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Psychometric validation of a reformulated version of the Thirteen-item Sense of Coherence Scale (SOC-13) in a Mexican student population

Validación psicométrica de una versión reformulada de la escala de sentido de coherencia de trece ítems (SOC-13) en una población estudiantil mexicana

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Abstract

The main objective of this research is to obtain validity and reliability evidence that supports the use of a reformulated version of the 13-item Sense of Coherence Scale (SOC-13). To achieve this objective, an instrumental study was carried out by applying a reformulated version of the 13-item sense of coherence scale to 250 higher education students from the city of Durango, Mexico. Confirmatory factor analysis led to the elimination of six items from the original scale and the validation of a seven-item version that showed a good fit to the three-factor model ($x2 = 12.72$; $x2/df = 1.1$; $p = 0.31194$; RMSEA = 0.025); likewise, it reports a reliability in Cronbach's alpha of 0.77 and of 0.79 in the reliability by halves for an unequal length according to the Spearman-Brown formula. These results show that the seven-item version is a good option to measure the sense of coherence in the Mexican population.

Key words: stress, control, manageability, understandability, significance.

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Resumen

La presente investigación tiene como objetivo central obtener evidencias de validez y confiabilidad que respalden el uso de una versión reformulada de la escala de sentido de coherencia de 13 ítems (SOC-13). Para el logro de este objetivo se llevó a cabo un estudio instrumental mediante la aplicación de una versión reformulada de la escala de sentido de coherencia de 13 ítems a 250 alumnos de educación superior de la ciudad de Durango, México. El análisis factorial confirmatorio condujo a eliminar seis ítems de la escala original y someter a validación una versión de siete ítems que mostró un buen ajuste al modelo de tres factores ($x2 = 12,72$; $x2/df = 1,1$; $p = 0,31194$; RMSEA = 0,025); además, reporta una confiabilidad en alfa de Cronbach de 0,77 y de 0,79 en la confiabilidad por mitades para una longitud desigual según la fórmula de Spearman-Brown. Estos resultados muestran que la versión de siete ítems es una buena opción para medir el sentido de coherencia en la población mexicana.

Palabras clave: estrés, control, manejabilidad, comprensibilidad, significatividad.

Introduction

Stress is an omnipresent fact in today's society. The dizzying and overwhelming advance of information and communication technologies, the gradual and persistent deterioration of the social structure, the emergence of new forms of socialization, new working conditions and high levels of self-demand, internalized by the new generations, make stress a permanent companion of the human being.

In the different sectors of the population in which this phenomenon has been studied, it has been associated with physical diseases (León & Fornes, 2015; Navinés et al., 2016; Zavala, Verdejo & Díaz-Loving, 2015) or mental (López-Trejo et al., 2018; Vargas, del Castillo & Guzmán, 2016; Urzúa, Heredia & Caqueo-Urízar, 2016); in line with this second type of variables, it is necessary to remember that the World Health Organization considers that one of the central components to strengthen mental health is the ability to deal with the stress of daily life.

This omnipresence of stress, and its widely documented effects, make it particularly important to study variables that help reduce its presence or mitigate its effects. One approach that offers

wide possibilities to better understand and deal with stress is salutogenic, which considers health and illness as two extremes of a continuum and focuses on explaining how a person can move towards the healthy end of that continuum (Antonovsky, 1979, 1987).

This approach presents two central analytical axes: the sense of coherence (SOC) and the general resources of resistance (GRR); both offer a consistent theoretical framework that allows health promotion through proper stress management (Naaldenberg et al., 2011). In the case of this research, attention is focused on the sense of coherence since its main function is to face stressful events directly, preventing the initial tension or pressure from turning into stress (Antonovski, 1987); this construct consists of three components: understandability, manageability, and significance (Antonovsky, 1979, 1987).

Understandability is the component that allows you to understand the way people see the world. The greater the presence of this component, people tend to see reality, both internal and external, as structured, predictable and explicable, which allows them to mobilize the relevant and necessary resources to adequately face the requirements or demands of the environment.

Manageability is the component that refers to the understanding of demand, specifically, and the availability of the necessary resources to face it in a correct way. The greater the presence of this component, people understand in a better way the specific demands that are posed to them and consider that they have the necessary resources to face them successfully.

Significance is the component that indicates that for the person facing or managing that demand or environmental problem makes sense. The greater the presence of this component, the requirements or demands of the environment are considered by people as challenges to which it is worth investing time and effort to solve them.

In short, and in the words of Antonovski (1987), the sense of coherence can be considered as "a generalized emotional-cognitive perception, by an individual, of the stimuli that bombard him, since they are, to a greater or lesser extent, controlled by him. Stimuli are considered understandable, manageable, and meaningful; as information rather than as concern" (p. 155).

To measure the sense of coherence, the Sense of Coherence Scale (SOC) was formulated, with the understanding that this construct should not be considered a way of coping or a personality trait, but rather an orientation to life, which is why some tend to also refer to it as the Life Orientation Questionnaire (Alonso-Castillo et al., 2018; Salazar-Estrada, 2018).

Initially, this questionnaire, designed based on Guttman's facet theory, consisted of 29 items in three subscales: understandability, manageability and significance (SOC-29). Subsequently, it underwent various modifications in relation to the number of items and the type of response,

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as well as the substitution of some questions, giving rise to a shorter version of 13 items (SOC-13) and even another of three items (SOC-3).

These different versions, along with others, have been used and validated in multiple studies (Drageset & Haugan, 2015; Getnet & Alem, 2019; Lerdal et al., 2014, 2017; Naaldenberg et al., 2011; Olsson, Gassne & Hansson, 2009; Rajesh et al., 2015; Sardu et al., 2012; Stern et al., 2019); in fact, since 1993, Antonovski already reported the application of this instrument in various studies carried out in 20 countries to determine its viability, reliability and validity. For their part, Lizarbe-Chocarro et al., in 2016, reported that there were at least 15 different versions of this scale, which had been translated into 33 languages and had been used in less 33 countries.

Of the different existing versions, the attention of this research is focused on the version of 13 items (SOC 13) validated in Spanish. In this regard, it can be observed that the main studies in this regard have been carried out in Spain (Lizarbe-Chocarro et al., 2016; Malagón et al., 2012; Vega, Frías & Del Pino, 2018; Virués-Ortega et al., 2007), except for one case from Peru (Saravia, Iberico & Yearwood, 2014) and another from Mexico (Velázquez et al., 2014).

In these validation processes, Cronbach's alpha ranged between 0.81 (Lizarbe-Chocarro et al., 2016) and 0.79 (Velázquez et al., 2014), with the rest of the studies reporting a Cronbach's alpha value of 0.80 (Saravia et al., 2014; Vega et al., 2018).

Regarding the factorial structure, most of the studies confirm the structure of three factors (Lizarbe-Chocarro et al., 2016; Malagón et al., 2012; Saravia et al., 2014; Vega et al., 2018) although others maintain a bifactorial structure (Velázquez et al., 2014). It is worth highlighting the case of Lizarbe-Chocarro et al. (2016) that despite maintaining a structure of three factors, they affirm that these do not correspond to the author's originals.

In the case of Mexico, Velázquez et al. (2014) reached a bifactorial structure, although for this they had to eliminate five items by presenting an 8-item version of this scale. Likewise, these authors recognize problems in the understanding of the items by the people surveyed, so they recommend taking care of the wording of the items and the clarity in the answer options.

Given this panorama, which continues to present inconclusive and diverse indicators related to the evidence of validity of this scale, it was considered convenient to reformulate the scale and develop the validation process of this version of the scale in the Mexican population.

Materials and Methods

Participants

This study, of an instrumental nature, was carried out with a sample of 250 higher education students from the city of Durango, Mexico. This sample was non-probabilistic, intentional and determined by accessibility to the respondents. The inclusion criteria were being a student at that institution, having attended classes on the day the questionnaires were applied, and having the appropriate motor and sensory skills to answer them.

The distribution of the surveyed students, according to the five sociodemographic variables investigated in the personal data section, are presented in table 1. As can be seen, there is a preponderance of women, of students with an age of 18 to 33 years, who study the undergraduate level and the fifth semester.

Table 1. Characterization of the simple

Variable	N	%
Sex		
Man	52	20.8
Woman	198	79.2
Age		
18 to 33 years old	236	94.4
33 to 48 years old	11	4.4
48 to 63 years old	3	1.2
Institution		
School of Medicine and Nutrition	98	39.2
Universidad Pedagógica de Durango	78	31.2
Benemérita y Centenaria Escuela Normal del Estado de Durango	56	22.4
Others	18	7.2
Level of studies		
Bachelor	239	95.6
Master	11	4.4

Variable	N	%
Semester		
Zero	1	.4
First	27	10.8
Second	14	5.6
Third	50	20
Fourth	27	10.8
Fifth	101	40.4
Sixth	1	.4
Seventh	27	10.8
Eighth	2	.8

Source: author own elaboration.

To collect the information, a questionnaire made up of two sections was used: in section one, personal data was investigated as sex, age, educational institution, educational level and semester being attended; and section two consisted of a reformulation of the 13-item version of the sense of coherence scale (Antonovsky, 1993).

The sense of coherence scale, in its original version of 13 items (SOC-13), is answered by means of a semantic differential with a scaling of seven values; this scale was translated into Spanish and submitted to validation by Virués-Ortega et al. (2007), presenting a reliability in Cronbach's alpha of 0.80 and a 4-factor solution that reported 65 % of the explained variance; however, the authors finally opted for a bifactorial solution that explained 41 % of the total variance.

In its application to the Mexican population (Velázquez et al., 2014), a reliability level of 0.79 was obtained in Cronbach's alpha and a bifactorial solution, although for this five items were eliminated so that in fact it would be a different version of 8 items. However, it is necessary to remember that in this application the authors recognized that there were problems in understanding the items, so they recommended taking care of their wording and clarity in the response options.

Given this recommendation, it was decided to reformulate the scale based on three changes: substitution of the semantic differential, inversion of the items written in the negative sense, and substitution of item 5.

In the first place, the semantic differential was replaced by a Likert-type scaling of five values, adjusting the wording of the items to the new scaling; this change in the scaling has already been made by other authors (Getnet & Alem, 2019; Vega et al., 2018). Here is an example of this change:

Original version: Item 4. So far your life...

Has had no clear objectives or goals at all						Has had very clear objectives and goals
1	2	3	4	5	6	7

Reformulated version:

Item	**N (0)**	**CN (1)**	**AV (2)**	**CS (3)**	**S (4)**
4. Until now my life has had clear objectives and goals					

Secondly, the items written in a negative sense were replaced by their opposite, so that all items were in a positive sense, e.g.:

Original version: Item 1. Do you have the impression that you do not really care about the things that happen around you?

Rarely or never						Very often
1	2	3	4	5	6	7

Reformulated version:

Item	**N (0)**	**CN (1)**	**AV (2)**	**CS (3)**	**S (4)**
1. I really care about the things that happen around me					

At this point it is worth remembering that the investment or establishment of negative items on a scale to overcome the phenomenon of acquiescence has been considered an inappropriate procedure (Tomás et al., 2012), despite its popularization. Therefore, in this case, it is decided to resume the tendency to show all the items in a positive sense and with a single directionality,

although it is recognized and accepted "the need to look for measurement alternatives that do not produce acquiescence without inverting items, or reducing these" (Tomás et al., 2012, p. 113).

Thirdly, item 5 was eliminated because it was considered that it did not correctly reflect the content of the dimension (manageability) and one that responded better to said dimension was added.

Item removed: Item 5. Do you have the impression that you are being treated unfairly?

Very often						Rarely or never
1	2	3	4	5	6	7

Added item:

Item	**N**	**CN**	**AV**	**CS**	**S**
5. I have at my disposal various supports to face life					

These changes are not arbitrary, nor is it the first time they have been made, the main precedent is the work carried out with SOC 29, which was modified in relation to the number of items, type of response of the scale and the substitution of some items, which that gave rise to SOC-13 (Rodríguez, Couto & Díaz, 2015).

This new version of the scale was piloted with fifteen students (five middle school students, five undergraduate students, and five graduate students) to verify vocabulary understanding and clarity in writing the items. In said piloting no problem was detected.

In the case of item five, a consultation was made with five experts in research methodology and with a doctorate degree in various areas of the social sciences; each of them was sent the definition of the dimension and the two items (the original and the reformulated) and they were asked to answer whether or not they corresponded to the dimension. All five agreed that the new one was part of the dimension and the original was not.

Once the final version of the scale was obtained, it was applied to a non-probabilistic sample of higher education students. Their selection was due to their accessibility based on contacts in the various institutions. Regardless of the number of students to be surveyed in each institution, it was proceeded to speak with the directors to explain the objective of the investigation and assure them that there was no risk for the students surveyed.

Upon having the authorization of the institutional directors, the internal contacts of the institution itself proceeded to apply it, explaining to the students the voluntary nature of their response.

In none of the cases was there a need to explain anything else since all decided to participate without requesting any extra explanation.

The application in the School of Medicine and Nutrition of Universidad Juárez del Estado de Durango, Universidad Pedagógica de Durango and the Benemérita y Centenaria Escuela Normal del Estado de Durango was given in the very classrooms where the students attend classes: while the Students identified with the category of another institution responded to the questionnaire in the cubicle of the institutional contact.

Once the questionnaire was applied, the database was built in the SPSS version 23 program. There was no need to impute the lost data since in no case did it exceed 5 % (Littlewood & Bernal, 2014); the item with the highest number of missing data was number four with 1.2 %.

This database was imported into the LISREL 8.80 Student program and the Confirmatory Factor Analysis was performed; as adequate results were not obtained, various items were eliminated one by one at the suggestion of the same program to reduce the chi square and the covariation error. After carrying out six analyzes, a final version of seven items was reached that showed a good fit of the data to the three-factor model, which were congruent with those reported in the original scale.

Based on seven items, the following analyzes were carried out in the SPSS program, version 23: (i) the three dimensions reported by this analysis were subjected to a correlational analysis using Pearson's *r* statistic; (ii) descriptive data were obtained of each item from the mean and standard deviation; (iii) the reliability of the scale was obtained from Cronbach's alpha procedures and reliability by halves, according to the Spearman-Brown formula, likewise, the level reliability of the scale in the event of eliminating an item through Cronbach's alpha; (iv) the internal consistency analysis was performed through Pearson's *r*.

The project that generated this research was approved by the Research Committee of the author's institution of assignment, in accordance with the protection of the rights and guarantees of the research participants, according to section 8.01 of the ethical principles of the American Psychological Association.

In this project the following provisions were taken into account: the questionnaire was anonymous and when it was presented, the confidentiality of the results was assured; in the personal data section, information was only requested regarding the sociodemographic variables that were of interest to characterize the sample and no other type of information was requested that could compromise their anonymity; in the presentation of the questionnaire it could be clearly read that its completion was voluntary and therefore they were completely free to answer it, or not to do so.

On the other hand, and according to article 17, section I, of the Regulation of the General Health Law on Health Research of Mexico, it is considered that this research can be characterized as a risk-free research, since in the collection of the information only questionnaires were used that did not affect or intentionally generate changes in the psychological and/or social variables of the participants.

Results

First, the Confirmatory Factor Analysis was carried out with the 13 items of the scale. As can be seen in table 2, there was not a good fit of the data to the model. Based on this, and taking as a basis the recommendations of the program to reduce the chi square and the covariation error, new analyzes were run eliminating items one by one until reaching six in the following order: 13, 11, 4, 5, 2 and 1. With the seven-item version, a good fit of the data was achieved (Table 2); to these values is added the value of the relationship of the chi-square on the degrees of freedom (x2/df), which in the initial version would be 2.52, while for the final version it would be 1.1, so the value of the final version represents a good fit of the model.

Table 2. Values obtained in the Confirmatory Factor Analysis in the two versions (initial and final) of the Reformulated Scale of the Sense of Coherence

Scale version	x2	df	p-value	RMSEA	Confidence Interval for RMSEA	p-value for test of close Fit
Initial release of 13 items	156.79	62	0.00000	0.078	0.063-0.094	(RMSEA <0.05) = 0.0015
Final version of 7 items	12.72	11	0.31194	0.025	0.0-0.073	(RMSEA <0.05) = 0.75

Source: author own elaboration.

The correlation coefficients between dimensions report the following values: *r* 0.342 p<0.001 for the relation between the comprehensibility and manageability dimensions; *r* 0.411 p<0.001 for the relation between the manageability and significance dimensions; and *r* 0.539 p<0.001 for the relation between the significance and understandability dimensions. These values are within the proposed range of usable values so that the analysis by dimensions is conducive when using this questionnaire.

Once this second version was obtained, it was proceeded to carry out the following analyzes, already planned, starting with descriptive statistics. As can be seen in table 3, the items with the greatest presence are "The people I have supported me when it was necessary" and "On occasions I have felt lucky for the support received", both items belong to the manageability

dimension; for their part, the items with the least presence were "At this moment I know what to do in the different situations I am experiencing" and "Doing the things that I do every day gives me great joy and satisfaction." The general mean was 3.07, which, transformed into a percentage, through the simple rule of three, gives us a value of 76.7 %.

Table 3. Descriptive data of the items that make up the seven-item version of the reformulated sense of coherence scale

Items	Average	Standard deviation
soc3	**3.13**	**.861**
soc6	*2.87*	*.796*
soc7	*2.88*	*.774*
soc8	3.03	.764
soc9	3.05	.943
soc10	**3.45**	**.755**
soc12	3.10	.878

Note: the highest means are highlighted in bold and the lowest means in italics. The numbering present in the initial version is respected.

Source: author own elaboration.

The scale obtained a reliability in Cronbach's alpha of 0.77 and of 0.79 in the reliability by halves for an unequal length according to the Spearman-Brown formula. The analysis of the reliability of the scale, in case of eliminating an item, reported that only in the case of item 3 the reliability coefficient in Cronbach's alpha rises to 0.784, while in all the others it drops.

In the internal consistency analysis, each item was positively correlated ($p<0.001$) with the general mean of the scale; the lowest correlation coefficient was 0.529 (item 1) and the highest was 0.700 (item 8).

Discussion

The omnipresence of stress in daily life, and its adverse effects, make it a pressing need to search for theoretical schemes that allow people to be supported to cope with it in an appropriate way. However, before proposing lines of action, it is necessary to verify the strength of the theoretical approach that is intended to be taken as a reference for the intervention.

The strength of a theory has several edges, including the conceptualization of the variable, the internal congruence of its postulates, and the instrument used to collect the information. In this sense, it is particularly important to determine the psychometric properties of the instruments to be used, not only because of their immediate impact on the development of a research, but also because of the mediate impact on helping to consolidate a particular theory. That is why the development of instrumental studies becomes a central piece in the development of theories.

In the case of this research, which is the salutogenic approach, the analysis of the Sense of Coherence Scale is considered pertinent, which, in its different versions, has been subjected to multiple validation processes. In the case of the 13-item version, antecedent research reports problems in its factorial structure, whether it is investigated at the exploratory or confirmatory level (Getnet & Alem, 2019; Jakobsson, 2011; Naaldenberg et al., 2011; Velázquez et al., 2014; Virués-Ortega et al., 2007). In this sense, it was considered convenient to develop the present validation process, however, as there were problems with the understanding of the items and the clarity of the answers, in the Mexican population, it was decided to carry out a reformulation of the scale and submit to validation this version.

The confirmatory factor analysis led to a seven-item version that presented a good fit to the three-factor model ($x2 = 12.72$; $x2/df = 1.1$; $p = 0.31194$; RMSEA = 0.025); this factorial structure is in line with that reported by Lizarbe-Chocarro et al. (2016), Malagón et al. (2012), Saravia et al. (2014) and Vega et al. (2018) for the 13-item version.

A reliability level of 0.77 and 0.79 was obtained in Cronbach's alpha and in the reliability by halves, for an unequal length according to the Spearman-Brown formula, respectively. This level of reliability is considered acceptable, according to the scale of values proposed by George & Mallery (2003) and is similar to that reported by Velázquez et al. (2014), for their version of SOC 13 in the Mexican population, and those reported by Saravia et al. (2014) and Vega et al. (2018) for the original version of SOC 13 in the Spanish-speaking population.

Conclusions

The internal consistency analysis concludes that all the items correlate positively with the general mean of the scale, thus confirming the homogeneity of the items and their unique directionality, this in line with the decision to substitute the items in the same direction negative of the scale for its positive version. This result coincides with those reported by Vega et al. (2018) and Virués-Ortega et al. (2007) and, as in their cases, all the correlation coefficients are greater than 0.40 and 0.30, respectively.

Based on these results, it can be affirmed that the Sense of Coherence Scale of seven items, proposed in this article, has the appropriate psychometric properties to become a serious option

for measuring the sense of coherence in the Mexican population. Despite the consistency of these results, it is necessary to recognize the limitations of the present study, the main one being the focus on a single type of population: higher education students; in this sense, it is considered pertinent to continue studies in this regard with other types of populations and to carry out studies of concurrent and divergent validity with other variables of interest.

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