



Analysis of the psychometric properties of the five-factor self-concept questionnaire (AF-5) in Spanish students during the COVID-19 lockdown

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Abstract

The present research aims to analyse the psychometric properties of the AF5 questionnaire for its adaptation for use with young people during a lockdown period. Research was conducted with a sample of 534 students aged between 13 and 17 years ($M = 14.49$; $SD = 1.805$). Exploratory factor analysis was conducted using the FACTOR program and confirmatory factor analysis was conducted using the M-PLUS 7 program. Results indicate that a four-dimensional model is most appropriate for bringing together the emotional and physical dimensions. Further, 11 items were removed due to poor factor loadings. The majority of factors were directly and positively correlated (99%; $p < .01$). The data obtained supports conclusions that the AF-5 meets validity and reliability requirements for it to be considered a useful instrument for use with young people during the COVID-19 lockdown period.

Keywords Self-concept · Youth · Factor analysis, psychosocial

Introduction

Self-concept has been defined in a number of ways, however, the various definitions can be summarised as an individual's knowledge and perception of themselves. Self-concept varies

over an individual's lifetime as they adapt to new environments and situations (Cantor & Kihlstrom, 1987; Markus & Wurf, 1987; O'Connor et al., 2018). It is the direct result of an interaction between the perceptions individuals hold about themselves and the perceptions others hold of them (Gecas, 1982; Murray et al., 2020; Peiffer et al., 2020; Shavelson et al., 1976), in addition to the way in which external behaviours are internalised (Bandura, 1986; Wu et al., 2019). Various versions of the theory have been applied over recent years but the most accepted version currently is that described by Shavelson et al. (1976). This conceives self-concept as a combination of five dimensions: emotional, physical, social, family and academic.

Self-concept is considered a crucial variable in education and so has been extensively researched in school settings (Peiffer et al., 2020; Shavelson et al., 1976). In fact, considerations of self and identity may negate behavioral risks (Pfeifer & Berkman, 2018). Interest in the concept has continued to increase in more recent times. Relevant conclusions of this research includes findings of the existence of gender differences (Chui & Wong, 2016; Fernández-Lasarte et al., 2019; Widlund et al., 2020; Wirthwein et al., 2020) and existence of a concave relationship during adolescence. Specifically, females traditionally exhibit greater self-concept in academic and affective contexts, whilst males do so in physical and

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social contexts (González-Valero et al., 2020; Marsh, 1989). Appropriate self-concept has been shown to enhance and predict achievement and teacher-engagement (Bakadorova et al., 2020; Guo et al., 2016; Kumar-Jaiswal & Choudhuri, 2017; Musetti et al., 2019), whilst also improving self-efficacy (Zamani-alavijeh et al., 2019), being positively correlated with peer perceptions of (Ingles et al., 2017) and generating higher self-esteem (Baudson et al., 2016; Coelho et al., 2020). From a general point of view, childhood is crucial for the development of personality and identity, where personal goals, commitment, motivations and psychosocial well-being are interrelated (Pfeifer & Berkman, 2018).

Although few studies have been published on self-concept during the COVID-19 lockdown (Alessandri et al., 2020; González-Valero et al., 2020; Lindell-Postigo et al., 2020; Zhang et al., 2020), similar situations have been examined, where health and social concerns underlie contexts such as those relating to refugees (Akgül et al., 2019; Derman et al., 2017; Hatoss, 2012; Klimidis et al., 1994; Schmidt et al., 2008) and long-term hospital patients (Choi & Ferro, 2018; Mishra et al., 2010). In this sense, these situations lead to lower self-concept since depression and isolation are correlated with a negative self-concept (González-Valero et al., 2020; Karatzias et al., 2019; Nasstasia et al., 2019; Van Meter et al., 2013). Conversely, a positive self-concept may buffer the psychological impact of trauma in adolescents (Wang et al., 2020).

In accordance with the theoretical precepts mentioned above (Shavelson et al., 1976), a questionnaire was created to measure the academic, family, social, physical and emotional dimensions of self-concept (García & Musitu, 1999). This questionnaire has previously been validated in a broad range of populations (Carranza-Esteban & Bermudez-Jaimes, 2017; Esnaola et al., 2011; García et al., 2018; Malo-Cerrato et al., 2011; Martínez-Martínez et al., 2018; Zurita-Ortega et al., 2018a; Zurita-Ortega et al., 2018b), with an English version also having been validated (García et al., 2013). Nevertheless, none of these validation studies were conducted with a population undergoing lockdown or experiencing a similar situation to that of the present crisis. This is, therefore, a great opportunity to evaluate the psychometric properties of this scale within such a population.

The COVID-19 pandemic has been shown to have not only caused physical and mental health problems (Bassi et al., 2020; De Miranda et al., 2020; Raballo et al., 2020) but to have also altered the psychosocial state of individuals and their perceptions of themselves, their families and their peers (De Figueiredo et al., 2020; Serlachius et al., 2020). In this sense, it is necessary to further investigate self-concept within a population undergoing lockdown measures, in order to uncover the actual state of affairs within this population and to be able to intervene effectively. Thus, the present research aims to assess the psychometric properties of the five-factor self-

concept questionnaire (García & Musitu, 1999) in a sample of adolescents during the COVID-19 lockdown.

Method

Participants

A total of 534 Spanish students aged between 13 and 17 years ($M = 14.49$; $SD = 1.805$) were invited to participate (39.7% male) in the present research. All participants were attending secondary school in Andalusia (Spain). A convenience sample was recruited from six secondary schools. A total of 534 individuals provided informed consent and were administered the questionnaires in April 2020. For inclusion, participants had to meet the criteria of being enrolled at secondary school and being aged between 13 and 17 years. Cases were excluded if they did not meet these conditions or did not fill questionnaires out correctly. Eighteen participants were excluded for failing to produce valid responses, leaving a final sample of 516. Of the aforementioned sample, 314 students attending four secondary schools participated in the analysis EFA (Exploratory Factor Analysis). 202 students attending 2 different secondary schools with similar characteristics to those of the schools in the first analysis participated in the analysis CFA (Confirmatory Factor Analysis). The sample met criteria for representativeness.

Instruments

An ad-hoc questionnaire was used to collect socio-demographic characteristics. This questionnaire recorded participants' sex (male or female) and age.

The five-factor self-concept questionnaire (AF-5) (García & Musitu, 1999) was used to evaluate self-concept in students during the COVID-19 lockdown. This test consists of 30 questions which are assessed along a five-point Likert scale, with 1 being 'never' and 5 being 'always'. Higher dimensional and overall scores indicated better self-concept. The questionnaire consists of five dimensions: academic self-concept (A-SC), social self-concept (S-SC), emotional self-concept (E-SC), family self-concept (F-SC) and physical self-concept (P-SC). Participants are asked to respond to thirty items on a five-point Likert scale ranging from never (1) to always (5). A number of items are used to address each of the dimensions (A-SC: items 1, 6, 11, 16, 21 and 26; S-SC: items 2, 7, 12, 17, 22 and 27; E-SC: items 3, 8, 13, 18, 23 and 28; F-SC: items 4, 9, 14, 19, 24 and 29; P-SC: items 5, 10, 15, 20, 25 and 30). Internal consistency of the scale was assessed according to Cronbach's alpha, with $\alpha = 0.800$ being obtained in the present study. Similar results have been previously reported by García and Musitu (1999), with a Cronbach's alpha of $\alpha = 0.810$ being reported in this case.

Procedure

Parents or legal guardians were informed by means of a letter prepared by the Department of Didactics of Musical, Artistic and Corporal Expression of the University of Granada. All participants were informed that data would be confidential and would only be used for scientific purposes. Questionnaires were administered online during lockdown. For this purpose, a Google form was created where the purpose of the study was stated and respondents were given the option to state their agreement to participate. Teachers informed participants of the relevant link in school during school hours. The digital platforms already being used by teachers to teach online classes were used. To avoid random responses and to control for response bias, one questionnaire item was repeated at a later stage in the questionnaire. A total of 18 questionnaires were eliminated due to incorrect completion or failure to meet inclusion criteria.

The present study adhered to the ethical research principles established by the Declaration of Helsinki (World Medical Association, 2009), ensuring anonymity and respecting the rights of participants. In addition, approval of the research was granted by the Ethics Committee of the University of Granada (1230/CEIH/2020).

Statistical Analysis

Basic descriptive coefficients (mean, dispersion, kurtosis and asymmetry) were analysed using SPSS 25.0 for Windows. Psychometric properties of the measures were examined through perusal of goodness of fit indices following exploratory factor analysis using the program FACTOR Analysis 9.3.1 (Lorenzo-Seva and Ferrando, 2006). Assessment was based on several criteria such as those recommended by Bentler (1990) and McDonald and Marsh (1990). Cronbach's alpha coefficient was examined in order to determine internal consistency of the instrument and its dimensions. M-PLUS 7 (Muthén & Muthén, 2007) was used to conduct confirmatory factorial analysis.

EFA and CFA were conducted according to classical methods (parametric) since these analyses are based on the structure of the correlation matrix, whose nature is always quantitative, regardless of the type of variables examined. "EFA analysis was conducted via maximum likelihood extraction methods, using the polychromic correlation matrix, due to their important advantages relative to other models (Fabrigar et al., 1999). Promin oblique rotation was used following recommendations made by Lorenzo-Seva (1999), which indicate that oblique rotations (promin) are probably the best option, at least in social sciences. Rotated factor loadings were analysed in order to establish whether groups matched the underlying factors of the original scale. The number of factors extracted were verified using Horn's parallel

analysis (PA). Horn (1965) and Timmerman and Lorenzo-Seva (2011) have proposed the AP as an empirical method based on the generation of random variables to determine the number of factors that must be retained when performing factor analysis. Finally, CFA was carried out through a structural equation model in order to verify whether the factor structure of the original scale was replicated. The Bentler-Bonett comparative index (CFI) and root mean square error of approximation (RMSEA) were calculated in order to estimate goodness of fit. The following cut-points were used to define good fit: CFI > 0.95 (Hu & Bentler, 1999) and RMSEA < 0.07 (Steiger, 2007).

Results

Descriptive Statistics and Missing Data

Table 1 shows the descriptive findings pertaining to the AF-5 alongside results of dispersion analysis (asymmetry and kurtosis) following steps recommended by experts in the field (Schmider et al., 2010). Minimum covariance coverage was 99.1%.

Exploratory Factor Analysis (EFA)

In the first part of the analysis, FACTOR Analysis 9.3.1 (Lorenzo-Seva and Ferrando, 2006) was used with a sample of 314 students. Factor analysis was conducted to develop various models, rotating data through three, four and five factors (Lorenzo-Seva and Ferrando, 2006) (Table 2).

Table 3 shows outcomes of the parallel analysis carried out in line with that described by Horn (1965), Timmerman and Lorenzo-Seva (2011). These analyses suggested the existence of three dimensions. Nonetheless, a four-dimensional model was used because the presence of emotional and physical dimensions could not be discarded. Both dimensions are of great interest in the field of social sciences.

Table 4 present results of the evaluation of the psychometric properties of the 30-item AF-5. Following examination of the loadings of all factors, it can be observed that for the 3-factor model the variables V.6, V.8, V.17 and V.30 were removed as these variables did not fulfil criteria. Furthermore, in the 4-factor model, the variables V.5, V.8, V.15, V.16, V.17, V.21, V.26 and V.30 were removed for not meeting fit criteria, whilst V.10, V.22 and V.27 were also removed owing to poor loading. With regard to the 5-factor model, variables V.17, V.26 and V.27 were removed. Further, factors 3 and 4 did not produce appropriate loadings and variables V.10 and V.15 did not meet fit criteria. The final scale was formed of four factors. Study researchers, therefore, selected the four-factor model which joined the emotional and physical dimensions (V3, V13, V18, V20, V23, V25 and V28). The family

Table 1 Descriptive statistics pertaining to the AF-5

	Mean	SD	Variance	Asymmetry	Kurtosis	Range
V 01	4.01	.856	.733	-.589	-.239	3
V 02	3.57	1.133	1.284	-.352	-.759	4
V 03	2.88	1.011	1.023	-.414	-.629	4
V 04	3.24	1.139	1.296	-.368	-.529	4
V 05	3.66	.990	.981	-.157	-1.010	3
V 06	3.93	1.001	1.002	-.526	-.638	4
V 07	4.21	.898	.806	-.997	.208	3
V 08	3.35	1.131	1.280	-.030	-.802	4
V 09	3.93	1.020	1.040	-.589	-.782	3
V 10	3.01	1.342	1.800	-.032	-1.138	4
V 11	3.67	1.019	1.038	-.277	-.841	4
V 12	3.68	1.210	1.465	-.600	-.602	4
V 13	3.32	1.191	1.418	-.503	-.650	4
V 14	4.07	1.048	1.099	-.956	.187	4
V 15	3.42	1.227	1.505	-.409	-.820	4
V 16	3.68	.964	.929	-.233	-.669	4
V 17	3.99	1.078	1.163	-1.028	.482	4
V 18	3.79	1.116	1.246	-.815	.077	4
V 19	4.39	.998	.995	-1.531	1.221	4
V 20	3.17	1.297	1.682	-.217	-1.014	4
V 21	4.01	.947	.896	-.759	-.026	4
V 22	3.21	1.230	1.513	-.353	-.748	4
V 23	3.57	1.269	1.609	-.565	-.692	4
V 24	3.99	1.142	1.303	-1.062	.302	4
V 25	3.53	1.192	1.421	-.430	-.653	4
V 26	3.85	1.046	1.094	-.552	-.548	4
V 27	3.71	1.135	1.288	-.526	-.578	4
V 28	3.11	1.153	1.328	-.395	-.596	4
V 29	4.27	.977	.955	-1.055	.052	4
V 30	2.97	1.186	1.407	-.078	-.786	4

dimension comprised V2, V7 and V12, and the social component consisted of V1, V6 and V11. The researchers considered it important to retain the two items which loaded on both the physical and emotional dimensions.

Table 5 shows the rotated four factor matrix. Examination of the Bartlett statistic [1.980.2 (df = 435; p = 0.000)] and

Table 3 Parallel Analysis (PA) based on minimum rank factor analysis

Variable	Real-data % of variance	Mean of random % of variable	95 percentile of random % of variance
1	28.6*	8.7	9.5
2	12.6*	8.0	8.6
3	9.8*	7.4	7.9
4	6.6	6.9	7.3
5	6.6	6.5	6.9
6	5.4	6.1	6.5
7	4.2	5.7	6.1
8	3.3	5.4	5.7
9	3.1	5.1	5.4
10	2.7	4.7	5.0
11	2.4	4.4	4.7
12	2.3	4.1	4.4
13	1.9	3.8	4.1
14	1.7	3.5	3.8
15	1.5	3.2	3.5
16	1.4	2.9	3.2
17	1.3	2.7	2.9
18	1.1	2.4	2.7
19	0.8	2.1	2.4
20	0.7	1.8	2.1
21	0.6	1.6	1.8
22	0.6	1.3	1.6
23	0.5	1.0	1.2

outcomes of the Kaiser-Meyer-Olkin (KMO) test (0.859) suggested that model fit was acceptable. The four factors extracted explained 50.5% of the total variance. Further, the CFI (comparative fit index) was 0.99, goodness of fit index (GFI) was 0.95, AGFI was 0.94, RMSEA (root mean square error of approximation) was 0.029 and the root mean squared residual (RMSR) was 0.067. All of these values indicate acceptable fit. In general, a good fit of the model to the empirical data was observed. The reliability coefficient for the overall questionnaire was 0.826. When broken down into the four dimensions, reliability coefficients were as followed: family

Table 2 Model fit statistics pertaining to model rotated around three, four and five factors

	Bartlett	KMO	Variance	CFI	GFI	AGFI	RMSEA	RMSR
Factor Three	1.980.2 (df=435; p=0.000)	0.859	43.6%	0.97	0.94	0.92	0.047	0.079
Factor Four	1.980.2 (df=435; p=0.000)	0.859	50.5%	0.99	0.95	0.94	0.029	0.067
Factor Five	1.980.2 (df=435; p=0.000)	0.859	60.7%	0.99	0.97	0.96	0.016	0.060

Table 4 Rotated factor matrix

	Five factors					Four factors				Three factors		
	F1	F2	F3	F4	F5	F1	F2	F3	F4	F1	F2	F3
V 01			0.793						0.611		0.469	
V 02				0.860				0.868			0.779	
V 03		0.659					0.453			0.456		
V 04					0.345	0.302						0.352
V 05			0.476								0.501	
V 06			0.808						0.676			
V 07			0.561					0.609			0.725	
V 08		-0.399										
V 09					0.600	0.475						0.454
V 10		0.338						0.393			0.388	
V 11			0.861						0.600		0.604	
V 12				0.818				0.790			0.659	
V 13		0.680					0.483			0.467		
V 14					0.608	0.712						0.714
V 15	0.427											0.365
V 16	0.738											0.567
V 17												
V 18		0.588					0.756			0.716		
V 19					0.744	0.657						0.438
V 20		0.418					0.467			0.450		
V 21	0.687											0.707
V 22		0.431					0.553			0.571		
V 23		0.623					0.659			0.608		
V 24					0.857	0.895						0.717
V 25							0.545			0.550		
V 26	0.866											0.624
V 27							0.409			0.422		
V 28		0.797					0.690			0.707		
V 29					0.918	0.959						0.696
V 30	0.518											

($\alpha = 0.779$), emotional-physical ($\alpha = 0.796$), academic ($\alpha = 0.826$) and social ($\alpha = 0.804$).

Confirmatory Factor Analysis (CFA)

In the second part of the study, the MPLUS-7 programme was used to conduct confirmatory factor analysis with a sample of 202 participants who were not included in the prior analysis. Figure 1 shows the outcome of confirmatory factor analysis of the adapted version of the AF5. RMSEA (0.074), CFI (0.93), TLI (0.91) and SRMR (0.09) values all suggest acceptable model fit.

Table 6 shows the correlations produced between the different dimensions of the questionnaire. A medium strength correlation is observed between family self-concept and

emotional-physical self-concept ($r = .264, p = .001$), and between family self-concept and social self-concept ($r = .330, p = .001$). Moreover, there was a moderate correlation ($r = .376, p = .001$) between the social and academic dimensions.

* $P < 0.05$; ** $P < 0.01$

Discussion and Conclusions

Given the issues that have arisen due to the COVID-19 pandemic in the context of Physical Education, it is essential that questionnaires are available which provide real and reliable data about the experiences of young during the coronavirus lockdown. Thus, the main aim of the present study was to

Table 5 Rotated factor matrix for the four-factor model

	F1 (FM)	F2 (EM-F)	F3 (AC)	F4 (SC)
V 04	0.302			
V 09	0.475			
V 14	0.712			
V 19	0.657			
V 24	0.895			
V 29	0.959			
V 03		0.453		
V 13		0.483		
V 18		0.756		
V 20		0.467		
V 23		0.659		
V 25		0.545		
V 28		0.690		
V 02			0.868	
V 07			0.609	
V 12			0.790	
V 01				0.611
V 06				0.676
V 11				0.600
Alpha Cronbach $\alpha=0.826$	$\alpha=0.799$	$\alpha=0.796$	$\alpha=0.826$	$\alpha=0.804$

analyse the psychometric properties of the AF5 questionnaire in order to paint a clear picture about individuals' perceptions about themselves in relation to five dimensions: academic, social, emotional, family and physical. Furthermore, through this process, the present study investigated the adaptation and application of this measure with young people.

The present sample enabled hugely novel data to be gathered in comparison to other studied samples given the fact that it pertains to a previously unknown context that of government enforced confinement. This is of further interest because such measures could be repeated in the future.

The AF5 is based on an initial model that is made up of five dimensions (García & Musitu, 1999). It has been adapted to different contexts and populations including those involving students and videogames (Martínez-Martínez et al., 2018), judokas (Zurita-Ortega et al., 2018a), undergraduates and religion (Zurita-Ortega et al., 2018b) or adults and adolescents (Malo-Cerrato et al., 2011). All of these contexts exhibited important adaptations to all or some of the dimensions of self-concept.

The present study examined a number of different models, analyzing the properties of models with three, four and five dimensions. The four-dimension model produced the most appropriate values and the strongest relationships with relevant indicators. The present model joined together both the emotional and physical components, which is in contrast to that seen in other studies on the topic. Indeed,

these other studies removed the family component due to poor fit (Tomás & Oliver, 2004; Esnaola et al., 2011). As previously explained by a number of researchers, the family component is often removed due to divergent responses as family is not highly regarded in adulthood. However, the present study combined both the emotional and physical components since physical activity engagement is highly associated with emotions (Cho, 2020; Padiál-Ruz et al., 2020). Given that physical activity outside of the home was forbidden, two items were found to be related to the emotional dimension.

With regard to Cronbach's alpha and scaling factors, results were satisfactory (Duhacheck & Iacobucci, 2004). This confirms that the measure is valid and reliable for estimating the self-concept of young people during a lockdown, reducing the original scale of 30 items to and adapted version with 19 relevant items.

Moreover, the family and emotional-physical dimensions of the original version of the questionnaire were found to be the most robust in the present study as all relevant factors were coherent with no items, therefore, having to be removed. This is supported by findings of studies conducted by Bachner et al. (2020) and Ng et al. (2020) who stated that family is a decisive element during potentially harmful situations. In this way, given that in the present study setting young individuals were confined at home with their guardians, family took on a critical role.

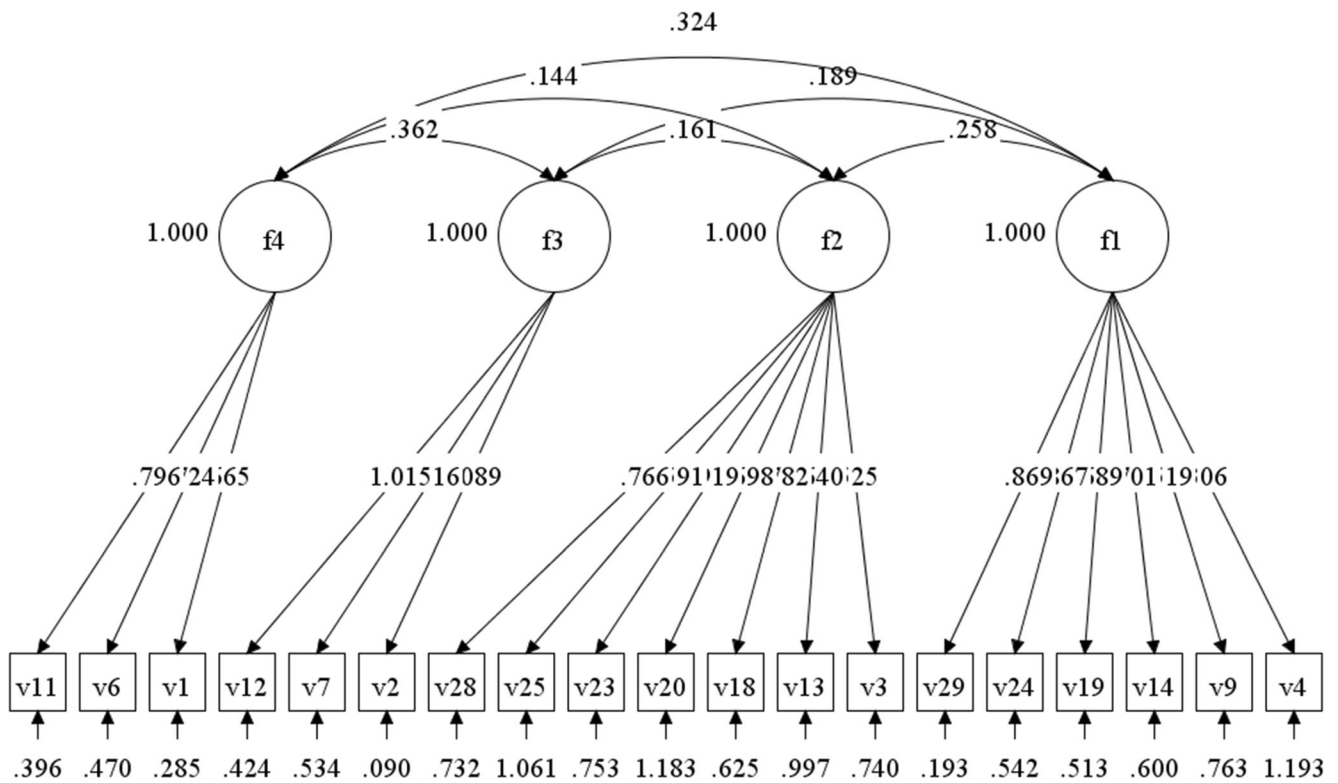


Fig. 1 Confirmatory factor analysis of the adapted version of the AF5

Furthermore, social and academic components were reduced with up to half of the questions pertaining to these components being eliminated. This is logical given that social relations and academic aspects were impeded during the lockdown period.

Additionally, it can be confirmed that the four dimensions of the present model showed acceptable adjustment, in addition to suitable reliability.

There was a moderate positive association between family self-concept and emotional-physical/social self-concept. Individuals' home environment may explain this since a higher family self-concept strengthens emotions and social relations. In this way, family becomes a pivotal element of student's happiness, ability to relate socially and engagement in physical activity (Ng et al., 2020; Verrastro et al., 2020; Villarejo et al., 2020). There was

also a moderate positive association between social and academic components. Such outcomes have also been reported by Ehm et al. (2019), who point out that high achievement results in better socialisation.

With regard to the methodology, the present analysis supports the use of a general measure of self-concept in different populations, although some limitations should be acknowledged. Firstly, a non-probabilistic sample was used and results, therefore, cannot be extrapolated to the whole Spanish population. Secondly, there was a low response rate from parents/guardians which limited the number of minors participating in the present study.

In conclusion, the examined measure was found to be valid and so is appropriate for use with young people during a lockdown.

Furthermore, the data also have some practical implications. Firstly, consistent with the theoretical groundings of the construct, self-concept is made up of five dimensions. Interventions targeting teaching should be directed towards potential virtual settings and encourage positive experiences in Physical Education. In this way, Physical Education may foster positive motivational patterns and enable engagement in physical activity. Thus, this version of the AF5 is recommended for use in other pandemic situations or health and social contexts similar to the COVID-19 pandemic. The results of the present study enable governmental and educational institutions to better understand the issues faced by the

Table 6 Correlations between the different dimensions of the questionnaire administered during lockdown

	AFM	AEMFIS	ASO	AAC
AFM	1	.264**	.330**	.198*
AEMFIS		1	.123	.196*
ASO			1	.376**
AAC				1

population and intervene effectively to address or prevent relevant psychosocial disorders.

Lastly, future research should delve deeper into the types of physical activity engaged in, in order to establish the way in which engagement may impact each of the dimensions of self-concept. It would also be useful to establish differences according to other relevant variables (e.g. gender, educational level).

In summary, results of the present research support the use of the AF5, in a four-dimensional format, as a valid and reliable test for examining self-concept in youth during a lockdown.

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Data Availability The data is available to the editors.

Code Availability Not applicable.

Declarations

Conflicts of Interest/Competing Interests The authors declare no conflict of interest.

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