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Factorial composition of the Dimensional Self-Concept Questionnaire AUDIM-M in Mexican university students
Composición factorial del Cuestionario de Autoconcepto Dimensional AUDIM-M en universitarios mexicanos

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Resumen

Introducción: El presente estudio pretende indagar si se replican los resultados psicométricos propuestos por Revuelta, Rodríguez, Ruiz de Azúa y Ramos (2015) para el Cuestionario de Autoconcepto Dimensional (AUDIM).

Método: La muestra total fue de 1518 universitarios mexicanos, con una edad media de 20.56 años (DE=1.88). La estructura factorial del cuestionario se analizó a través de análisis factoriales exploratorios y confirmatorios.

Resultados: Los análisis muestran que una estructura cuatro factores es viable y adecuada.

Discusión o **Conclusión**: La estructura de cuatro factores (autoconcepto personal, autoconcepto físico, autoconcepto social y autoconcepto académico), atendiendo a criterios estadísticos y sustantivos, ha mostrado adecuados indicadores de ajuste de fiabilidad y validez. Sin embargo el modelo obtenido no coincide con el plateado por Revuelta et al. (2015). Futuras investigaciones deberían replicar estos hallazgos en muestras más amplias.

Palabras Clave: autoconcepto; estudio instrumental; estructura factorial; validación de constructo; invarianza de medida

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Abstract

Introduction: The present study aims to investigate if the psychometric results proposed by Revuelta, Rodríguez, Ruiz de Azúa y Ramos (2015) for the Dimensional Self-Concept Questionnaire (AUDIM) are replicated.

Method: The total sample was of 1518 Mexican university students, with an average age of 20.56 years (SD = 1.88). The factorial structure of the questionnaire was analyzed through exploratory and confirmatory factor analysis.

Results: The analysis shows that four factors structure is feasible and adequate.

Discussion or **Conclusion**: The structure of four factors (personal self-concept, physical self-concept, social self-concept and Academic self-concept), based on statistical and substantive criteria, has shown adequate adjustment indicators of reliability and validity. However the obtained model does not match the one proposed Revuelta et al. (2015). Future research should replicate these findings in larger samples.

Keywords: self-concept; instrumental study; factor structure; construct validation; measurement invariance

Introduction

Self-concept is one of the most important findings in the field of motivational research, that's why psychology has always given preference attention to self-concept; considering it as an important predictor of behavior and emotional and cognitive outcomes of people (Marsh y Martin, 2011).

Self-concept may be defined as the person's own self-perceptions that are formed through experience and interpretations of the own environment (Shavelson, Hubner y Stanton, 1976). Likewise, the relationship between self-concept and academic performance is one of the most intriguing questions in the research of self-concept. This relationship has been studied extensively in the past decades (Esnaola, Goni y Madariaga, 2008; Marsh y Martin, 2011; Marsh y Shavelson, 1985) considering the self-concept as a relevant motivation source for behavior in general and learning behaviors in particular.

Self-concept plays a crucial and central role in the development of personality; a positive self-concept is the basis of good personal, social and professional functioning, proving to be a good indicator of mental health and adjustment to life (Goñi, 2009; Goñi e Infante, 2010; Reigal, Videra Vine y Juárez, 2012) since when we feel good with ourselves helps to generate positive feelings. Therefore achieving a positive self-concept is one of the objectives pursued in numerous psychological intervention programs (Esnaola et al., 2008).

On the other hand, has been offered different definitions and explanations varied about its nature and formation. Initially the way of understanding the self-concept was based on the idea that perceptions around it form a comprehensive and indivisible whole. In this conception it will inevitably corresponded a general unifactorial evaluation of the self-concept, this way of understanding the self-concept changes dramatically after the seventies, of the last century when it begins to consider as a multidimensional construct.

Before the seventies it had tended to emphasize the unitary nature of self-concept, which was intended to measure in a globally way, assuming that self-perceptions are strongly dominated by a general factor, so that can not adequately differentiate separate dimensions (Marx y Winne, 1978). However, in the seventies new models are proposed, which share the common assumption that the self-concept is a set of partial perceptions of a hierarchized self.

One of the most widespread and accepted multidimensional models, among those proposed, is from Shavelson et al. (1976) according to which the overall self-concept is at the top of the

hierarchy being divided into academic self-concept and non-academic self-concept. The non-academic self-concept also includes the domains of social, emotional and physical self-concept (Marsh, 1987; Marsh y Shavelson, 1985). Model which is based our work.

Revuelta et al. (2015) consider four specific factors: academic self-concept, social self-concept, self-concept, physical and Personal self-concept and a general self-concept, factors measured through the Self-concept questionnaire (AUDIM); that is analyzed in this study and according to Revuelta et al. it is a questionnaire that offers adequate levels of reliability and validity. The physical self-concept is the particular perception of the physical shape, the abilities and qualities for the practice of physical-sport activity and the own physical appearance, as well as the degree to people looks or feels physically, social self-concept refers to the perception of one's own social competence when it comes to developing relationships and interacting with other people; aside from the perception of social responsibility. Personal self-concept refers to the perception of oneself as an integral person in which it can be trusted, independent of others, it also includes self-perception of the most impulsive and reactive aspects of one's own. Academic self-concept refers to the subject's perception of himself as a student and in his/her learning performance.

Therefore the present instrumental study (Montero y León, 2005) has been directed to provide empirical support for the factorial division of the self-concept questionnaire AUDIM, proposed by Revuelta et al. (2015); which it is justified by the importance of checking the factorial structure of an instrument and psychometric equivalence of it in different groups; since in the context of intergroup comparison, it is essential to consider the need to conduct the adaptation of an instrument of psychological measurement that meets all criteria of equivalence, but above all, consider whether the same factorial structure is applicable to different groups of subjects or, more generically, to different populations (Abalo, Levy, Rial y Varela, 2006).

Method

Participants

1518 subjects participated in the study, 815 women and 703 men, all university students of Mexico. The subjects' age ranged between 18 and 26 years, with an average of 20.56 and a standard deviation of 1.88 years.

The sample was randomly divided into two parts using the Statistical Package for Social Sciences (SPSS) version 18.0; in order to perform parallel studies to corroborate and verify the obtained results (cross validation).

The first half (subsample 1) was composed of 787 subjects; 449 women and 338 men. The ages range between 18 and 26 years, with an average of 20.48 and a standard deviation of 1.87 years.

The second half (subsample 2) was composed of 731 subjects; 366 women and 365 men. The ages range between 18 and 26 years, with an average of 20.66 and a standard deviation of 1.89 years.

Instrument

Self-Concept Questionnaire (AUDIM) Likert scale of 33 items related to the person itself; where the respondent answers on a scale of 1 to 5 (1 = False, 2 = Rather false 3 = neither true nor false, 4 = Rather true and 5 = True) their level of agreement with each of the aspects proposed (choosing the answer that best fits their person). The questionnaire items are grouped into four specific factors: academic self-concept (8 items), social self-concept (4 items), physical self-concept (8 items), personal self-concept (8 items) and one General, General self-concept (5 items).

For our study, three adaptations to the original version of Goñi, Madariaga, Axpe and Goñi (2011) were made: First adaptation, in the original version is scored five response options: (0) false, (1) almost always false, (2) sometimes true sometimes false, (3) almost always true and (4) true; in the version used in this research the subject chooses between 11 possible answers. We combine the original scale with our version to make it as follows: false (0), almost always false (1, 2 and 3), sometimes true, sometimes false (4, 5 and 6), almost always true (7, 8 and 9) and true (10). This first adaptation is justified because the subjects as students are used to the scale of 0 to 10, since like that they have been evaluated by the education system in our country (Mexico).

The second adaptation was to change some terms used in the items of the original version in order to use a language appropriate to the context of the Mexican culture and summarizing the content of the 8 items of academic self-concept factor, in only 3 items (I'm good with subjects of grammar and Spanish; I'm good at math and in science subjects); reason why we refer to the AUDIM questionnaire as questionnaire AUDIM-M.

The third adaptation was to apply the instrument through a computer (Figure 1); this in order to allow the storage of data without prior encoding stages, with greater precision and speed.

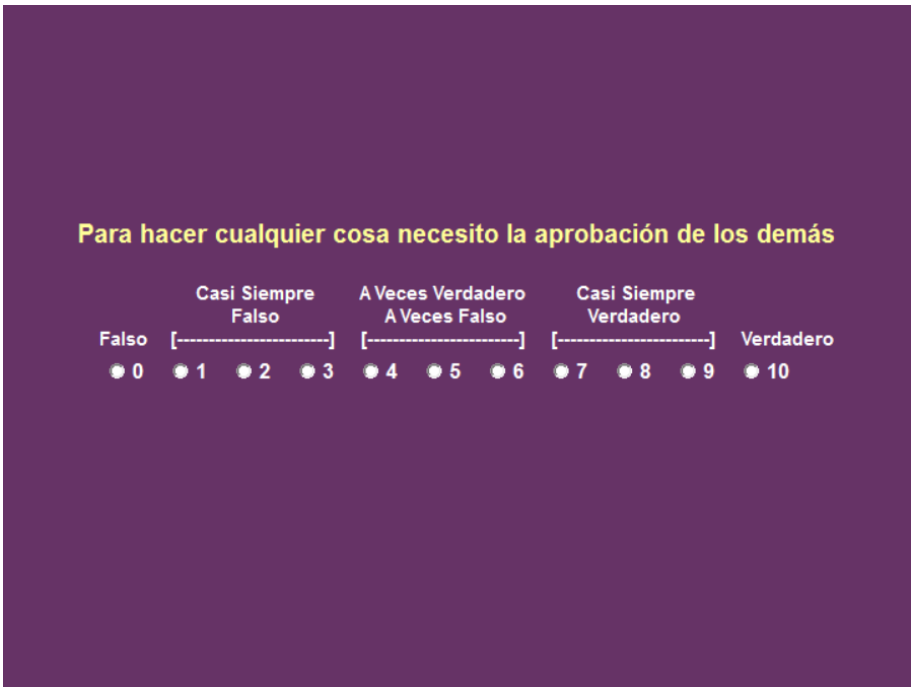

Figure 1. Sample answer to the questionnaire items.

Procedure

Students of the degrees offered at the Faculty of Physical Culture (FCCF) of the Autonomous University of Chihuahua were invited to participate. Those who agreed to participate signed the consent letter. Then, the instrument described above was applied using a personal computer (administrator module of the instrument of the scales editor of typical execution), in a session of about 30 minutes in the computer labs of the FCCF. At the beginning of each session students were given a brief introduction on the importance of the study and how to access the instrument; they were asked the utmost sincerity and they were guaranteed the confidentiality of the data obtained. Instructions on how to respond were in the first screens; before the first instrument item. At the end of the session they were thanked for their participation.

Once the instrument was applied, data was collected by the results generator module of scales editor, version 2.0 (Blanco et al., 2013).

Finally the results obtained are analyzed using SPSS 18.0 and AMOS 21.0.

Data analysis

The psychometric analysis was conducted in two steps: 1) Exploratory factor analysis and 2) confirmatory factor analysis and factorial invariance; in order to obtain proof that presents the best properties for the conformation of body image scores in college students.

Classic Analysis of the Psychometric properties of the scale.

The first step in analyzing the psychometric properties of the questionnaire was to calculate the mean, standard deviation, skewness, kurtosis and discrimination indexes of each item. Then remove of the scale those who obtain a kurtosis or extreme asymmetry, or a discrimination index below .30.

Then, to determine the minimum number of common factors capable of reproducing, in a satisfactory manner, the observed correlations between the instrument items (with good discrimination), two separate exploratory factor analysis with sub-samples 1 and 2 were made, from the method of maximum verisimilitude, based on the criterion of Kaiser-Guttman (Costello y Osborne, 2005), plus to ensure an adequate representation of variables (items), only those whose initial communality was higher than .30 were kept; after a varimax rotation (Costello y Osborne, 2005).

Subsequently, the reliability of each of the factors of the models obtained in both subsamples was calculated through the Cronbach's alpha coefficient (Elosua y Zumbo, 2008; Nunnally y Bernstein, 1995) and the Omega coefficient (Revelle y Zinbarg, 2009; Sijtsma, 2009).

Confirmatory factor analysis and factorial invariance.

Were submitted to comparison two measurement models: Model 1 (M5), five-factor model according to the original distribution of the items in the questionnaire and Model 2 (M4) four-factor model according to the results of exploratory factor analyzes, removing the items that were not sufficiently well explained and / or obtained an index of low discrimination.

To conduct the confirmatory factorial analysis, AMOS 21 software was used (Arbuckle 2012), variances in terms of error were specified as free parameters, in each latent variable (factor) a structural coefficient was set associated to one, so that scale was equal to one of the observable variables (items). The estimated method used was the maximum likelihood method; following the recommendation of Thompson (2004), so when the confirmatory factorial analysis is used, it is necessary to verify not only the fit of the theoretical model but it is recommended to compare the fit indexes of some alternative models to select the best.

To evaluate the adjustment model, statistical chi-squared, the Goodness-of-fit index (GFI), the standardized root mean square residual (SRMR) and the root mean square error of approximation (RMSEA) were used as absolute adjustment measures. Adjusted goodness of fit index (AGFI) the Tucker-Lewis Index (TLI), the comparative fit index (CFI) as measures of increasing adjustment.

The chi-squared fit index divided by degrees of freedom (CMIN/GL) and the Akaike Information Criterion (AIC) as adjusting measures of Parsimony (Byrne, 2010; Gelabert et al., 2011).

Subsequently, following the recommendations of Abalo et al. (2006) was made an analysis of the factorial invariance of the questionnaire for the subsamples, taking as a base the best measurement model obtained in the previous stage.

Finally was calculated the reliability of each of the dimensions, of the measurement models obtained in each subsample, through Cronbach's alpha (Elosua y Zumbo, 2008; Nunnally y Bernstein, 1995) and Omega coefficient (Revelle y Zinbarg, 2009; Sijtsma, 2009).

Results

Exploratory factor analysis (first and second factorial solutions).

In Table 1 are summarized the results of the descriptive analysis and the discrimination indexes (total-item correlation corrected) of each of the 28 items on the questionnaire in the subsample 1 and 2.

In the subsample 1, responses to all items reflect mean scores that oscillate between 4.97 and 9.31, and the standard deviation provides, in all cases, higher values than 1.50 (within a response range between 0 and 10). With the exception of the items 2 and 9, all values of skewness and kurtosis are within the range ± 2.00 and ± 7.00 respectively; so it is inferred that the variables are reasonably fit a normal distribution. As for the discrimination indexes most items satisfactorily discriminate with discrimination indexes above .30 (Brzoska y Razum, 2010).

In the subsample 2, responses to all items reflect mean scores that oscillate between 5.01 and 9.29, and the standard deviation provides, in all cases, higher values than 1.50 (within a response range between 0 and 10). With the exception of the items 2 and 9, as in the subsample 1, all values of skewness and kurtosis are within the range ± 2.00 and ± 7.00 respectively; so it is inferred that the variables are reasonably fit a normal distribution. As for the discrimination indexes most items satisfactorily discriminate with discrimination indexes above .30 (Brzoska y Razum, 2010).

Table 1. Descriptive Analysis and discrimination indices of the questionnaire items "AUDIM-M". Subsamples 1 and 2.

	Subsample 1					Subsample 2				
Item	M	DE	AS	CU	$r_{i\text{-}total}$	M	DE	AS	CU	$r_{i\text{-}total}$
Item 1	7.67	2.58	-.89	-.09	.39	7.81	2.52	-1.02	.27	.49
Item 2	9.31	1.52	-3.61	16.10	.33	9.29	1.52	-3.35	13.56	.25
Item 3	8.21	2.07	-1.67	3.41	.43	8.14	1.97	-1.19	1.37	.48
Item 4	7.59	2.85	-1.08	.24	.47	7.46	2.94	-.94	-.25	.53
Item 5	5.68	2.96	-.30	-.78	.46	5.66	2.95	-.37	-.78	.46
Item 6	5.11	3.25	-.01	-1.10	.38	5.12	3.17	-.01	-1.06	.37
Item 7	5.79	2.97	-.42	-.68	.20	5.86	2.81	-.45	-.49	.15
Item 8	6.59	3.00	-.43	-.93	.42	6.68	2.98	-.52	-.82	.49
Item 9	8.89	1.80	-2.31	6.30	.58	8.84	1.77	-2.11	5.12	.59
Item 10	7.27	3.18	-.99	-.30	.39	7.59	2.97	-1.10	.00	.41
Item 11	6.24	2.66	-.45	-.33	.32	6.27	2.81	-.50	-.53	.28
Item 12	7.90	2.28	-1.37	1.68	.64	7.85	2.32	-1.20	1.03	.64
Item 13	8.63	1.75	-1.69	3.83	.62	8.47	1.83	-1.50	2.53	.62
Item 14	8.07	1.87	-1.43	3.12	.54	7.96	1.77	-.98	1.22	.52
Item 15	7.50	2.78	-.97	.00	.36	7.44	2.75	-.86	-.29	.45
Item 16	4.97	2.86	-.09	-.75	.32	5.01	2.86	-.12	-.71	.28
Item 17	5.36	3.20	-.23	-1.09	.27	5.46	3.23	-.29	-1.06	.33
Item 18	7.58	3.01	-1.04	-.08	.53	7.57	3.00	-1.03	-.09	.54
Item 19	5.45	3.12	-.08	-1.03	.37	5.42	3.15	-.07	-1.08	.32
Item 20	5.71	2.88	-.33	-.74	.49	5.80	2.90	-.37	-.76	.47
Item 21	6.34	2.47	-.45	-.17	.41	6.44	2.44	-.53	.04	.33
Item 22	8.14	1.93	-1.13	1.15	.48	8.33	1.82	-1.26	1.66	.40
Item 23	8.59	1.92	-1.90	4.35	.56	8.55	1.94	-1.86	4.15	.45
Item 24	8.39	2.10	-1.74	3.30	.55	8.38	2.05	-1.53	2.37	.54
Item 25	6.81	2.41	-.66	.14	.45	6.92	2.34	-.63	.12	.36
Item 26	8.27	1.97	-1.48	2.58	.65	8.26	1.88	-1.32	2.07	.63
Item 27	6.35	2.75	-.58	-.36	.50	6.75	2.59	-.69	-.07	.55
Item 28	6.66	3.24	-.59	-.89	.22	6.62	3.26	-.60	-.92	.31

Note: M = mean; SD = standard deviation; AS = asymmetry; CU = kurtosis; $r_{i\text{-}total}$ = total-item correlation corrected

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After a varimax rotation (Costello y Osborne, 2005) the exploratory factor analysis of the items, in both subsamples, revealed a four-factor structure; leading to eliminate 13 of the 28 items analyzed. The set of the selected factors explained 66.06% of the variance in the first subsample and 66.85% of the variance in the second subsample (Tables 2 and 3).

Table 2. Eigenvalues and percentage of variance explained by each of the retained factors. Exploratory Factorial Analysis Sub-samples 1 and 2. Rotated Solution

Factors	Subsample 1			Subsample 2		
	Eigenvalues	% of the variance	% accumulated	Eigenvalues	% of the variance	% accumulated
Personal self-concept	3.75	25.03	25.03	3.87	25.80	25.80
Physical self-concept	2.74	18.27	43.30	2.98	19.86	45.66
Social self-concept	1.93	12.85	56.15	1.70	11.33	56.99
Academic self-concept	1.49	9.91	66.06	1.48	9.86	66.85

Table 3. Items grouped by factor. Rotated solution. Exploratory Factorial Analysis Sub-samples 1 and 2

Item	Subsample 1				Subsample 2			
	F1	F2	F3	F4	F1	F2	F3	F4
9 I feel happy	**.78**	.07	.17	.03	**.84**	.08	.15	-.02
12 I am happy with my body image	**.69**	.29	.18	.07	**.69**	.31	.15	.09
13 I am satisfied with the things I am getting in life	**.79**	.13	.13	.01	**.85**	.08	.16	.06
23 I feel I'm a lucky person	**.82**	.09	.03	.13	**.79**	-.05	.05	.08
24 I like my face	**.70**	.05	.14	.20	**.75**	.08	.14	.17
26 I'm proud of how I'm leading my life	**.79**	.11	.16	.20	**.75**	.14	.23	.09
5 I can run and do exercise for a long time without getting tired	.15	**.81**	.09	-.01	.10	**.81**	.11	.13
16 I have more strength than most of the people of my age	.06	**.67**	-.10	.23	.01	**.77**	-.07	.06
20 I have a lot of physical strength	.11	**.92**	.09	.05	.10	**.88**	.07	.04
27 I'm strong physically	.18	**.77**	.04	.20	.20	**.82**	.17	.07
6 I consider myself a very nervous person	.11	.15	**.66**	.04	.11	.25	**.52**	-.05
8 When making a decision, I rely too much on the opinion of others	.18	.01	**.82**	.04	.22	.06	**.84**	.06
15 To do anything I need the approval of others	.19	-.08	**.78**	.03	.26	-.09	**.73**	.13
11 I'm good in the subjects of grammar and Spanish	.10	.13	.06	**.77**	.08	.10	.04	**.80**
25 I'm good at science subjects	.28	.21	.05	**.67**	.17	.12	.06	**.81**

Note: F1 = Personal self-concept, *F2* = Physical self-concept, *F3* = Social self-concept, *F4* = Academic self-concept

Congruence between the factors of the two factorial solutions (cross-validation).

The values of the Congruence coefficients and Pearson correlation coefficients between the factor weights of the factors obtained in the exploratory factor analyzes conducted with subsamples 1 and 2; indicate, according to suggested by Cureton and D'Agostino (1983), Mulaik (1972) and Cliff (1966), a high congruence between pairs of factors (Table 4).

Table 4. Coefficients of congruence and Pearson correlation between saturations of the factors obtained in the exploratory factor analysis subsamples 1 and 2.

Factors	Coefficient of Congruence	Correlation coefficient
Personal self-concept	.999	.684
Physical self-concept	.998	.964
Social self-concept	.995	.995
Academic self-concept	.997	.999

Reliability of the subscales (internal consistency).

The subscales (factors) resulting in the exploratory factor analysis, of both subsamples, possess mostly, internal consistency values above .70 in both samples demonstrating adequate internal consistency for these type of subscales, particularly when you consider the reduced number of items (Table 5).

Table 5. Coefficient alpha and omega for the factors obtained in the exploratory factor analysissubsamples 1 and 2.

	Subsample 1		Subsample 2	
Factor	Ω	α	Ω	α
Personal self-concept	.893	.884	.903	.862
Physical self-concept	.873	.845	.892	.848
Social self-concept	.799	.666	.746	.676
Academic self-concept	.684	.532	.786	.596

Confirmatory factor analysis for subsamples 1 and 2

The overall results of the confirmatory factor analysis in the subsample 1 (GFI .746; RMSEA .097; CFI .694) and the subsample 2 (GFI .792; RMSEA .089; CFI .725) for the M5 model indicate that the measurement model, in both subsamples is acceptable (Table 6).

Table 6 Absolute, incremental and Parsimony fit indexes for the generated models. Subsamples 1 and 2.

	Absolute indexes				Incremental Indexes			Parsimony Idexes	
Model	χ^2	GFI	RMSEA	SRMR	AGFI	TLI	CFI	CMIN/DF	AIC
First factor solution (subsample 1)									
M5	2855.166*	.746	.097	.1149	.697	.660	.694	8.398	2987.166
M4	223.396*	.964	.049	.039	.944	.960	.971	2.901	309.396
Second factor solution (subsample 2)									
M5	2313.237*	.792	.089	.107	.751	.695	.725	6.804	2445.237
M4	286.187*	.951	.061	.051	.923	.935	.952	3.717	372.187

Note: * p < .05; GFI = goodness of fit index; RMSEA = root mean square error of approximation; SRMR = Standardized Root Mean Square Residual; AGFI = adjusted goodness of fit index; TLI = Tucker-Lewis index; CFI = comparative fit index; CMIN/DF = chi-squared fit index divided by degrees of freedom; AIC = Akaike information criterion

The set of the four factors of the model M5 account approximately 53% of the variance in both subsamples. Furthermore according to the results of Table 7; only 8 of the 28 items in both subsample, have saturations equal or greater than .70 in its intended dimension (items 5, 9, 13, 14, 20, 25, 26 and 27). Also observed in both subsamples, high intercorrelations among the factors of personal self-concept and general self-concept showing a poor discriminant validity among them.

Table 7. Standardized solutions confirmatory factor analysis for the M5 Model. Subsample 1 and 2

	Subsample 1					Subsample 2				
Item	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5
Factor weights										
2 I am a person you can trust	.38					.32				
6 I consider myself a very nervous person	.33					.35				
8 When making a decision, I rely too much on the opinion of others	.43					.53				
13 I am satisfied with the things I am getting in life	.82					.77				
15 To do anything I need the approval of others	.39					.50				
19 I suffer too much when something goes wrong	.40					.40				
22 I am a person of my word (I fulfill what I promise)	.51					.43				
26 I'm proud of how I'm leading my life	.84					.78				
1 I look clumsy in sports		.44					.56			
5 I can run and do exercise for a long time without getting tired		.76					.78			
12 I am happy with my body image		.46					.49			
16 I have more strength than most of the people of my age		.58					.58			
20 I have a lot of physical strength		.88					.85			
24 I like my face		.29					.30			
27 I'm strong physically		.79					.80			
28 I find it hard to learn a new sport		.16					.24			
3 I feel I accepted when I'm in a group			.59					.69		
7 I feel committed to society			.35					.23		
14 People likes me			.73					.77		
21 I collaborate for a better society			.49					.40		
11 I'm good in the subjects of grammar and Spanish				.52					.56	
17 I'm good in mathematics				.44					.46	
25 I'm good at science subjects				.70					.74	
4 I feel disgusted with myself					.51					.61
9 I feel happy					.77					.78
10 I don't have too many qualities as a person					.37					.44
18 I wish I could be different					.58					.64

23 I feel I'm a lucky person				.74					.61	
Correlations between factors										
F1	-					-				
F2	.41	-				.42	-			
F3	.76	.51	-			.70	.47	-		
F4	.52	.56	.66	-		.43	.38	.46	-	
F5	.96	.37	.76	.45	-	.95	.39	.64	.31	-

Note: F1 = Personal self-concept, *F2* = Physical self-concept, *F3* = Social self-concept, *F4* = Academic self-concept *F5* = general self-concept

The overall results of the confirmatory factor analysis in the first (GFI .964; RMSEA .049; CFI .971) and second subsample (GFI .951; RMSEA .061; CFI .952), the second model tested (M4) that corresponds to a four-dimensional structure according to the results of the exploratory factor analysis of the questionnaire items, indicate that this measurement model is better than the previous model and its setting is optimal (Table 6). The four factors of this model explain together approximately 62% of the variance in both subsamples.

Furthermore according to the results of Table 8; 10 of the 15 items have saturations equal or greater than .70 in its intended dimension (items 8, 9, 12, 13, 15, 20, 23, 25, 26 and 27) in the first subsample and 9 in the second subsample (items 8, 9, 12, 13, 15, 20, 25, 26 and 27). Also observed in both subsamples, low to moderate intercorrelations between factors evidencing an adequate discriminant validity between them.

Table 8 standardized solutions confirmatory factor analysis for the model M4. Subsamples 1 and 2.

	Subsample 1				Subsample 2			
Item	F1	F2	F3	F4	F1	F2	F3	F4
Factor weights								
9 I feel happy	.72				.75			
12 I am happy with my body image	.72				.75			
13 I am satisfied with the things I am getting in life	.83				.79			
23 I feel I'm a lucky person	.72				.59			
24 I like my face	.66				.64			
26 I'm proud of how I'm leading my life	.87				.81			
5 I can run and do exercise for a long time without getting tired		.62				.65		
16 I have more strength than most of the people of my age		.64				.63		
20 I have a lot of physical strength		.75				.72		
6 I consider myself a very nervous person			.50				.52	
8 When making a decision, I rely too much on the opinion of others			.75				.79	
15 To do anything I need the approval of others			.72				.73	
27 I'm strong physically			.95				.95	

11 I'm good in the subjects of grammar and Spanish				.50				.58
25 I'm good at science subjects				.73				.75
Correlations between factors								
F1	-				-			
F2	.38	-			.41	-		
F3	.45	.13	-		.54	.30	-	
F4	.55	.52	.22	-	.37	.30	.25	-

Note: F1 = Personal self-concept, *F2* = Physical self-concept, *F3* = Social self-concept, *F4* = Academic self-concept

Invariance of the factor structure between subsamples

The fit indexes obtained (Table 9) allow to accept the equivalence of the basic measuring models between the two subsamples. Although the value of Chi-squared exceeds to that required to accept the hypothesis of invariance, the CFI=.962, RMSEA=.039 y AIC=681.583 indexes contradict this conclusion allowing us to accept the base model invariance (unrestricted model).

Adding to the base model restrictions on factorial loads the metric invariance was characterized. The values shown in Table 9 allow to accept this level of invariance. The goodness of fit index (GFI .956) and root mean square error of approximation (RMSEA .038) continue to provide convergent information in this direction. Also, the Akaike Information Criterion (AIC 676.968) and Bentler comparative fit index (CFI .961) do not suffer large variations over the previous model. Using the criteria for the evaluation of the nested models proposed by Cheung and Rensvold (2002), who suggest that if the calculation of the difference of the CFI of both nested models diminish in .01 or less, the restricted model is taken for granted therefore the compliance of the factorial invariance; the difference of the CFIs obtained allows to accept the metrical invariance model. We can conclude up to this point that factorial charges are equivalent in the two subsamples.

Having demonstrated the metric invariance between the subsamples, we evaluate the equivalence between intercepts (strong factorial invariance). The Indices (Table 9) show a good adjustment of this model, evaluated independent as well as analyzed toward nesting with the metric invariance model. The difference between the two comparative indices of Bentler is less than .002; and the general adjustment index is .953 and the root mean square error of approximation is .038. Accepted then the strong invariance, the two evaluated models are equivalent toward the factorial coefficients and the intercepts.

Table 9 Goodness of fit indexes of each of the models tested in the factorial invariance.

Model	Fit Indexes						
	χ^2	gl	GFI	NFI	CFI	RMSEA	AIC
Model without restrictions	509.583*	154	.958	.947	.962	.039	681.583
Metric Invariance	526.968*	165	.956	.945	.961	.038	676.968
Strong factor invariance	561.684*	175	.953	.942	.959	.038	691.684

Note: * $p < .05$; GFI = goodness of fit index; NFI = normed fit index; CFI = comparative fit index; RMSEA = root mean square error of approximation; AIC = Akaike information criterion

The factors obtained in the confirmatory factor analysis, mostly all reached values above o equal to .70 of internal consistency in both samples; demonstrating adequate internal consistency for these type of subscales, particularly if it is considered the small number of items (Table 10).

Table 10 Coefficient omega and alpha for the factors obtained in confirmatory factor analysis subsamples 1 and 2.

	Subsample 1		Subsample 2	
Factor	Ω	α	Ω	α
Personal self-concept	.889	.884	.869	.862
Physical self-concept	.711	.845	.706	.848
Social self-concept	.828	.666	.843	.676
Academic self-concept	.554	.532	.616	.596

Conclusions

Based on the study presented, the following main conclusions can be drawn:

The exploratory and confirmatory factor analyzes conducted revealed a four-factor structure: personal, physical self-concept, social self-concept and academic self-concept for the Self-concept questionnaire (AUDIM-M).

On the other hand, the factors of both Subsamples showed adequate reliability; and a high congruence between pairs of factors, particularly considering the small number of items in each. Which means that the results of the model are fully confirmatory.

Discussion

The obtained model does not match completely with the proposed one by Revuelta et al. (2015), and to achieve a better adjustment a factor had to be removed and 13 of the 28 items analyzed.

However, it should be noted that the factors: personal self-concept, physical self-concept, social self-concept and academic self-concept are maintained, although with a smaller number of items. In this way, reference is made to the dimensions of self-concept described by the different authors who support a multifactorial model (Esnaola et al., 2008; Marsh, 1987; Revuelta et al., 2015; Rodríguez y Fernández, 2011; Shavelson et al., 1976).

The discrepancies observed between the model proposed by Revuelta et al. (2015) and the one here suggested, can be attributed to social or cultural differences of the participants; such as being college students in the area of physical activity. In any case, the validation of a questionnaire is a slow and continuous process, so that future research should compare these findings in larger samples (Holgado, Soriano y Navas, 2009).

However, it should be noted that the scope of these results is limited and therefore it is necessary that future research will confirm the obtained structure, which will allow to have more robust evidence regarding the factorial structure of the scale. Specifically, it must be demonstrated if the invariance of the structure of the scale is accomplished by gender, age, between students of different degrees, among others; so it is considered that further studies are necessary in order to corroborate or refute the data obtained in the investigations carried out so far. In addition to retake the questionnaire validation increasing the number of items in each of the factors in order to improve its reliability and validity. It is also essential to check if the scale is useful to study the relationship between self-concept and variables such as academic performance and resilience in university students.

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