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Validity and reliability of the Connor-Davidson Brief Resilience Scale (CD-RISC 10) in university students from Metropolitan Lima

Validez y confiabilidad de la Escala Breve de Resiliencia Connor-Davidson (CD-RISC 10) en estudiantes universitarios de Lima Metropolitana

Validade e confiabilidade da Escala Breve de Resiliência de Connor-Davidson (CD-RISC 10) em estudantes universitários da região metropolitana de Lima

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Abstract

The purpose of the research was to analyze the psychometric properties of the Connor-Davidson Brief Resilience Scale (CD-RISC 10). The sample consisted of 345 university students of both genders from a private university, aged between 18 and 50 years from Metropolitan Lima. The tools used were the Brief Scale of Resilience CD-RISC 10, the Perceived Stress Scale (PSS-10), and the General Self-efficacy Scale (GSE). Regarding the results, for the construct validity the factor analysis was carried out, which showed that the unifactorial model explains 47 % of the total accumulated variance, then the proposed model was corroborated through the confirmatory factor analysis, which yielded optimal values of goodness setting. Convergent validity was established with the variable's general self-efficacy ($r = .664$, $p = .000$) and divergent validity with perceived stress ($r = -.402$, $p = .000$). Reliability was established through the coefficients of Cronbach's Alpha ($\alpha = .827$) and McDonald's Omega ($\Omega = .827$). These results allow us to conclude that the tool presents evidence of validity as well as its scores are consistent.
Keywords: resilience; psychometric properties; factor analysis; validity; reliability

Resumen

La investigación tuvo como propósito analizar las propiedades psicométricas de la Escala Breve de Resiliencia Connor-Davidson (CD-RISC 10). La muestra constó de 345 universitarios de ambos sexos de una universidad privada, con edades comprendidas entre los 18 a 50 años provenientes de Lima Metropolitana (Perú). Los instrumentos utilizados fueron la escala breve de resiliencia CD-RISC 10, la Escala de Estrés Percibido (EEP-10) y la Escala de Autoeficacia General (EAG). Para analizar la validez de constructo se realizó un análisis factorial que demostró que el modelo unifactorial explica el 47 % la varianza total acumulada, posteriormente se pasó a corroborar el modelo propuesto a través del análisis factorial confirmatorio que arrojó valores óptimos de ajuste. Se estudió la validez convergente con las variables autoeficacia general ($r = .664$, $p = .000$) y una validez divergente con estrés percibido ($r = -.402$, $p = .000$). La confiabilidad se estableció a través de los coeficientes de alfa de Cronbach ($\alpha = .827$) y Omega de McDonald ($\Omega = .827$). Los

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resultados permiten concluir que el instrumento presenta evidencias de validez y que sus puntuaciones son consistentes.

Palabras clave: resiliencia; propiedades psicométricas; análisis factorial; validez; confiabilidad

Resumo

O objetivo da pesquisa foi analisar as propriedades psicométricas da Escala de Resiliência Breve de Connor-Davidson (CD-RISC 10). A amostra utilizada foi de 345 universitários de ambos os sexos de uma universidade privada, com idade entre 18 e 50 anos da região metropolitana de Lima. Os instrumentos utilizados foram a escala de resiliência curta CD-RISC 10, a Escala de Estresse Percebido (EEP-10) e a Escala de Autoeficácia Geral (EAG). Em relação aos resultados, foi realizada a análise fatorial, a qual mostrou que o modelo unifatorial explica 47 % da variância total acumulada, posteriormente o modelo proposto foi corroborado por meio da análise fatorial confirmatória, esta rendeu valores ótimos de ajuste de bondade. Foi estabelecida uma validade convergente com as variáveis autoeficácia geral ($r = 0,664$, $p = 0,000$) e uma validade divergente com estresse percebido ($r = -0,402$, $p = 0,000$). A confiabilidade foi estabelecida por meio dos coeficientes de Alfa de Cronbach ($\alpha = 0,827$) e Ômega de McDonald ($\Omega = 0,827$). Os resultados permitem concluir que o instrumento apresenta evidências de validade, e que seus escores são consistentes.

Palavras-chave: resiliência; propriedades psicométricas; análise fatorial; validade; confiabilidade

The human being along his life and as he develops, learns through experiences that help him to understand his environment and survive, however, this involves being exposed to situations that can be considered tragic and often unavoidable, such as grief or failure. These experiences can mark a person throughout his or her life, which is why it has been a matter of study to determine what makes some people capable of resisting and overcoming adversity and others, on the other hand, are deeply affected (Calderón, 2016).

According to the World Health Organization (WHO, 2020), we are living in a time of chaos and uncertainty due to the worldwide pandemic of COVID-19. This has forced people to adapt to an abnormal situation, affecting the daily life of everyone equally due to the protocols put in place to protect public health, through confinement and social restriction, generating panic and fear in the face of a situation that was not expected. This scenario requires certain psychological capacities that help to resist and overcome adverse situations, mitigating the psychological consequences to which many people are exposed.

Killgore et al. (2020) point out that some people are psychologically more resilient to adversity than others. They have identified that those who seek resources to cope with the confinement of the Covid-19 pandemic did an everyday physical activity, perceived more pleasant interaction with family and friends, slept better, and prayed frequently, therefore, resilience, as a protective psychological factor against the pandemic, is related to modifiable factors.

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Resilience is usually the term most used when referring to the ability to adapt adequately to unforeseen situations and recover from their stressful effects, considered an essential factor in psychological well-being (Fernández et al., 2015)**.**

Over the years, the number of studies related to resilience has gradually increased. At a worldwide level, the longitudinal study conducted by Werner and Smith in 1982 stands out. This study was conducted over 30 years with 698 children from Hawaii, who were exposed to different risk factors: perinatal aspects, inadequate parenting, absent or violent parents, or extreme poverty. The results showed that children who faced four or more risk situations developed behavioral and/or learning problems, and that as they grew older, some already had criminal records, early pregnancies, or mental health problems. However, one third of those children grew up well into adulthood (Muñoz-Silva, 2012).

Resilience is a factor that has been studied in different contexts and stages of human life. Focusing on a student environment, several studies reveal that a higher level of resilience counteracts symptoms of discomfort such as emotional exhaustion (Alsharif, 2020) or mood alterations such as depression (Thompson et al., 2016). This is confirmed in research with nursing and medical students where 63 % who scored at a high level of resilience also had superior academic performance. Also, it was the younger students who scored higher, and there was a significant gender difference, with females scoring higher. In general, these studies infer that it is a combination of factors such as acceptance of change, frustration tolerance and personal competency that influences the maintenance of academic resilience (Álvarez & Cáceres, 2010; Rivas, 2012).

Uriarte (2005) points out that resilience implies the ability to adapt both personally and socially, even in an unfavorable environment, representing the psychological adjustment to overcome adverse circumstances, to take control of one's life and to see the future with optimism. This aspect reflects that it is constituted as a protective mechanism, depending on individual, family and sociocultural aspects.

On the other hand, several studies have related resilience to other variables that can directly influence its development. A positive correlation has been evidenced with self-efficacy (Bandura, 1999), with sense of life (Smedema & Franco, 2018), with self-esteem and with psychological well-being (Morales & González, 2014); as well as negative correlations with perceived stress (León et al., 2019), depression and anxiety (Oliva, 2015).

There has been great interest in developing or adapting instruments that measure resilience in different contexts and age groups. Ahern et al. (2006) and Windle et al. (2011) reviewed the most relevant instruments, such as the Resilience Scale (ER) by Wagnild and Young (1993); the Baruth Protective Factors Inventory (BPFI) proposed by Baruth and Caroll (2002); the Resilience Scale for Adults (RSA) by Friborg et al. (2003); and the Adolescent Resilience Scale (ARS) by Oshio et al. (2003). On the other hand, efforts have also been made in Peru to construct resilience scales, as proposed by Saavedra and Villalta (2008) as well as Prado-Álvarez y Águila-Chávez (2003).

One of the most widely used instruments is the CD-RISC developed in the United States by Connor and Davidson (2003), which consisted of 5 dimensions grouped together. However, several versions have emerged over the years, one of the most commonly used is the shortened 10-item version, with a unidimensional structure, which showed better evidence of validity compared to its original scale (Campbell & Stein, 2007).

Connor and Davidson (2003) constructed the CD-RISC from the work done by Kobasa (1979), which focuses on the integration of three features that contribute to the construction of a resilient personality. The firs one is challenge, as the ability to visualize

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difficulties as an opportunity to gain experience and learn from the solutions attempted. The next one is commitment, linked to the ability to get involved in situations of their daily, work or social life that may be considered unforeseen or stressful, with adequate self-confidence. And finally, control, which refers to the ability to maintain composure in difficult circumstances, managing to adapt to it and overcome it.

The CD-RISC-10 has been studied psychometrically in various contexts. In Colombia, it has been analyzed in university students (Riveros et al., 2017), workers (Soler et al., 2016), as well as in unemployed people (Fernández et al., 2018). In Nigeria, Aloba et al. (2016) studied it in university nursing students; in Spain, Notario-Pacheco et al. (2011; 2014) worked with university students and patients with fibromyalgia; and in Peru, Cueva (2019) evaluated the psychometric aspects in high school students in a sample of 902 adolescents aged 12 to 17 years, of both genders, with a Cronbach's alpha coefficient of .85 and a unidimensional factorial structure.

The objective of this research is to determine the validity and reliability of the CD-RISC 10 Brief Resilience Scale in university students in Metropolitan Lima, as well as to perform a descriptive analysis of the items, analyze the evidence of validity based on the internal structure, evidence of criterion validity with the variables self-efficacy and perceived stress, and evaluate the reliability by internal consistency.

Method

Sample

A sample of 345 students of both genders was invited to this instrumental study: 131 males and 214 females, ranging in age from 18 to 50 years ($M = 26.7$; $SD = 6.12$).

The sample size was considered appropriate because of the consideration made by Catena et al. (2003), who believe that sample sizes below 200 are insufficient to adequately evaluate a model, due to the instability of the parameters, the rule being eight times more individuals than variables or 15 cases per shallow variable.

Instruments

Connor-Davidson Brief Resilience Scale (CD-RISC 10). It was originally designed by Connor and Davidson (2003) and was adapted to the brief version by Campbell and Stein (2007), with the purpose of measuring resilience through 10 items which are scored by means of a 5-point Likert-type scale (4: *always*, 3: *almost always*, 2: *sometimes*, 1: *rarely* and 0: *never*). Regarding psychometric properties, the test has unidimensional internal structure validity (CFI = .97, RMSEA = .05, SRMR = .03) and adequate internal consistency reliability ($\alpha = .85$). The Spanish version adapted by Notario-Pacheco et al. (2011) was used for this study.

General Self-Efficacy Scale (GSES). Created by Jerusalem and Schwarzer (1992) with the purpose of determining one's ability to find solutions and adequately resolve adversities that may arise at any time in life. Adapted to Spanish by Brenlla et al. (2010) with 10 items, with a Likert-type response scale, directed mainly towards adolescents and adults. $\alpha = .76$ and $\Omega = .78$ reliability was reported. The construct validity showed a unidimensional structure, with adequate fit values (X2/gl = 2, TLI = .94, GFI = .97, CFI = .95, SRMR = .03, RMSEA = .04, AIC = 138).

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Perceived Stress Scale (PSS). Created by Kamarck and Mermelstein (1983) to evaluate the intensity of stress that can be experienced in various daily circumstances. Remor (2006) worked on the abbreviated version of 10 items grouped into a single factor. The test has internal structure validity, evidenced by the goodness-of-fit values for a unidimensional structure (X2/gl = 6, GFI = .94, TLI = .87, CFI = .90, SRMR = .05, RMSEA = .07, AIC = 257.83), on the other hand, the Cronbach's Alpha d coefficient indicated a value of .79 which indicates that the scores are consistent.

Procedure

The information was collected through a virtual form, which included informed consent. The form was filled out anonymously and voluntarily. The present research was conducted following the principles of the code of ethics of the Peruvian College of Psychologists.

Data design and analysis

We conducted an instrumental study (Ato et al., 2013).

With the responses obtained by the participants, an Excel spreadsheet was prepared, and the database was created in the SPSS v.25 program for the descriptive evaluation of the data. The factor analysis and internal consistency analysis were carried out with the programs FACTOR (10.10), JASP (0.13), Stata (16), RStudio and G Power (3.1) to evaluate the effect size of the correlation.

The item analysis considered the criteria of response percentage, skewness and kurtosis coefficients, the corrected homogeneity index, and the discrimination index by the extreme group method. This analysis was complemented with aspects of item communality and factor weights. To corroborate the construct validity and the unidimensional model of the CD-RISC-10, confirmatory factor analysis (CFA) was performed using the RStudio program with the robust weighted least square mean and variance adjusted variance weighted estimator (WLSMV). The following fit indices were analyzed: chi-square over degrees of freedom (X2/gl); root mean squared residual approximation (RMSEA); root mean squared residual (SRMR); comparative fit index (CFI); non-normed fit index (TLI). Also, with said program and the CMC package, the Cronbach-Mesbah curve was performed to corroborate the one-dimensionality (Cameletti & Caviezel, 2012).

On the other hand, reliability was examined through the internal consistency method, using Cronbach's Alpha and McDonald's Omega coefficients using JASP version 0.10. Pearson correlations between the CD-RISC, EAG and EPP were performed using the Jamovi program.

Results

Item analysis of the Brief Resilience Scale CD-RISC 10

The descriptive analysis of the items indicated that none of the alternatives exceeds 80 % of the response frequency (RF). On the other hand, the asymmetry measurement units (g1) presented scores between -1.0 to -0.4 and -0.6 to 1.0 in the kurtosis (g2) values that do not exceed +/-1.5, therefore they are within the adequate margins. It can also be noted that the item-test correlation (IHC) values vary between .40 and .63, which when higher than .30 would indicate an adequate relationship of each of the items with the test as a whole; in the

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same way, the communalities (h2) have factor weights with values between 0.41 and 0.58, exceeding the .40 expected to be considered acceptable. Finally, all the items of the instrument have a good discriminative capacity (id) since they are all less than .005 and are therefore considered adequate (Nunnally & Bernstein, 1995).

Table 1

Descriptive analysis of the CD-RISC 10 Scale items

Items	RF					M	SD	g^1	g^2	HCI	h^2	di	Aceptable
	0	1	2	3	4								
Item 1	0.3	0.9	11.9	42.3	44.6	3.30	0.733	-0.9	0.7	0.53	0.49	0.00	Yes
Item 2	0	1.2	17.1	46.7	35.1	3.16	0.738	-0.4	-0.5	0.59	0.51	0.00	Yes
Item 3	0	3.5	21.4	39.1	35.9	3.08	0.842	-0.5	-0.6	0.50	0.45	0.00	Yes
Item 4	0	1.2	15.1	31.0	52.8	3.35	0.775	-0.9	-0.3	0.48	0.43	0.00	Yes
Item 5	0	3.2	17.4	44.6	34.8	3.11	0.799	-0.6	-0.2	0.44	0.41	0.00	Yes
Item 6	0	1.4	12.5	40.0	46.1	3.31	0.742	-0.8	0.0	0.63	0.58	0.00	Yes
Item 7	0.9	5.5	31.9	40.0	21.7	2.76	0.883	-0.3	-0.3	0.42	0.55	0.00	Yes
Item 8	2.6	11.0	25.8	34.2	26.4	2.71	1.056	-0.5	-0.4	0.40	0.58	0.00	Yes
Item 9	0.6	2.0	13.3	36.8	47.2	3.28	0.814	-1.0	1.0	0.62	0.57	0.00	Yes
Item 10	0.3	3.5	23.2	41.2	31.9	3.01	0.847	-0.5	-0.4	0.60	0.51	0.00	Yes

Note. RF: response frequency; M: mean; SD: standard deviation; g1: skewness coefficient; g2: kurtosis coefficient; HCI: homogeneity index; h2: communalities; DI: discrimination index.

Construct validity

Exploratory factor analyses were performed, and they showed that there is an adequate interrelation between the items (KMO = 0.89; Bartlett = 1344.8; *p* < .000). The variance percentage explained and the eigenvalues greater than one point to a unidimensional structure, which represents 47 % of the total accumulated variance. As can be seen in Table 2, all items have factor loadings greater than .30. In general, factor loadings are considered significant if they exceed .32 (Comrey & Lee, 1992; Tabachnick & Fidell, 2012).

Table 2

Factor matrix and communalities of the CD-RISC 10 scale items (N = 345)

Items	Description	Factorial Load	Communalities
1.	I can adapt when changes occur.	0.676	0.500
2.	I can deal with anything.	0.723	0.531
3.	I try to see the funny side of things when I am faced with problems.	0.609	0.503
4.	Facing difficulties can make me stronger.	0.610	0.395
5.	I tend to recover quickly after illness, injury or other hardships.	0.553	0.315
6.	I believe I can achieve my goals, even if there are obstacles.	0.775	0.615
7.	Under pressure I focus and think clearly.	0.493	0.277
8.	I am not easily discouraged by failure.	0.498	0.295
9.	I believe that I am a strong person when faced with life's challenges and difficulties.	0.787	0.648
10.	I am able to handle unpleasant and painful feelings such as sadness, fear and anger.	0.715	0.558
	Percentage of variance explained	47.52 %	

To validate the obtained model, a CFA was performed (Figure 1) for a polychoric matrix. Table 3 shows the absolute fit indexes through the Chi-Square (X2/gl) with a value ($\leq$ 3), which is considered acceptable, and the RMSEA which, being less than .08, is considered an adequate measure of fit. On the other hand, the SRMR is below .050 and is therefore considered an acceptable fit. Continuing with the comparative fit indices, both the CFI and the TLI have values ranging from .915 to .934 located above .90 so they are considered adequate (Lara, 2014).

Figure 1

*Confirmatory factor analysis with the 10 items of CD-RISC 10*

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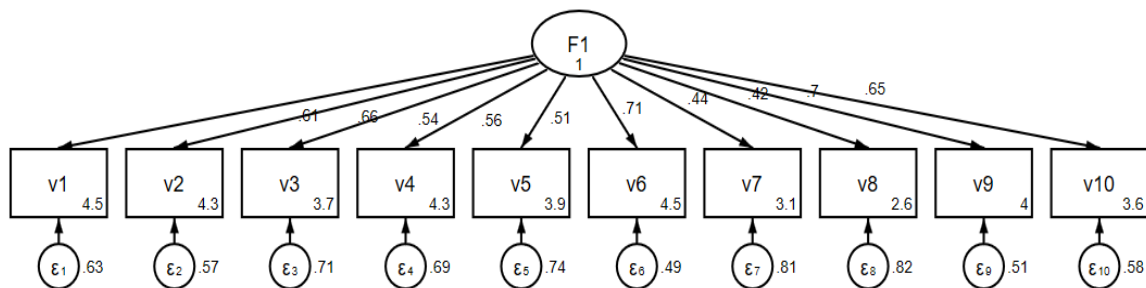
Table 3
CD-RISC 10 scale goodness of fit measures

Adjustment indexes	Model	Optimum rates
Absolute adjustment		
X^2/gl	2.438 (Acceptable)	≤ 3.00
RMSEA	.070 (Acceptable)	<0.08
RMR	.047 (Acceptable)	<0.05
Comparative adjustment		
CFI	.915 (Acceptable)	>0.90
TLI	.934 (Acceptable)	>0.90

Note. X2/gl: Chi-square; RMSEA: root mean square error of approximation; RMR: root mean square error; CFI: comparative fit index; TLI: non-standardized fit index.

To corroborate the one-dimensionality of the set of CD-RISC 10 items, the Cronbach-Mesbah curve was plotted to obtain a visual evaluation, which convergently supported the hypothesized unidimensional factorial solution, indicating consistency of the items as the curve is monotonic, in the sense that they are all measuring the same attribute (Figure 2).

Figure 2
Cronbach-Mesbah curve with the 10 items of CD-RISC 10
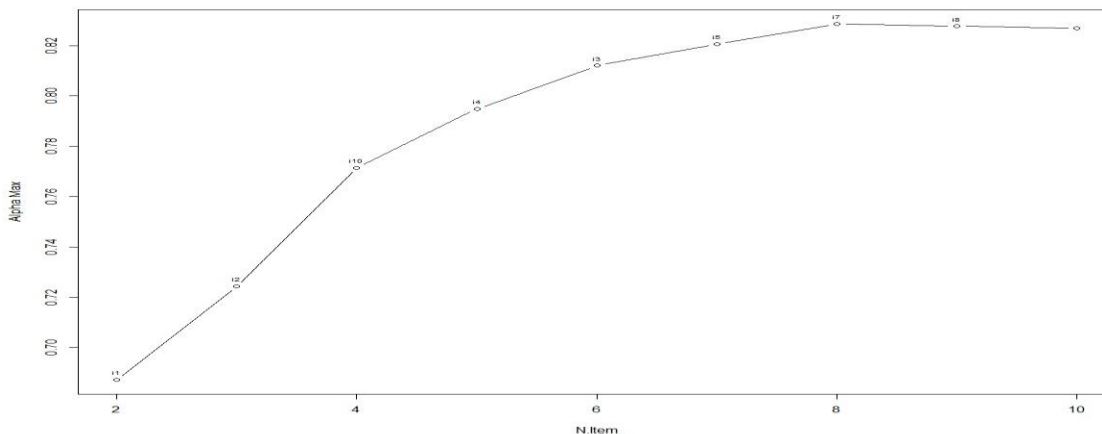
Criterion-referenced validity of the CD-RISC 10 brief resilience scale

Through Spearman's Rho test, the correlation with the self-efficacy construct was performed, which obtained a coefficient of $r = .664$; $p = .000$, which implies a moderate positive correlation, and would represent convergent validity, with a large effect size ($d = 0.81$). On the other hand, divergent validity was obtained through the variable perceived stress, which obtained a value of $r = -.402$ ($p = .00$) being a moderate negative correlation and a large effect size ($d = 0.64$).

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Internal consistency of the CD-RISC 10 brief resilience scale

Regarding the reliability analysis of the instrument, the internal consistency established a Cronbach's Alpha and McDonald's Omega coefficient of .82 (Table 7), with a coefficient of .70 or higher being considered acceptable (George & Mallery, 2003), which is why the CD-RISC 10 scores are consistent.

Table 4

Reliability coefficients and confidence intervals of the CD-RISC 10 Scale

Estimation	Ω	α
Estimation point	.827	.827
95% CI lower limit	.800	.798
95% CI upper limit	.855	.853

Regarding the item's homogeneity, Table 5 records that the corrected item-total correlations are adequate (from .40 to .63) which implies that all the items contribute to measure the construct, as pointed out by Abad et al. (2015), it means the degree to which the item contributes to measure the same as the test measures.

Table 5

Item-test correlation of the CD-RISC 10 scale

Items	*M*	*SD*	Item-test correlation	α	Ω
Item 1	3.30	0.733	.534	.810	.820
Item 2	3.16	0.738	.594	.804	.815
Item 3	3.08	0.842	.499	.813	.825
Item 4	3.35	0.775	.479	.814	.825
Item 5	3.11	0.799	.438	.818	.829
Item 6	3.31	0.742	.632	.800	.810
Item 7	2.76	0.883	.419	.821	.832
Item 8	2.71	1.056	.402	.828	.833
Item 9	3.28	0.814	.618	.800	.811
Item 10	3.01	0.847	.598	.802	.815

Discussion

The objective of this research was to determine the validity and reliability of the Brief Resilience Scale CD-RISC 10 Spanish adaptation in university students in Metropolitan Lima. Resilience was chosen as a study variable due to its great importance in maintaining good mental health, being a subject of study by many professionals in the clinical field. This work shows the need for an instrument to evaluate the resilience of a person according to the Peruvian context.

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Regarding the internal structure, the results of the factor analysis show that the CD-RISC 10 scale responds to a unidimensional model which explains 47 % of the total accumulated variance, which coincides with the results obtained in Lima in high school students (Cueva, 2019), as well as with Campbell and Stein (2007), in Spain, Notario-Pacheco et al. (2011), in Colombia, Soler et al. (2016); Riveros et al. (2017) who validate the same unidimensional model. This one-dimensionality implies that the instrument registers in the responses of its items a set of psychological processes involved in resilience in a single latent factor and that to the same extent, they can be affected based on the same responses given as all the items are strongly related to each other and therefore to the test as a whole (Burga, 2006).

On the other hand, to analyze the criterion validity, variables related to or having a direct influence on the development of resilience were considered, such as self-efficacy, since overcoming unforeseen and adverse situations implies exercising a certain degree of self-control in oneself and involvement in the search for effective solutions (Bandura, 1999). Likewise, the negative correlation with perceived stress would indicate that the greater the resilience capacity, the better the stress management (León et al, 2019). The significant relationship between the scores of these constructs is demonstrated in the studies conducted by Cueva (2019) in both criteria and Fernández et al. (2018) in the perceived stress variable; these results confirm that resilience correlates positively with self-efficacy and negatively with perceived stress, which reaffirms what was previously stated, also following the expected direction.

Reliability was analyzed through the internal consistency method by Cronbach's Alpha coefficient ($\alpha = .827$) and McDonald's Omega coefficient ($\Omega = .827$), with results like the Peruvian adaptation by Cueva (2019). While in studies of the Spanish version by Notario-Pacheco et al. (2011) and the Colombian adaptation by Fernández et al. (2018), obtained scores above .80, in addition to being slightly higher than the work of Aloba et al. (2019) in Southeastern Nigeria. These values indicate that the items that comprise the instrument have adequate discriminative capacity, allowing for the effective measurement of resilience.

Finally, it is important to add the scope of this work, which can be synthesized in three aspects, the first being the reaffirmation of the instrument as a scale capable of making an optimal assessment of the psychological construct for which it was designed. Following the same line is the second aspect, which is the contribution to the research field as an updated reference in a context rarely evaluated, such as a pandemic and its respective emotional repercussions. The third contribution refers to the most practical aspect, and its usefulness in a Peruvian university population to be used as a screening instrument easily usable in the educational field for the detection of the level of resilience of students, given the relevance that this has on academic performance (Cleary et al., 2018).

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