et al., 2020).

The MG-CFA results also support the measurement invariance of the VMQ across countries and gender. Establishing an equivalent scale supports the claim that people from different places and gender think in similar aspects when questioned about their motivations to play videogames. Hence the present study provides a useful measure for assessing and comparing gaming motives across college students from different countries, and also across men and women (Byrne, 2013).

When comparing VMQ subscale scores across countries, North American (US and Canada) college students reported higher scores than those from other countries on all the motives except recreation and cognitive development. Spanish and Argentinean college students obtained higher recreation scores than those from other countries. Previous studies have found higher mean levels of motives for drinking, as reported by undergraduates from individualistic (i.e., US and Canada) vs collectivistic countries (i.e., Spain and Argentina) (Mackinnon et al., 2017). Taken together, these results suggest that the individualism (i.e., countries that prioritize individual goals and autonomy) vs collectivism (i.e., countries that prioritize group interests and interdependence) cultural dimensions could explain the differences in the mean level of motives across countries and substances/behaviors (e.g., Pilatti et al., 2022). However, this affirmation is speculative because other cross-national-related variables (e.g., investment in the game industry [Newzoo, 2021]) could influence the different associations found between motives and gaming outcomes across countries.

Similar to previous work, men reported higher levels for time spent gaming, disordered gaming, and gaming motives than women (Laconi et al., 2017; Kim et al., 2022). These findings may indicate that male players form an at-risk group with vulnerability to problematic gaming.

Table 2
Invariance testing results of the VMQ across countries and gender.

Invariance across countries									
Overall Fit Indices						Comparative Fit Indices			
	χ^2	*df*	CFI	TLI	RMSEA	Model Comparison	ΔCFI	ΔTLI	ΔRMSEA
1. Configural	7244.98*	1344	0.97	0.96	0.07 (0.07, 0.07)				
2. Metric	7347.25*	1424	0.97	0.96	0.07 (0.07, 0.07)	1 vs 2	0.000	0.002	-0.002
3. Scalar	8391.02*	1744	0.96	0.97	0.07 (0.07, 0.07)	2 vs 3	-0.004	0.003	-0.003
Invariance across gender									
Overall Fit Indices						Comparative Fit Indices			
	χ^2	*df*	CFI	TLI	RMSEA	Model Comparison	ΔCFI	ΔTLI	ΔRMSEA
1. Configural	6602.20*	448	0.96	0.95	0.07 (0.07, 0.08)				
2. Metric	6529.98*	464	0.96	0.95	0.07 (0.07, 0.07)	1 vs 2	0.001	0.002	-0.002
3. Scalar	6785.45*	528	0.96	0.96	0.07 (0.07, 0.07)	2 vs 3	-0.002	0.005	-0.004

Note. * $p < .001$; We used the comparison criteria of ΔRMSEA $\leq$ 0.015 (increase indicates a worse fit; Chen, 2007) and ΔCFI/ΔTLI $\leq$ 0.01 (decrease indicates a worse fit; Cheung & Rensvold, 2002) to test for measurement invariance; VMQ = Videogame Motives Questionnaire; RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; df = degrees of freedom.

Table 3
Descriptive statistics and mean comparisons of the scores of the VMQ subscales across countries and across gender.

VMQ subscales	Total sample (n = 5192)	US (n = 2449)	CAN (n = 1013)	SAF (n = 391)	SPA (n = 436)	ARG (n = 568)	ENG (n = 256)	Women (n = 3067)	Men (n = 2080)	Significant mean differences by country	Significant mean differences by gender
Recreation	3.11 (0.71)	3.04 (0.72)	3.09 (0.69)	3.06 (0.71)	3.21 (0.72)	3.29 (0.61)	2.97 (0.75)	2.93 (0.74)	3.32 (0.59)	SPA > US, ENG ARG > US, CAN, SAF, ENG	Women < Men
Competition	2.36 (0.93)	2.49 (0.90)	2.55 (0.89)	2.29 (0.95)	2.29 (1.00)	2.32 (0.94)	2.23 (0.87)	2.12 (0.89)	2.90 (0.79)	US, CAN > SAF, SPA, ARG, ENG	Women < Men
Cognitive Development	2.18 (0.83)	2.16 (0.82)	2.22 (0.75)	2.28 (0.89)	2.22 (0.89)	2.56 (0.88)	1.92 (0.83)	2.02 (0.83)	2.42 (0.77)	US, CAN, SAF, SPA, ARG > ENG	Women < Men
Coping	2.24 (0.99)	2.31 (0.99)	2.34 (0.97)	2.37 (1.00)	2.02 (0.1.02)	2.25 (0.98)	2.18 (0.97)	2.09 (0.99)	2.55 (0.92)	US, CAN, SAF > SPA	Women < Men
Social Interaction	1.47 (1.08)	1.63 (1.08)	1.74 (1.11)	1.37 (0.97)	1.42 (1.05)	1.30 (0.92)	1.39 (1.06)	1.20 (0.95)	2.09 (1.03)	US > SAF, ARG CAN > SAF, SPA, ARG, ENG	Women < Men
Violent Reward	1.17 (1.06)	1.30 (1.05)	1.36 (1.07)	1.15 (1.02)	1.03 (1.05)	1.07 (1.01)	1.11 (1.00)	0.85 (0.92)	1.80 (0.99)	US, CAN > SPA, ARG	Women < Men
Customization	2.37 (1.07)	2.50 (1.03)	2.53 (1.01)	2.45 (1.10)	2.20 (1.13)	2.21 (1.20)	2.36 (1.00)	2.35 (1.12)	2.56 (0.97)	US, CAN > SPA, ARG	Women < Men
Fantasy	2.27 (1.10)	2.36 (1.07)	2.40 (1.05)	2.39 (1.12)	2.18 (1.15)	2.06 (1.18)	2.26 (1.05)	2.11 (1.12)	2.61 (0.99)	US, CAN, SAF > ARG	Women < Men

Note. VMQ = Videogame Motives Questionnaire; US = United States; CAN = Canada; SAF = South Africa; SPA = Spain; ARG = Argentina; ENG = England. Significant mean differences in the VMQ subscales across countries were determined by post-hoc comparisons using Bonferroni correction (p <.0004) within an MANCOVA framework (gender and age as covariables). Significant mean differences across gender were determined by univariate results.

Table 4
Bivariate correlations of the VMQ subscales with time spent gaming and videogame use disorder for the total sample and across countries and gender.

	Time spent gaming								
	Total sample	US	CAN	SAF	SPA	ARG	ENG	Women	Men
Recreation	**0.29**	**0.29**	**0.33**	**0.26**	**0.26**	**0.22**	**0.37**	**0.19**	**0.30**
Competition	**0.26**	**0.25**	**0.27**	**0.17**	**0.28**	**0.18**	**0.34**	**0.12**	**0.23**
Cognitive development	**0.23**	**0.24**	**0.26**	**0.19**	**0.18**	**0.17**	**0.41**	**0.11**	**0.25**
Coping	**0.29**	**0.30**	**0.30**	**0.20**	**0.28**	**0.21**	**0.36**	**0.20**	**0.29**
Social interaction	**0.36**	**0.34**	**0.40**	**0.25**	**0.35**	**0.29**	**0.44**	**0.22**	**0.33**
Violent reward	**0.24**	**0.23**	**0.23**	**0.17**	**0.34**	**0.19**	**0.33**	**0.16**	**0.12**
Customization	**0.17**	**0.18**	**0.19**	**0.12**	**0.13**	0.07	**0.21**	**0.12**	**0.19**
Fantasy	**0.26**	**0.25**	**0.28**	**0.20**	**0.30**	**0.28**	**0.31**	**0.20**	**0.26**
	Videogame use disorder								
	Total sample	US	CAN	SAF	SPA	ARG	ENG	Women	Men
Recreation	**0.29**	**0.30**	**0.36**	**0.38**	**0.13**	**0.20**	–	**0.29**	**0.20**
Competition	**0.28**	**0.29**	**0.30**	**0.33**	**0.28**	**0.23**	–	**0.22**	**0.20**
Cognitive development	**0.29**	**0.30**	**0.34**	**0.31**	**0.22**	**0.18**	–	**0.24**	**0.27**
Coping	**0.42**	**0.43**	**0.46**	**0.40**	**0.42**	**0.37**	–	**0.41**	**0.37**
Social interaction	**0.38**	**0.37**	**0.47**	**0.34**	**0.36**	**0.33**	–	**0.31**	**0.33**
Violent reward	**0.31**	**0.32**	**0.32**	**0.28**	**0.35**	**0.23**	–	**0.26**	**0.19**
Customization	**0.22**	**0.22**	**0.27**	**0.26**	**0.16**	**0.16**	–	**0.21**	**0.20**
Fantasy	**0.33**	**0.32**	**0.38**	**0.36**	**0.33**	**0.32**	–	**0.32**	**0.27**

Note. VMQ = Videogame Motives Questionnaire; US = United States (n = 2449); CAN = Canada (n = 1013); SAF = South Africa (n = 391); SPA = Spain (n = 436); ARG = Argentina (n = 568); ENG = England (n = 256); Women = (n = 3067); Men = (n = 2080). Significant correlations (p <.05) are depicted in bold. According to Cohen (1992), correlations of 0.10, 0.30 and 0.50 are considered small, medium and high, respectively. The correlations between VMQ constructs and videogame use disorder symptoms (i.e., assessed with IGDS9-SF) were not conducted in the ENG subsample because it was not possible to test the measurement invariance of IGDS9-SF for this country (see Supplementary Material, the IGDS9-SF model fit across countries and measurement invariance).

Our last aim was to provide criterion-related validity evidence for gaming motives. We observed that higher motive scores were related to spending more time gaming (de Hesselle et al., 2021; López-Fernández et al., 2020) and a higher level of gaming disorder symptoms (Kim & Kang, 2021; López-Fernández et al., 2020). In line with previous meta-analyses (Bäcklund et al., 2022; Wang & Cheng, 2022), coping motives showed the strongest correlations with disordered gaming. Prior research has found coping motives to mediate the relations of personality with disordered gaming (López-Fernández et al., 2021; Tang et al., 2020) and psychopathological symptoms and disordered gaming (Montag et al., 2019; Plante et al., 2019). These findings suggest that gamers who play videogames to cope with distress or to escape from problems may adopt less adaptive strategies to regulate negative emotional states. Thus, videogame use may be adopted as a dysfunctional strategy to deal with difficulties (Bäcklund et al., 2022; Wang & Cheng, 2022).

Finally, substantial differences appeared between traditionally classified individualistic countries (i.e., England, Canada, South Africa) and collectivistic countries (i.e., Argentina and Spain) on the correlations of cognitive development and recreation motives with gaming outcomes. In line with these results, a previous meta-analysis also found that the correlations between escapism and disordered gaming were stronger in individualistic vs collectivistic cultures (Wang & Cheng, 2022). These findings suggest that individualism-collectivism could moderate the relation between motives and gaming behaviors. However, further research is needed to clarify the role that individualistic/collectivistic

Table 5
Correlation differences across countries and gender in the eight VMQ subscales and time spent gaming and videogame use disorder.

	Time spent gaming															
	US-CAN	US-SAF	US-SPA	US-ARG	US-ENG	CAN-SAF	CAN-SPA	CAN-ARG	CAN-ENG	SAF-SPA	SAF-ARG	SAF-ENG	SPA-ARG	SPA-ENG	ARG-ENG	Women-Men
Recreation	0.03	0.04	0.04	0.08	0.08	0.07	0.07	0.11	0.05	0.00	0.04	0.12	0.04	0.12	*0.16*	0.12
Competition	0.02	0.08	0.03	0.07	0.09	0.10	0.01	0.08	0.07	0.11	0.01	*0.17*	0.09	0.06	*0.16*	0.11
Cognitive development	0.02	0.05	0.06	0.07	*0.17*	0.07	0.08	0.09	*0.15*	0.01	0.02	**0.22**	0.01	**0.22**	**0.24**	0.14
Coping	0.00	0.11	0.02	0.10	0.06	0.10	0.02	0.10	0.06	0.08	0.01	*0.16*	0.08	0.08	*0.16*	0.08
Social interaction	0.06	0.09	0.01	0.05	0.10	*0.15*	0.05	0.12	0.04	0.10	0.04	**0.19**	0.06	0.09	*0.15*	0.10
Violent reward	0.01	0.05	0.12	0.04	0.11	0.06	0.11	0.04	0.10	*0.17*	0.02	*0.16*	*0.15*	0.01	*0.14*	0.04
Customization	0.01	0.06	0.05	0.11	0.04	0.07	0.05	0.11	0.03	0.01	0.05	0.09	0.06	0.08	*0.14*	0.06
Fantasy	0.03	0.05	0.05	0.03	0.06	0.08	0.02	0.00	0.03	0.10	0.08	0.11	0.02	0.01	0.03	0.06
	Videogame use disorder															
	US-CAN	US-SAF	US-SPA	US-ARG	US-ENG	CAN-SAF	CAN-SPA	CAN-ARG	CAN-ENG	SAF-SPA	SAF-ARG	SAF-ENG	SPA-ARG	SPA-ENG	ARG-ENG	Women-Men
Recreation	0.07	0.08	*0.16*	0.09	–	0.02	**0.23**	*0.16*	–	**0.25**	*0.17*	–	0.07	–	–	0.09
Competition	0.01	0.05	0.01	0.05	–	0.04	0.02	0.06	–	0.06	0.10	–	0.04	–	–	0.01
Cognitive development	0.04	0.01	0.08	0.12	–	0.03	0.12	*0.16*	–	0.09	*0.13*	–	0.04	–	–	0.03
Coping	0.03	0.03	0.01	0.06	–	0.07	0.04	0.09	–	0.02	0.03	–	0.05	–	–	0.03
Social interaction	0.10	0.03	0.01	0.04	–	*0.13*	0.11	*0.14*	–	0.02	0.01	–	0.03	–	–	0.03
Violent reward	0.00	0.04	0.03	0.09	–	0.04	0.04	0.09	–	0.08	0.05	–	0.12	–	–	0.05
Customization	0.05	0.03	0.07	0.06	–	0.02	0.12	0.12	–	0.10	0.10	–	0.00	–	–	0.01
Fantasy	0.06	0.05	0.02	0.00	–	0.02	0.05	0.06	–	0.03	0.05	–	0.02	–	–	0.05

Note. VMQ = Videogame Motives Questionnaire; US = United States ($n = 2449$); CAN = Canada ($n = 1013$); SAF = South Africa ($n = 391$); SPA = Spain ($n = 436$); ARG = Argentina ($n = 568$); ENG = England ($n = 256$); Women = ($n = 3067$); Men = ($n = 2080$). In comparison across countries, the medium correlation differences are depicted in italic ($0.122 < r\text{diff} < 0.173$), large differences in bold ($0.173 < r\text{diff} < 0.224$) and substantial differences in bold and underlined ($r\text{diff} \geq 0.224$).

orientations have in gaming behaviors.

4.1. Clinical implications

Considering multiculturalism presents on most college campuses, providing a suitable measure to assess gaming motivations across undergraduates from different cultural backgrounds could be useful. Using the VMQ may also contribute to identifying college students at risk of developing disordered gaming (e.g., those with higher coping motives) (Brand et al., 2020; Melodia et al., 2020). Understanding underlying motivational mechanisms to gaming behaviors might be helpful for designing effective interventions to reduce problematic videogame use (Dieris-Hirche et al., 2021).

4.2. Limitations

This study presents several limitations. Participants came from four continents, which provides the sample with cultural diversity. However, we followed a convenience sampling procedure (i.e., researchers recruited students from their universities) with distinct recruitments strategies and incentives. These variations in the procedure could have affected the representativeness of the samples from each country. Moreover, some samples are relatively small (i.e., England and Uruguay), and the modest sample size for Uruguay prevented us from examining the internal structure and criterion-related validity evidence for the VMQ. In addition, the samples included in the present study are composed of college students and our results cannot be generalized to other sample populations. Lastly, a more restrictive level of invariance (i.e., strict invariance) could have been examined and further research should replicate our findings by examining other forms of validity (e.g., construct validity with another videogame motives measure).

4.3. Conclusions

The results of this study generally evidence the internal VMQ structure, measurement invariance of the VMQ across countries and gender, and the criterion-related validity evidence for the VMQ scores. This evidence supports the utility of this scale to assess and compare gaming motives among college student gamers across the US, Canada, South Africa, Spain, England, and Argentina.

Role of Funding Sources

Dr. Bravo was supported by a training grant (T32-AA018108) from the National Institute on Alcohol Abuse and Alcoholism (NIAAA) in the United States during the duration of data collection for this project. Data collection was supported, in part, by grant T32-AA018108. NIAAA had no role in the study design, collection, analysis or interpretation of the data, writing the manuscript, or the decision to submit the paper for publication. Data collection in Spain was also supported by grants UJI-B2022-29 from the Universitat Jaume I and CIAICO/2021/052 from the Generalitat Valenciana. Data collection in Argentina was also supported by grants from the National Secretary of Science and Technology (FONCYT, Grant No PICT 2018–03170) and by grants from the Secretary of Science and Technology- National University of Córdoba (SECyT-UNC).

Author Agreement

The manuscript is original, has not been published previously, or submitted for review elsewhere, and reports on IRB-approved research. We do not have any conflict of interest that could inappropriately influence, or be perceived to influence, our work. Each author has contributed significantly to the work and agrees to the submission of the manuscript.

CRediT authorship contribution statement

Yanina Michelini: Formal analysis, Writing – original draft, Writing – review & editing, Visualization. **Manuel I. Ibáñez:** Conceptualization,

Methodology, Validation, Investigation, Resources, Supervision, Project administration, Funding acquisition. **Angelina Pilatti:** Conceptualization, Methodology, Validation, Supervision. **Adrian J. Bravo:** Conceptualization, Methodology, Validation, Supervision. **Francisco J. López-Fernández:** Methodology, Validation, Investigation, Writing – review & editing, Visualization. **Generós Ortet:** Conceptualization, Methodology, Validation, Investigation, Resources, Supervision, Project administration, Funding acquisition. **Laura Mezquita:** Conceptualization, Methodology, Validation, Investigation, Resources, Formal analysis, Writing – review & editing, Visualization, Supervision, Project administration, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.addbeh.2023.107624.

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