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Psychometric analysis of the Escala de Cansancio Emocional in Ecuadorian college students during the COVID-19 outbreak

Análisis psicométrico de la Escala de Cansancio Emocional en estudiantes universitarios ecuatorianos durante el brote de COVID-19

Análise psicométrica da Escala de Cansancio Emocional em estudantes universitários equatorianos durante o surto de COVID-19

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Abstract

Academic emotional exhaustion is the first stage of academic burnout syndrome, and it is necessary to evaluate it and intervene early since the consequences are significant for people. The objective of this research is to perform a psychometric analysis of the Emotional Exhaustion Scale (Escala de Cansancio Emocional, ECE) to evaluate its internal structure, measurement invariance, and internal consistency reliability, in a sample of Ecuadorian college students in the context of the COVID-19 pandemic. Four hundred and fifty-three college students from Ecuador participated (76.21 % women) between the ages of 17 and 35 ($M = 22.76$ years). Results show that the one-dimensional structure has statistical support, is invariant concerning sex, and shows adequate internal consistency reliability. It is concluded that the ECE has adequate psychometric properties that allow its use in Ecuadorian college students.

Keywords: academic emotional exhaustion; academic burnout; validity; reliability; measurement invariance; factor analysis

Resumen

El agotamiento emocional académico es la primera etapa del síndrome de burnout académico, y es necesario evaluarlo e intervenir temprano ya que las consecuencias son significativas para las personas. El objetivo de esta investigación es realizar un análisis psicométrico de la Escala de Cansancio Emocional (ECE) para evaluar su estructura interna, invariancia de medida y confiabilidad de consistencia interna, en una muestra de estudiantes universitarios ecuatorianos en el contexto de la pandemia COVID-19. Participaron 453 estudiantes universitarios de Ecuador (76.21 % mujeres) de entre 17 y 35 años ($M = 22.76$ años). Los resultados muestran que la estructura unidimensional tiene soporte estadístico, es invariante en cuanto al sexo y muestra una adecuada confiabilidad de consistencia interna. Se concluye



que la ECE tiene propiedades psicométricas adecuadas que permiten su uso en estudiantes universitarios ecuatorianos.

Palabras clave: agotamiento emocional académico; agotamiento académico; validez; fiabilidad; invarianza de medición; análisis factorial

Resumo

O esgotamento emocional acadêmico é o primeiro estágio da Síndrome de Burnout Acadêmico, sendo necessário avaliá-lo e intervir precocemente, pois as consequências são significativas para as pessoas. O objetivo desta pesquisa é realizar uma análise psicométrica da Escala de Cansaço Emocional (Escala de Cansancio Emocional, ECE) para avaliar sua estrutura interna, invariância de medida e confiabilidade da consistência interna, em uma amostra de estudantes universitários equatorianos no contexto da pandemia COVID-19. Participaram 453 estudantes universitários do Equador (76,21 % mulheres) entre 17 e 35 anos ($M = 22,76$ anos). Os resultados mostram que a estrutura unidimensional possui suporte estatístico, é invariável em relação ao sexo e apresenta adequada confiabilidade de consistência interna. Conclui-se que a ECE possui propriedades psicométricas adequadas que permitem seu uso em estudantes universitários equatorianos.

Palavras-chave: exaustão emocional acadêmica; exaustão acadêmica; validade; confiabilidade; invariância de medição; análise fatorial

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The emergence of COVID-19 pandemic and its effects on humanity are still present, not only due to the impact it has on public health worldwide, causing the contagion of millions of people, the saturation of medical and social services, and even the death of hundreds of thousands of people (Silva et al., 2021), but also because its effect on the economy, the society, the family and other activities generated by the different strategies and restrictions that have been taken to contain the spread of the virus (Chakraborty & Maity, 2020).

In the case of Ecuador, the management of the COVID-19 pandemic was inadequate, and it became one of the most affected countries in the world. When considering the number of deaths per million inhabitants, Ecuador became the fourth most affected country in the Americas region until October of 2020 (World Health Organization, 2020). Preliminary data report more than 36,000 additional deaths than usual due to various causes (including COVID-19) until the end of 2020, mainly due to the difficulties in managing the health crisis (Cevallos-Valdiviezo et al., 2021), which had repercussions on mental health (Moreta-Herrera et al., 2021a), education (Torres-Toukoumidis et al., 2021), among others.

Students, in general, present several affections both in mental health and performance (Kecojevic et al., 2020; Moya-Solís & Moreta-Herrera, 2022). This population, traditionally considered vulnerable (Lipson et al., 2019; Mayorga-Lascano & Moreta-Herrera, 2019; Montano, 2021), is now more susceptible and presents greater symptoms of anxiety, depression, extreme fear, stress, and others (Caycho-Rodríguez et al., 2021; Elmer et al., 2020; Wang et al., 2020). This is mainly due to changes in teaching methodology, which

meant for some to get used to virtual classes (with an increase in absenteeism due to limited internet access in several cases), while many others had to leave their studies or postpone them to retake them in a post-pandemic context (Santibañez & Guarino, 2021). The difficulties appeared due to changes in students' lifestyle, use of technologies, loss of social status, isolation, and others (Wang et al., 2020), as well as the cultural component that implies an overload of activities associated with sex, in which women assume greater responsibility and work (Xiong et al., 2020).

Emotional exhaustion during the pandemic: sex differences

Vulnerability in students (especially among college students) derives mainly from the high presence of stress (Sani et al., 2020), induced by effort and academic pressure (Pascoe et al., 2020). As a consequence of stress and poor coping strategies, students are more likely to develop Academic Burnout Syndrome (ABS; Lee et al., 2017; Schaufeli et al., 2002) which negatively affects mental health in general (Gavilanes-Gavilanes & Moreta-Herrera, 2020).

ABS is a state of mental exhaustion, intense stress, and low motivation, which is expressed persistently and is strongly associated with academic activity (Salanova & Llorens, 2008). The construct is traditionally studied from a multidimensional perspective, which also considers cynicism and inefficacy, in addition to emotional exhaustion (EE). Nevertheless, evidence suggests that EE initiates and consolidates the presence of ABS (Maslach & Leiter, 2016) since it is also related to emotional and cognitive distancing from one's work/study (Ariani, 2019), and presumably it is a way of coping with stress overload (Maslach et al., 2001). Therefore, it is considered the core of burnout (Rosales & Rosales, 2013), and it has become increasingly relevant to study it independently, especially in the academic context (Li et al., 2018; Yedidia et al., 2014).

Regarding sex differences, the evidence is not conclusive yet. For example, some studies conducted before the pandemic show greater recurrence and intensity of ABS in men than in women (Bikar et al., 2018; Zahedbablaan et al., 2014), although in other studies women score higher (Herrmann et al., 2019; Salmela-Aro et al., 2016), especially in EE (Dominguez-Lara et al., 2018; Worly et al., 2017, 2019). However, changes and living conditions associated with the pandemic, along with the academic pressure experienced, have caused an increase in ABS, and EE reaching higher levels of discomfort (Jiang, 2021; Seperak-Viera et al., 2021). Additionally, women and college students experienced greater stress than men and the elderly (Xiong et al., 2020). This is probably due to the fact that in societies such as those in Latin America, women, unlike men, traditionally have roles associated with caring for the home and family, thus female college students would be more affected during the pandemic due to the overload of activities (Spagnolo et al., 2020).

Measurement of academic emotional exhaustion

The Escala de Cansancio Emocional (ECE; Ramos et al., 2005) was designed in Spain to measure Emotional Exhaustion in college students from the items of the Emotional Exhaustion dimension of the Burnout Inventory (MBI; Maslach & Jackson, 1997) and Freudenberger's concepts of burnout.

Since its creation, the ECE has received evidence of adequate validity and reliability in samples of college students from Spain (Torres et al., 2016), Peru (Dominguez-Lara, 2013), Colombia (Dominguez-Lara et al., in press), Argentina (Fontana, 2011), and Mexico (González-Ramírez & Landero-Hernández, 2007). However, in Ecuador, there are no similar psychometric studies to know its psychometric properties.

The present study

Considering this background, it is important to extend the study of the psychometric properties of the ECE to a new country such as Ecuador, including it within the scientific debate of the current academic literature. This will also allow empirical research and academic evaluation within the Ecuadorian cultural context, with a tool that provides precise measurement. In the same way, it is necessary to analyze the measurement invariance, barely studied within current instrumental research (Moreta-Herrera & Velástegui-Parra, 2020) which is important for studies focused on the comparison between men and women (eg, Moreta-Herrera et al., 2021b) given that its lack of verification prevents knowing the real differences between groups by introducing measurement bias. Analyzing measurement invariance related to sex will allow more precise comparisons in a context that could introduce irrelevant variances or measurement errors, achieving greater objectivity in the study of groups classified by sex.

Therefore, the objective of this research is to analyze the psychometric properties of the ECE in Ecuadorian college students in the context of the COVID-19 pandemic, in terms of its internal structure, measurement invariance, and internal consistency reliability.

Method

Design

This is an instrumental or psychometric study (Ato et al., 2013) whose objective was the analysis of the psychometric properties (factor validity, measurement invariance and reliability) of the ECE in Ecuadorian college students.

Participants

They were part of the study 453 Ecuadorian students (76.21 % women) were evaluated, between 17 and 35 years old ($M = 22.76$; $SD = 4.40$), predominantly single (79 %), without children (74 %) and without current job (64.2 %). Students from different professional careers participated, including psychology (24.5 %), law (24.5 %), education (15.5 %), architecture (13.7 %), among others, who were in the first to the fourth year of studies.

Instruments

The assessment tool utilized was the Escala de Cansancio Emocional (Ramos et al., 2005), in its version adapted to Perú (Dominguez-Lara, 2013). It is made up of a 10 items questionnaire completed on a five-option Likert scale (from *rarely* [1] to *always* [5]).

Procedure

The Ecuadorian researchers were invited to participate in the present study to know the influence the COVID-19 in different educational variables like the emotional exhaustion, who directly requested the participation of their students through a Google Docs form. Initially, informed consent was presented highlighting the voluntary nature of participation, and the questionnaires were completed anonymously. In the present investigation, the principles of the Declaration of Helsinki (World Medical Association, 1964) were applied.

Data analysis

Initially, multivariate normality was evaluated through the Mardia coefficient, where magnitudes less than 70 are adequate (Rodríguez & Ruiz, 2008). Subsequently, a confirmatory factor analysis (CFA) was applied to verify the internal structure of the test within the group of men and women separately. The WLSMV estimator and polychoric correlation matrix were used. The model was evaluated through the values obtained in various adjustment indices such as the CFI ($> .90$; McDonald & Ho, 2002), the RMSEA both in its point estimate ($< .08$; Browne & Cudeck, 1993) as well as considering the upper limit of its 90 % confidence interval ($< .10$; West et al., 2012), and the WRMR (< 1 ; DiStefano et al., 2018). In addition, the analysis also verified the factor loadings ($> .50$; Dominguez-Lara, 2018), and the average variance extracted (AVE $> .50$) were assessed.

Measurement invariance was evaluated through multi-group confirmatory factor analysis in different stages: configural invariance (internal structure), metric invariance (factor loadings), scalar invariance (thresholds), and strict invariance (residuals) (Pendergast et al., 2017); evidence supporting invariance depended on the variation of RMSEA ($\Delta \leq .015$) and CFI ($\Delta \geq -.01$) (Chen, 2007).

Afterward, given that the modification indices (MI) suggested potential non-invariant parameters between the groups (eg factor loadings). These were analyzed under a misspecification approach (Saris et al., 2009) with a specialized module (Domínguez-Lara & Merino-Soto, 2018). Finally, the effect size for the measurement invariance approach was implemented (Pornprasertmanit, 2021) to compare the factorial parameters between men and women. In this sense, the absence of differences between men and women was determined through Cohen's q ($< |.10|$) for factor loadings, Cohen's d ($< |.20|$) for the thresholds, and Cohen's h ($< |.10|$) for the residuals (Dominguez-Lara & Merino-Soto, 2019).

Regarding reliability, before estimating the α coefficient, the tau-equivalence or statistical equivalence of factor loadings was analyzed through the change in χ^2 with the DIFFTEST command (Asparouhov & Muthén, 2006) of the tau-equivalent model concerning the congeneric (one-dimensional) model. Subsequently, the reliability of the construct was estimated with the ω coefficient ($> .70$), and the difference between both coefficients ($\Delta\omega - \alpha$) was considered significant when it was greater than $|.06|$ (Gignac et al., 2007). The main analyzes were carried out with the Mplus version 7 (Muthén & Muthén, 1998-2015).

Results

Internal structure and measurement invariance

Multivariate normality received support in both men ($G2_{(men)} = 29.888$) and in women ($G2_{(women)} = 49.422$). Likewise, the statistical adjustment of the one-dimensional model in men and women are appropriate in both groups considering the magnitudes of CFI and WRMR, but not of RMSEA (table 1). On the other hand, factor loadings ($> .65$) and AVE ($> .60$) reached high magnitudes (table 2). Thus, after the preliminary analysis that establishes a baseline for the measurement of ECE in each group, the invariance of the measurement was assessed. Then, the variation of the adjustment indices (CFI and RMSEA) did not significantly exceed the established limits (table 1), so favorable evidence was obtained.

Table 1*Measurement models and measurement invariance of ECE in Ecuadorian college students*

	χ^2 (df)	CFI	RMSEA (IC90%)	WRMR	Δ CFI	Δ RMSEA
Base line						
Men	139.698 (35)	.978	.124 (.102, .145)	0.911	-	-
Men-tau equivalence	236.063 (44)	.959	.149 (.131, .168)	1.597	-	-
Women	133.222 (35)	.988	.104 (.086, .124)	0.790	-	-
Women-tau-equivalence	393.302 (44)	.958	.176 (.160, .192)	2.047	-	-
Invariance analysis						
Configural	272.211 (70)	.985	.113 (.099, .127)	1.206		
Metric	234.293 (79)	.988	.093 (.080, .107)	1.362	.003	-.020
Scalar	268.418 (108)	.988	.081 (.069, .093)	1.329	.000	-.012
Strict	270.513 (118)	.988	.076 (.064, .087)	1.468	.000	-.005

Note. χ^2 : Chi-Square; df: degrees of freedom; CFI: Comparative Fit Index; RMSEA: Root Mean Square Error of Approximation; WRMR: Weighted Root Mean Square Residual.

Table 2*Factorial parameters of ECE in Ecuadorian men and women*

	Men						Women					
	λ	Θ	τ_1	τ_2	τ_3	τ_4	λ	Θ	τ_1	τ_2	τ_3	τ_4
Item 1	.769	.409	-1.686	-0.74	0.352	1.045	.704	.504	-1.344	-0.582	0.191	1.029
Item 2	.647	.581	-1.045	-0.352	0.507	1.067	.699	.511	-0.919	-0.333	0.427	0.996
Item 3	.775	.399	-0.449	0.141	0.845	1.635	.818	.331	-0.537	0.093	0.89	1.275
Item 4	.772	.404	-1.114	-0.435	0.312	1.242	.82	.328	-1.172	-0.492	0.241	0.904
Item 5	.86	.26	-0.792	-0.102	0.612	1.361	.856	.267	-0.715	-0.083	0.678	1.232
Item 6	.859	.262	-1.045	-0.193	0.435	1.329	.915	.163	-0.861	-0.132	0.571	1.116
Item 7	.908	.176	-0.921	-0.102	0.551	1.163	.91	.172	-0.82	-0.044	0.678	1.172
Item 8	.86	.26	-1.188	-0.407	0.206	0.94	.867	.248	-1.116	-0.312	0.417	0.965
Item 9	.835	.303	-1.114	-0.421	0.232	0.845	.864	.254	-0.996	-0.374	0.211	0.82
Item 10	.806	.35	-1.114	-0.312	0.394	1.023	.893	.203	-0.934	-0.191	0.503	0.965
AVE	.660						.702					
Ω	.951						.956					
A	.934						.946					
$\Delta\omega-\alpha$.017						.010					

Note. λ : factor loadings; Θ : residuals; τ_n = nth threshold; AVE: Average Variance Extracted; ω : coefficient omega; α : coefficient alpha; $\Delta\omega-\alpha$: difference between coefficients.

A staged analysis showed that when factor loadings equivalence (metric invariance) was specified, the MI suggested freeing the parameters loadings of items 1 ($MI_{men} = 29.302$; Expected Parameter Change [EPC] = .116; $MI_{women} = 29.312$; EPC = -.169) and 10 ($MI_{men} = 19.401$; EPC = -.148; $MI_{women} = 19.389$; EPC = .219) because they are considered non-invariant. After executing the contrast procedures, there was no conclusive evidence of the presence of misspecifications, which is supported by the ES measures implemented for the difference in factor loadings ($q < |.10|$; table 3).

A similar scenario occurred within scalar invariance with the mean of item 4 ($MI_{men} = 10.223$; EPC = -.199; $MI_{women} = 10.203$; EPC = .187), where the unreleased parameter was considered as misspecification, but evidence from the effect size as a result of the comparison between thresholds indicates that there are no differences between items ($d < |.20|$; table 3).

Finally, with regard to strict invariance, the MI also suggested freeing the residuals of items 1 ($MI_{men} = 28.899$; EPC = -.350; $MI_{women} = 28.892$; EPC = .320) and 10 ($MI_{men} = 15.285$; EPC = .202; $MI_{women} = 15.264$; EPC = -.172), and also misspecifications were considered, which along the effect size of this comparison ($h > |.10|$; table 3), allows us to conclude that the residuals of these two items differ between groups.

Table 3

Differences between the factorial parameters of men and women according to effect size

	ES(q)- λ	ES(d)- τ_1	ES- τ_2	ES- τ_3	ES- τ_4	ES(h)- Θ
Item 1	0.039	-0.135	-0.063	-0.064	-0.006	0.193
Item 2	-0.034	-0.063	-0.009	-0.04	-0.035	-0.141
Item 3	-0.024	0.046	0.025	0.023	-0.187	-0.142
Item 4	-0.027	0.026	0.026	-0.032	-0.154	-0.159
Item 5	0.002	-0.038	-0.009	0.032	-0.063	0.016
Item 6	-0.028	-0.086	-0.028	0.063	-0.099	-0.244
Item 7	-0.001	-0.05	-0.029	0.063	0.004	-0.01
Item 8	-0.004	-0.034	-0.045	0.1	0.012	-0.028
Item 9	-0.015	-0.063	-0.025	-0.011	-0.013	-0.11
Item 10	-0.045	-0.09	-0.06	0.054	-0.029	-0.333

Note. ES: Effect size; q : Cohen's q ; λ : factor loadings; d : Cohen's d ; τ : threshold; h : Cohen's h ; Θ : residuals.

Academic emotional exhaustion: Differences between men and women

Since strong invariance was met, differences between men and women were explored, and no differences were found both at the construct level (Dif = -0.034; $p = .711$) and scores ($t[451] = .290$; $p = .772$; $d = 0.03$).

Reliability

In order to achieve a more precise estimate of the α coefficient, the tau-equivalence was evaluated, and although evidence was not favorable both for men ($\Delta\chi^2 = 83.483$; $p < .001$) and for women ($\Delta\chi^2 = 167.713$; $p < .001$) (table 1), the α coefficients, whose magnitudes were high, are reported for descriptive purposes (table 2). On the other hand, reliability of the construct is excellent in both groups ($\omega > .95$; table 2), and there are no differences between coefficients ($\Delta\omega - \alpha < .06$).

Discussion

Emotional exhaustion has become more relevant in the context of the pandemic associated with COVID-19, especially due to its relationship with several difficulties that affect people in different areas of their life, negatively impacting mental health in general (Caballero et al., 2007; Gavilanes-Gavilanes & Moreta-Herrera, 2020; Lee et al., 2017; Schaufeli et al., 2002), so having an assessment tool with adequate psychometric properties is essential.

In this sense, findings show that the ECE presents adequate indicators of unidimensionality and reliability in Ecuadorian college students, which converges with studies carried out in other Iberoamerican countries (Dominguez-Lara, 2013; Dominguez-Lara et al., in press; Fontana, 2011; González-Ramírez & Landero-Hernández, 2007; Torres et al., 2016). In addition, the values of factor loadings, as well as the AVE, suggest good representativeness of the items concerning the evaluated construct.

However, the RMSEA presented high magnitudes, even above what is acceptable, which was also found in other psychometric studies of the ECE (González-Ramírez & Landero-Hernández, 2007), but there is evidence that this index tends to be high, regardless of the number of misspecifications, when factor loadings are high ($> .70$) (Savalei, 2012; Shi & Maydeu-Olivares, 2020). However, it is not problematic if the CFI is acceptable even in the presence of a high RMSEA (Lai & Green, 2016). For that reason, it can still be considered a good measurement model.

Regarding measurement invariance, favorable evidence was obtained at all levels of invariance, which allows a fair comparison between groups. However, unlike other studies in which women presented greater emotional exhaustion than men (Worly et al., 2017, 2019), no differences were found between the participants of this study. In this sense, and given the current health crisis, it is likely that emotional exhaustion has increased in men. This could be explained from resilience theory, wherein the face of real or potential difficulties, women approach the family environment in search of support, seek it in other people (Caldera et al., 2016), or display greater personal strength (Connor & Davidson, 2003), while men minimize support networks and present more risky behaviors, given that the social roles associated with men do not facilitate emotional expression and search for support (Peña, 2009). This would not be contradictory, since there are other studies where men present higher academic burnout than women (Bikar et al., 2018; Zahedbablaan et al., 2014).

The practical implications of the findings are diverse. First, it is possible to have a short scale easily applicable and with adequate psychometric evidence, and suitable for use in massive institutional evaluations without monetary restrictions, as well as for use in research work in the Ecuadorian context. Likewise, given that the ECE is invariant according to sex, it is possible to adequately develop a comparative evaluation or research processes,

thus reducing measurement errors that tend to occur due to the use of instruments that are not properly validated (Moreta-Herrera & Velástegui-Parra, 2020).

Regarding the limitations of this study, it is necessary to mention the potential affective interference as a result of the COVID-19 pandemic (grief, worries, etc.) which could have an impact on the analysis in the form of transitory error, so it is advisable to analyze the longitudinal invariance in future studies. Furthermore, although the sample size was sufficient for a reliable estimation of the psychometric parameters of ECE in Ecuadorian college students, always is necessary a replication study with a larger number of people would be interesting to consolidate the results (American Educational Research Association et al., 2014). On the other hand, from the population point of view, the work responds only to the segment of university students in Ecuador, so it is not possible to establish generalizable criteria of validity of the scale to other segments (children, adolescents, adults of non-formal education, others). And although the data give a guideline to consider the probable validity of the ECE in other groups, it is necessary to replicate these studies in the aforementioned groups (especially of invariance between levels of schooling). Thus, with the results obtained in the future, the scale would win in terms of global validity criteria in all educational segments. From a methodological point of view, the cut-off points for assessing invariance were based on simulation studies that use continuous and non-ordinal variables (Chen, 2007), but it is possible to use them, with caution, when the sample is large enough wide ($n > 150$) (Pendergast et al., 2017), although it is necessary to mention again that the findings were complemented with other criteria (analysis of misspecifications and effect size).

It would be advisable for future studies to prepare normative data to know the prevalence of the phenomenon (Seperak-Viera et al., 2021), since the academic context is not unfamiliar with different adverse factors that affect both mental health and academic performance, so its follow-up and monitoring are essential. Likewise, it is necessary to address other groups of college students, such as postgraduate students who are a group scarcely studied and present difficulties associated with their academic life (Barattucci et al., 2021).

Conclusion

It is concluded then that this first psychometric analysis of the Escala de Cansancio Emocional presents adequate psychometric properties, evidence of validity regarding its internal structure and reliability, as well as a sufficient degree of measurement invariance; therefore, is a suitable assessment tool to measure this construct in Ecuadorian college students.

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