Design and validation of the general scale of academic engagement for Spanish adolescents (CAADE)

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A R T I C L E I N F O

A B S T R A C T

Academic engagement is considered one of the most essential elements to achieve educational success and decrease levels of school dropout. However, there is a need to develop reliable, practical and valid instruments that evaluate the academic engagement of adolescents taking into account their multidimensionality. The main aim of this research was to design and validate the General Scale of Academic Engagement for Spanish Adolescents that overcomes this limitation. The elaboration process began with the creation of items that are relying on the evaluation of existing literature, then the items were refined thanks to the reviews of the experts and discussion groups with adolescents. Data from 1158 students in compulsory secondary education were analyzed. The instrument's psychometric properties were determined by comprehension validity, analysis of content, reliability and construct validity. An Exploratory Factor Analysis was performed with the first sample (n = 356), while the second sample (n = 802) was used to verify the factor structure identified through Confirmatory Factor Analysis. Evidence of reliability and validity was provided for the instrument using SPSS Version 27 and SPSS AMOS. The results of the analyses resulted in a questionnaire of 17 items grouped into three factors (Cognitive, Affective-Emotional and Behavioral), and confirm that the General Scale of Academic Engagement for Spanish Adolescents (CAADE) has an adequate construct validity and reliability. In summary, this study has resulted in the development of a tool that can be utilized by educators or any institution concerned in evaluating student academic engagement, a construct that does not yet to have consensus.

1. Introduction

Engagement is a term that is present in the school environment, even calling it the academic engagement, emerging as a response to the perception of students increasingly discouraged and disinterested with their studies [1,2]. In this sense, academic engagement is now an essential factor in the school environment [3] and, therefore, is a fundamental variable to achieve success and reduce levels of school dropout [4,5].

However, according to some authors, levels of academic engagement decrease from the secondary stage due to the transition from elementary to secondary education, as well as the continuous biological, psychological and social changes that arise during adolescence, influence personal well-being and lead to an increase in levels of exhaustion, anxiety and stress in young people, due to the increase in curriculum content, effort and demands of parents and teachers [6–8]. These factors can cause in adolescents the

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appearance of academic burnout syndrome and a loss of motivation towards studies [9–12]. To deal with negative emotional responses associated with anxiety and stress levels of adolescents [13], studies are more interested in positive psychology, personal well-being, positive development and student success [14–17].

Among the psychological and educational factors that influence the personal well-being and positive development of the adolescent is academic engagement, which refers to a primary concept for understanding the phenomenon of school dropout and promoting successful educational trajectories. That is, academic engagement is an essential variable for adolescents to be able to cope with the changes and difficulties that arise during adolescence and thus achieve success in their studies [4,5]. However, despite its relevance, the diversity of existing models and theoretical structures make it a little vague [18,19]. Therefore, as academic engagement is considered an important factor to promote academic performance, to have reliable and valid information on the construct would favor the prevention of the school dropout and the reduction of the appearance of the academic burnout syndrome [10,20].

1.1. Definition

Regarding the conceptualization of this construct, although there are different definitions [19], some authors have preferred to focus on the student and their internal experience using this term [21,22]. While other authors have preferred not only placed the emphasis exclusively on the pupil, but also on contextual variables as essential elements for its conceptualization [23]. However, approaches agree that the key element without which academic engagement cannot be understood is student motivation [24].

Therefore, academic engagement involves the student in a set of emotional and personal resources that characterize his academic work, facilitate his school performance, promote positive attitudes towards the school and the positive development of the adolescent, as well as allowing him to take a participatory role in the learning process [25]. For this reason, interest in the concept of academic engagement has grown, since schools can focus on those variables that have some effect, supporting students to achieve favorable results [3].

The definition of academic engagement is a cognitive-affective-behavioral state of satisfaction and motivation that aids students to achieve success in their studies and deal with academic challenges [22,26–28]. In addition, some studies indicate that it is an essential variable in school dropout, because it drives the student towards learning, as well as a moderating factor of stress, anxiety and depression [28,29]. In this sense, students who are academically engaged have a greater chance of graduating with low levels of risky behaviors and high academic performance, they can more easily overcome the difficulties of this stage, are more satisfied and motivated in their learning, present a meaningful learning and can achieve school success [1,24,30].

1.2. Dimensions

Given the definition of academic engagement, there are several approaches, such as the one that approaches the construct from a two-dimensional perspective [31–33] or the engagement approached from a multidimensional perspective [3,4,26,27,34,35].

If the main objective of academic engagement is that students learn and achieve success in their studies, the development of certain personal attitudes is essential [25]. For this reason, academic engagement must be taken into account as a multidimensional construct (Fig. 1). Thus, the proposed model consists of cognitive, affective-emotional and behavioral components and brings together all those
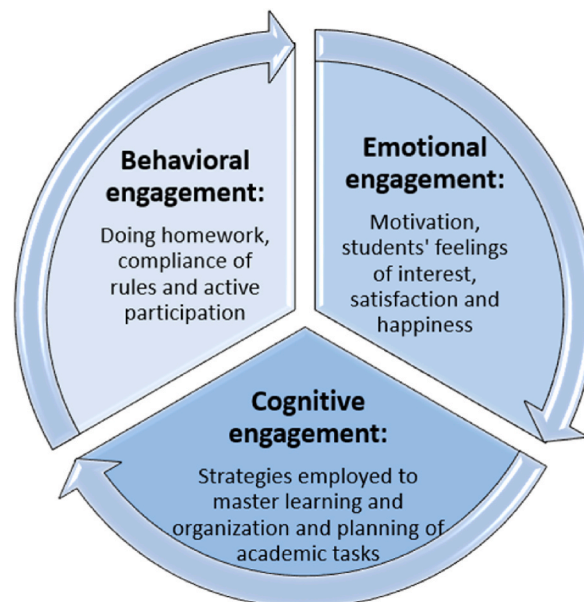

Fig. 1. Three component model of engagement [27].

attitudes that adolescents must develop to improve their levels of academic engagement. Among the three components, there are both positive observable behaviors (e.g. performing school tasks, compliance of rules) and negative ones that interfere with the learning process, as well as non-observable components associated with the cognitive and affective dimension (e.g. organization and planning of time and academic tasks, motivation, psychological well-being and emotions as interest and satisfaction with achievements).

Considering the cognitive dimension, this is more difficult to specify because it lacks consensus regarding its characteristics and its measure [19]. However, most often it refers to how the student uses their management, cognitive and metacognitive strategies during learning [4]. Therefore, within this dimension, there are other important factors associated with academic engagement such as organizational and planning capacity, the student's effort and dedication in learning and ability to use strategically what is necessary for success [4,36,37]. By way of example, a cognitively engaged student will persist in difficult tasks, review the material learned and organize to be able to invest more time and effort in learning tasks, implementing self-regulation strategies [27,38,39].

On the other hand, the affective dimension is characterised by the student's emotional response to their learning procedure [3]. Within this dimension, there is an element strongly associated with engagement which is motivation, understood as the urge to persist in a task because of the innate satisfaction of the task itself (intrinsic) or the urge to perform a task to achieve a result separate from the task itself (extrinsic) [40]. Currently, this element is particularly important in the study of academic engagement because, in general school samples, academic motivation levels decrease from the secondary stage, affecting the academic engagement of students [2].

In addition, and as previously mentioned, some authors such as [1,39,41] mentioned the existence of other affective factors associated with academic engagement, such as psychological well-being and emotions as interest and satisfaction for achievements as a fundamental part of adolescents concerned about the proper development of their school tasks. In this sense, emotionally engaged students consider school to be fun and meaningful in their lives, are satisfied and motivated with the tasks performed and admit the school provides the tools to achieve achievements outside the school context [42]. In turn, it allows them to establish a good disposition towards school work and feel well-being within the school [21,27]. On the contrary, a negative perception of the value of education, a lack of interest in the educational center, boredom, anxiety, social isolation, poor relationships with peers or rejection of peers could be signs to consider for recognizing students who are losing engagement to their studies [1].

Finally, within the behavioral dimension, which pertains to the interactions and responses of students both in academic and extracurricular settings [4], it is essential that adolescents be involved in the activities organized by the school. Other authors such as [42] add a component related to the rules and rules to follow. For example, arrive on time to class and meet the established rules. That is, having proper behavior that facilitates the learning process [39].

For all these reasons, the importance of academic engagement in adolescents is evident. In this regard, to identify students with low levels of academic engagement and, consequently, at risk of school dropout, as well as to deepen the construct and promote it, its measurement is fundamental. However, according to reviews of instruments measuring academic engagement by various authors [43,44], there are few instruments that measure this construct considering its multidimensional nature, the key variables associated with academic engagement and focused on the adolescent population.

1.3. Measuring instruments

Adding to the difficulty of finding a theoretical definition or model to support the understanding of academic engagement due to its multidimensional nature, there is the difficulty of finding suitable measuring instruments.

As regards the most commonly used instruments, the Utrecht Work Engagement Scale (UWES) [45], has 17 items divided into three dimensions (Vigor, Dedication and Absorption) whose scores range from 0 to 6 depending on their frequency (0 Never, 6 Always). The results allow to obtain both a total score and by sub-scales. On the other hand, the scale *Student Engagement Instrument* (SEI) [46] has 56 items measured with a 4-point Likert scale. The SEI offers student information through 4 categories: Academic, Behavioral, Cognitive and Psychological. As well as, the scale *Students Engagement in School Four-Dimensional Scale* (SES-4DS) [47], consists of 20 items and offers information of students through 4 dimensions: Cognitive, Affective, Behavioral and Agentic. For the author, the 4 dimensions are essential elements to consider. However, the existing instruments for measuring academic engagement are not entirely satisfactory outside the Anglo-Saxon context [19].

1.4. The present study

Overall, after reviewing the current literature on this construct, it is necessary to design a specific instrument for the general measure of academic engagement in adolescents for varied reasons:

a) The existing instruments for measuring the construct are not entirely effective or satisfactory. Although there are different instruments that measure academic engagement in the Anglo-Saxon context, there is no consensus on an effective measure of it [19].
b) As evidenced by the review of measuring instruments of the academic engagement of [18], there are few instruments with adequate psychometric properties that measure this construct taking into account its multidimensional nature, and noted the internal inconsistency of the items used between the different measures.
c) There are no instruments that have been developed and validated considering the linguistic aspects that allow measuring academic engagement in Spanish-speaking population. The design of this instrument is essential to identify students who are losing motivation and interest in their studies. This loss of interest can be diagnosed thanks to the detection of observable and unobservable components. This instrument allows students who are in the transition stage between school cycles to be evaluated, offering a deeper measurement than other instruments that focus on separate stages [48].

In this sense, we are convinced that attention should be focused on a paradigm of thought in which adolescents assume an active role in the improvement of positive behavior towards school and their learning [26]. This means giving teens psychological tools, educational and personal attitudes that will enable them to succeed in their studies so that they can become more involved in their learning process and be able to face the challenges of school transition and adolescence.

From the above literature review, it is evident that, to date, there is a difficulty and diversity of instruments and models to measure academic engagement. Thus, the current study proposes as its main objective: design and validate a general evaluation instrument of academic engagement that encompasses the multidimensionality of the construct in its cognitive, affective-emotional and behavioral dimensions and take advantage of the most up-to-date findings in this area. Hence, the specific objectives are.

- To evaluate the validity of the content regarding the *General Scale of Academic Engagement for Spanish Adolescents* (CAADE).
- To evaluate the validity of the comprehension regarding the CAADE.
- To study the construct validity of the CAADE.

2. Methods

2.1. Participants and procedures

According to the recommendation of [49], to prevent problems associated with common method variance, it is necessary to have one sample for Exploratory Factor Analysis (EFA) and another sample for Confirmatory Factor Analysis (CFA). Consequently, we split our sample into two groups: the first group (n = 380) underwent the EFA, while the second group (n = 802) was utilized for CFA.

The sample of the first group was made up of 380 adolescents who are studying in public high schools of Almería (Spain) and whose ages range between 12 and 17 years (M = 14.09; SD = 1.32). Of the entire sample, 52 % (n = 185) were men and 48 % (n = 171) were women, with a mean age of 14.05 (SD = 1.37) and 14.13 (SD = 1.26), respectively. The sample of the second group was composed of 802 adolescents from high schools of Almería (Spain), aged 12 to 17 with a mean age of 13.65 years (SD = 1.24). According to gender, 50.6 % (n = 406) were girls and 49.4 % (n = 396) were boys, with average ages of 13.68 (SD = 1.14) and 13.63 (SD = 1.24), respectively. All in all, 27.4 % (n = 220) of these students study in first grade, 31.9 % (n = 256) study in second grade, 24.8 % (n = 199) study in third grade and 15.8 % (n = 127) study in fourth grade.

After obtaining informed consent from study participants, students completed a questionnaire anonymously and voluntarily. Control questions were part of the questionnaire to detect random or inconsistent responses, which caused the elimination of 24 questionnaires from the first group. Therefore, the final sample of the first group was composed of a total of 356 subjects, of which 32.58 % (n = 116) were in second year, 26.69 % (n = 95) were in first year, 23.31 % (n = 83) were in fourth year and the remaining 17.58 % (n = 62) were in third year. Finally, a total sample of 1158 adolescents were collected.

Prior to collecting the data, three heads of high schools were contacted with the request that teachers contribute to the procedure. Participants were guaranteed compliance with the rules of information, confidentiality and ethics in the processing of data. In addition, no personal information that could be used to identify participants would be requested, who could leave the research at any moment. It was also reported that the study was purely academic. The Bioethics Committee of the University of Almería (UALBIO2020/046) gave its approval to the study. Teachers of each group of students together with the researchers distributed the survey in person and manually to adolescents, who completed them voluntarily and individually. This study was conducted using convenience sampling. The first sample group conducted the study during the second and third weeks of June, that is, from 7 to June 17, 2022, and the second simple group conducted the study during the third and fourth weeks of September, that is, from 12 to September 22, 2022. Participants completed the questionnaires in approximately 25–30 min.

In compliance with the provided rights and guarantees, the data was collected and processed in accordance with EU Regulation 2016/679 and Organic Law 3/2018, of 5 December, on the Protection of Personal Information and Guarantee of Digital Rights.

2.2. Development of the instrument

The literature review phase was the initial step. During this phase, a search was conducted for instruments that were utilized in preliminary research on the topic of academic engagement in an adolescent population. The search's aim was to acquire various tools to explore how the academic engagement of adolescents has been evaluated. Databases were used to identify and compile theoretical approaches and measurement tools that could contribute to the development and formulation of questionnaires [1,18,22,50]. Then, a map of the construction was prepared. The initial point is to focus on the definition that is most frequently used and the dimensions that relate to it in the literature (cognitive, affective-emotional and behavioral). Based on this information, the next step was to write a wide range of items (120 items in total), which would allow proper debugging throughout the analyses, with a Likert four-point scale (1 = never, 2 = sometimes, 3 = many times, 4 = always). The questionnaire was designed to be self-reported, so the items were written in first person.

A panel of 7 experts in research and education used the Delphi technique to revise the first version of the questionnaire and ensure the content's validity. A table designed for this purpose was utilized by the experts, which indicated the dimensions to which each item was assigned based on its content and the clarity of its wording. Furthermore, they had the freedom to propose improvements. Only those items that were deemed "well expressed" and included in the same dimension by 5 out of 7 experts were included. At the same time, in order to evaluate the understanding of the items, two discussion groups were formed by 16 students of similar characteristics to those that would make up the final sample of secondary education. This process made it possible to eliminate or modify confusing or

inappropriate items that complicated understanding in students. Finally, the result of these analyses resulted in the reduction to 108 items of the initial 120.

The result section of this manuscript provides a detailed description of the validation and reliability processes carried out in this tool, with the goal of creating a reliable and valid instrument for evaluating academic engagement.

2.3. Analysis of data

The different data analyses were performed thanks to the statistical program SPSS, version 27 for Windows and the program AMOS 22 (IBM, Chicago, IL, USA).

To check the quality of the developed instrument, the recommendations of [51] were followed, submitting the CAADE to several preliminary analyses (EFA) and CFA with two samples. For factor analysis, it is generally acceptable to have a sample-to-variable ratio of more than 300 cases [52]. The larger sample can be utilized for item evaluation and scale construction, while the smaller sample can be utilized for cross-validation. Hence, the first sample (n = 356) was used in EFA and the second sample (n = 802) in CFA. The survey was designed to measure a multidimensional construct composed of three dimensions. To investigate the possible factor structure of a set of observed variables, EFA was employed in SPSS 27, without imposing any preconceived structure on the outcome. Sample 1 was permitted to identify the underlying factor structure through an EFA (n = 356). By examining all of the items, we can determine the number of latent factors that support academic engagement. Maximum likelihood was the extraction method used in the first analysis, and the extracted factors were rotated with Promax rotation, considering components with eigenvalues greater than 1, items with commonalities exceeding 0.40, and factor loading exceeding 0.50. On the basis of the EFA two models were proposed that could be plausible from the review of the literature: a) Model 1: Academic engagement is formed by items that correspond to the cognitive, affective and behavioral dimensions in a correlated way (model of three correlated factors) and b) Model 2: Academic engagement consists of the three expected factors (cognitive, affective and behavioral), but without differentiating in them (unifactorial model). The second step was to extract a more appropriate factor structure from the new data set after performing the EFA. In order to determine if the exploratory factor structure fits the data, a Maximum Likelihood (AMOS 21) was used in sample 2 (n = 802) in the second stage. Generally, extraction methods such as maximum likelihood and principal axis factoring are recommended. CFA of the proposed engagement models allowed to determine construct validity. In this model, a principal component analysis was used as an extraction method, and the extracted factors were rotated using Promax rotation, taking into account the following adjustment indices as measures [53]: χ^2/df, Tucker-Lewis Index (TLI), Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), with a confidence interval (CI) of 90 %. The χ^2/df was employed, taking into account values below five [54], a CFI and IFI above or near 0.90 and an RMSEA below or very near to 0.08 to be acceptable. In general, the model fit well when: The 2/DF ratio $\leq$5; GFI, AGFI and TLI >0.90; CFI >0.90; and RMSEA $\leq$0.06. Finally, Cronbach's Alpha (α) was used to examine the reliability of the items in each factor. This validation assures that the scale is accurate in its measurement.

3. Results

3.1. Preliminary analysis

After the expert panel made decisions on the validation of the questionnaire's content, the pilot study was conducted to enhance comprehension validity. During the piloting, there were no difficulties detected.

First, descriptive statistical analyses (M, SD, skewness and kurtosis) were performed (Table 1). According to the data, the scale's

Table 1
Descriptive statistics of the calibration sample (n = 356). SD: Standard Deviation.

Dimensions	Items	M	SD	Skewness		Kurtosis	
				Statistic	Standard error	Statistic	Standard error
Cognitive (COG)	Enga3	2.28	1.046	.288	.129	−1.103	.258
	Enga6	2.66	.969	−.122	.129	−.983	.258
	Enga15	2.62	.934	−.053	.129	−.891	.258
	Enga9	2.42	.994	.148	.129	−1.013	.258
	Enga17	2.62	.940	−.024	.129	−.926	.258
	Enga12	2.63	.908	−.023	.129	−.837	.258
Affective-Emotional (EMO)	Enga2	2.62	.859	.091	.129	−.737	.258
	Enga5	2.56	.909	−.023	.129	−.798	.258
	Enga8	2.74	.913	−.068	.129	−.948	.258
	Enga11	3.01	.904	−.587	.129	−.478	.258
	Enga14	2.88	.924	−.324	.129	−.855	.258
	Enga16	2.90	.939	−.322	.129	−.948	.258
Behavioral (COND)	Enga1	3.06	.825	−.382	.129	−.778	.258
	Enga10	2.86	.832	−.140	.129	−.787	.258
	Enga7	3.21	.839	−.650	.129	−.661	.258
	Enga4	2.85	.896	−.199	.129	−.908	.258
	Enga13	2.95	.929	−.478	.129	−.711	.258

distribution of items is within the normal limits, following the criteria of [55], for whom 2 and 7 are the maximum permitted values for skewness and kurtosis. It could therefore be confirmed that the skewness and kurtosis of each item were acceptable.

3.2. Exploratory Factor Analysis (n = 356)

The EFA carried out with the 108 items obtained after the results of the expert and adolescent discussion groups showed favorable indicators in relation to sample adequacy (KMO = 0.91) and as regards the presence of correlations necessary for a factor analysis (Bartlett sphericity test with p < .01). The EFA results showed that some items had a saturation lower than 0.40 in all factors, and others had factor loads greater than 0.40 in more than one factor, which were progressively eliminated one by one. Then, we analyzed the items that showed saturation in factors other than the dimension for which they were created, eliminating them one by one. Altogether, this process involved the realization of 19 EFAs for the purification of the factorial structure. Finally, the final version of these analyses was configured by 17 items grouped into three factors: cognitive (6 items), affective (6 items) and behavioral (5 items) (Table 1; Appendix 1 and 2). Furthermore, the CFA is possible due to its adequate reliability, both in terms of the factors and the entire instrument.

The EFA performed with the final 17 items used for the extraction of the main components with rotation Promax <.70 (KMO = 0.91) and is significant Bartlett χ^2 ($\chi^2_{(136)}$ = 2149.79, p < .000), based on the EFA of the suggested theoretical model for the general construct of academic engagement for adolescents (Table 1). The eigenvalues obtained and the screen test were used to extract three factors. Three factors, with eigenvalues ranging from 6.17 to 1.41, are adequate for rotation as demonstrated by the Scree Plot, which distinguishes them from the fourth factor, which has a score of 0.93 (Fig. 2). The existence of these three factors was confirmed through a parallel analysis (PA) conducted using SPSS.

Afterwards the factor analysis, items with factor saturation above 0.40 from the matrix of rotating components (Promax Rotation) were selected. Factor 1 refers to items that include the Cognitive component in the scale. Factor 1 integrates six items, all with a weight above 0.40, demonstrating 36.28 % of the variance. Factor 2 integrates six items that make up the Affective-Emotional component and show 9.28 % of the variance. Factor 3 is made up of five items, and shows 8.30 % of the variance, corresponding to the Behavioral component. In general, all items have scores above 0.40 and justify 53.86 % of the variance (Table 2).

3.3. Confirmatory Factor Analysis (n = 802)

For the purpose of analysing the internal structure, a CFA was performed as it provides the acceptable statistical framework in which to study the validity and reliability of each item, rather than studying them globally. Thus, CFAs were performed to test the two plausible models of academic engagement for the 17 selected items, that is, the first model tested whether academic engagement is configured in three correlated factors and, the second model, if set to a single factor.

According to the results obtained from the CFA, the second model that conceived academic engagement as a single factor was not confirmed. While the first model proposed, composed of three factors and coincides with what was found in the exploratory analysis and the theoretical evidence, submitted good levels of adjustment. In other words, it made it possible to examine the relationship between the dimensions of academic engagement (Cognitive, Emotional and Behavioral), and also establish a global score of engagement (Table 3). Accordingly, the three-factor model was selected to correlate for better adjustment indices. The
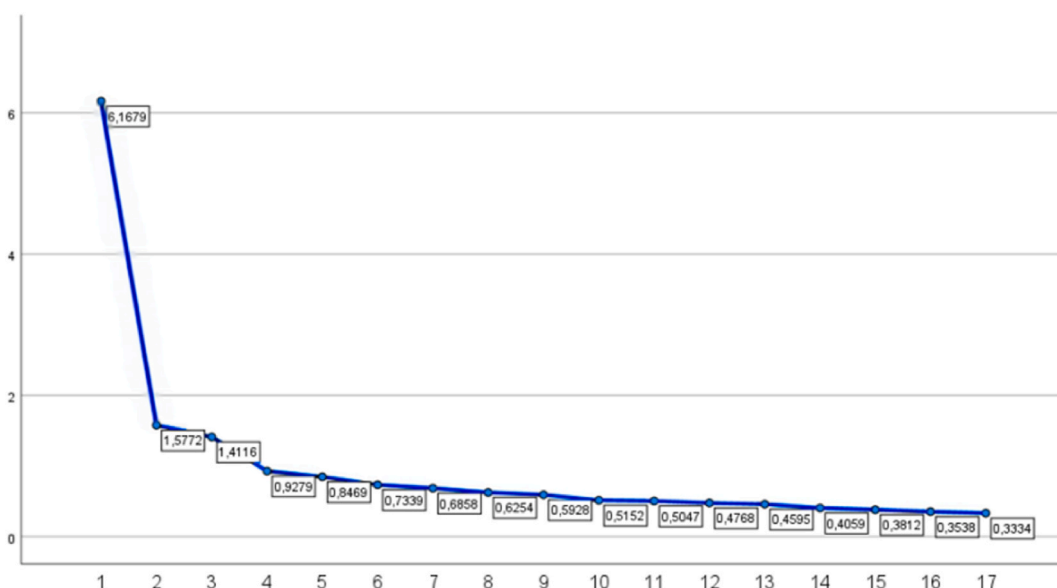

Fig. 2. Scree Plot for the factor analysis of the scale, according to the suggested theoretical model.

Table 2

Factor structure, Cronbach's alpha, communalities (h^2) and percentage of the explained variance (n = 356). Rotation method: Promax with Kaiser normalization.

Items	F1	F2	F3	h^2
Item 9. I set a schedule to carry out my responsibilities	.817			.633
Item 6. In general, I plan my time on my own initiative	.765			.573
Item 3. I set a schedule to perform my tasks on my own initiative	.738			.542
Item 17. I organize/plan my work	.673			.601
Item 12. I think about how best to plan my time	.638			.557
Item 15. I reorganize my tasks in case of unforeseen events	.429			.483
Item 8. I enjoy fulfilling my responsibilities		.757		.556
Item 14. I like to fulfill my obligations		.748		.594
Item 16. I am satisfied with my work		.724		.586
Item 11. I feel good when I take on my responsibilities		.718		.545
Item 5. I am motivated to fulfill my obligations		.640		.534
Item 2. I'm interested in the work I have to do		.473		.494
Item 1. In general, I fulfill my duties and obligations			.803	.652
Item 4. I'm punctual about my duties			.715	.551
Item 10. I fulfill all the required tasks			.711	.643
Item 7. I meet the established standards			.699	.449
Item 13. In general, I behave well			.490	.463
Percentage of explained variance	36.282	9.278	8.303	
Kaiser-Meyer-Olkin	.907			
Bartlett's sphericity	$\chi^2_{(136)} = 2149.794, p < .000$			
Cronbach's alpha	.827	.809	.757	.897

Note: The items are enumerated in decreasing order of saturation. Visualization coefficient >0.40. F1: Cognitive; F2: Emotional; F3: Behavioral.

multidimensionality hypothesis of the construct can be supported by this model as it provides a reasonable approximation to the data.

Fig. 3 explains the model characteristics of three correlated factors, incorporating the correlations between the factors and the standardized factor saturations of the items in the membership factors. As seen in the figure, the three factors relate to each other in a coherent manner and they are well differentiated. The correlation between the cognitive and affective-emotional factor was 0.67, between the affective and behavioral factor of 0.74 and between the behavioral and cognitive factor of 0.62. This can be seen as evidence of the research instrument's internal consistency.

Abbreviations: CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; TLI = Tucker-Lewis Index; CI = Confidence Interval; df = Degrees of Freedom.

Then, the consistency of the items used in the assessment of the same subject was determined through the examination of convergent validity [56]. Standardized factor saturations ranged from 0.41 to 0.74, which was greater than 0.40. Furthermore, the Composite Reliability (CR) and Average Variance Extracted (AVE) of each dimension in the CFA were assessed (Table 4). Despite AVE was below 0.50, could be taken into account, because CR is over 0.70 [57], which could give support to retain factors.

3.4. Internal consistency

Cronbach's alpha coefficient (α), which is the most commonly used index to calculate instrument reliability, was used to calculate reliability. The instrument's overall reliability was acceptable (α = 0.888). Specifically, reliability for each of the dimensions was: cognitive (α = 0.827), affective (α = 0.809) and behavioral (α = 0.757) (Table 2). All in all, it can be considered that the scale is adequate [56].

4. Discussion

The need to reach a consensus on the concept of academic engagement has been reported by several studies, with the objective of facilitating its development and adequate measurement in the educational field [18,19]. In this respect, previous studies have concluded that academic engagement is built on the development of certain positive attitudes towards school that allow students to learn and achieve success in their studies and thus, avoid negative emotional responses associated with the levels of anxiety and stress that adolescents are subjected to Refs. [13,25].

From the results found in this study, it can be evidenced that there is an instrument that appropriately measures academic

Table 3

Results of the CFA according to the two models proposed (N = 802).

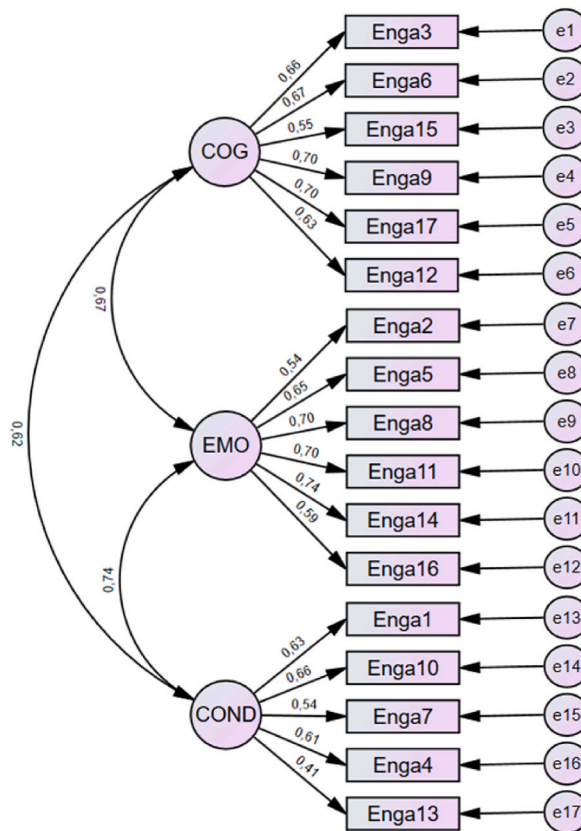| Model	$\chi^{2 (df)}$	$\chi^{2/df}$	p	CFI	TLI	RMSEA	CI90 %	
							Lower	Upper
1. Model of three correlated factors	482.170 (116)	4.157	0.000	0.915	0.900	0.063	0.057	0.069
2. Single-factor model	1017.437 (119)	8.550	0.000	0.791	0.761	0.097	0.092	0.103

Fig. 3. Standardized estimated parameters of the academic engagement model with three correlated factors (N = 802). Note: The item numbers refer to the items shown in Table 2. COG= Cognitive dimension; EMO = Emotional dimension; COND= Behavioral dimension.

Table 4
CR and AVE of each dimension in the CFA.

Dimensions	Average Variance Extracted	Composite Reliability
F. Cognitive	0.43	0.81
F. Emotional	0.43	0.84
F. Behavioral	0.33	0.77

engagement. First, the results show the existence of three clear and coherent dimensions in terms of their content and psychometric properties: cognitive, affective-emotional and behavioral dimensions, in line with the studies of [3,22,26,27]. Thus, the results obtained from the factorial analyses made it possible to properly identify a structure of three correlated factors. The implications of these results allow the study of academic engagement in a global way. Thus, the proposed model of three correlated factors explains that cognitive, affective and behavioral are highly related and allow the use of the global measure of academic engagement for studies that lend greater interest in analyzing in general the implications of academic engagement with other variables.

Given the reliability of the scale, the instrument designed and validated with academic engagement shows an adequate internal consistency in the overall scale and in each of the dimensions that compose it. In addition, as previously mentioned, the use of this tool offers reliable indicators that allow educational communities and teachers to identify students with low levels of academic engagement and, consequently, at risk of school dropout; with the aim of helping those who need guidance and greater support, as well as those who attend school, but are progressively losing motivation in their learning process [1,9]. Thus, those students who score significantly lower on the scale could indicate disengagement or lack of involvement in education [5]. These scores would allow us to know in which dimensions more attention is needed. On the other hand, those students who score significantly higher on the scale could indicate a higher probability of having a successful academic career.

In this sense, the new CAADE scale can be a tool of easy administration and codification to address the measure of academic engagement, which can favor students, but also educational centers. On the one hand, students can develop those essential attitudes to engage academically and develop positively, thus avoiding risky behaviors [24,28,30]. On the other hand, schools have the opportunity to identify the needs of students, focus their efforts on adolescents whose engagement levels are low and decide on the most appropriate intervention programs [4].

5. Conclusions

This review led to the conduct of content validity, construct validation, expert judgment validity and reliability analyses, with the instrument CAADE achieving positive results. According to the validation system for CAADE, documents reported in the scientific literature were filtered and analyzed to define the dimensions of the instrument. Each item's concordance index could be adjusted based on the criteria of clarity, relevance, and coherence with the help of the Delphi method, maximizing the instrument through the evaluations of experienced researchers in the field. Positive construct validity values were obtained, supporting the relevance of the EFA. Positive values were found in the community analysis and principal component analysis, along with the fact that the factor structure was adequately explained. In all cases, the correlations between the dimensions were positive, and the factor weight for each dimension indicated the suitability of each item in its respective dimension. In conclusion, the instrument's reliability analysis using Cronbach's alpha yielded satisfactory results for both overall reliability and all the dimensions that compose it.

A reliable and validated instrument for evaluating academic engagement was generated as part of this study, which provides practical implications related to its added value and prospective. The scientific literature on academic engagement has been increased by this study on a theoretical level, a very broad and diverse field of research. In this way, this instrument encompasses the multi-dimensionality of this construction, allowing us to evaluate in a global way the academic engagement of adolescents of the Spanish-speaking population. The end of this study is to create an instrument that has two purposes on a practical level. On the one hand, it will promote the advancement of research on academic engagement in adolescents as a global construction. This tool will measure the benefits of intervention programs aimed at developing essential attitudes for students to engage academically. On the other hand, the design of this questionnaire allows for effective assessment of such actions. A tool has been created that provides a comprehensive viewpoint by covering a large spectrum of dimensions, which are most in demand among the research and educational communities. As a result of this study, a comprehensive assessment tool has been created that can be utilized by educators and institutions interested in this field. Considering the previous ideas, enhancing academic engagement of adolescents may lead to prevent early dropout.

Among the limitations of this study, it should be noted the need to consider other variables associated with an academic engagement that allow its study in a more intelligible way. As mentioned, academic engagement is a construct associated with personal and contextual variables. Therefore, as future lines of research, it would be interesting to conduct studies that measure academic engagement from the student's perception and add information on contextual variables that could influence the academic engagement scores of adolescents, in order to intervene and reduce the risk of dropout. In addition, another limitation of this study is the contextual limitation caused by generalizing the results, as well as the exploratory phase of the research field. Particularly, the research's contextual limitations are the result of the questionnaire's initial validation in a Spanish context and adolescent population. Hence, to guarantee its valid and reliable psychometric properties, the tool is limited to this group. The opportunity for future research has been created by this contextual limitation, which aims to translate and adapt to other contexts to enhance the tool's internationalization and aid in the study of academic engagement in diverse regions and cultures.

Additional information

No additional information is available for this paper.

Data availability statement

The data that has been used is confidential because the authors do not have permission to share data.
The data associated with this study have not been deposited in any public repository.

CRediT authorship contribution statement

Begoña María Tortosa Martínez: Conceptualization, Formal analysis, Investigation, Methodology, Validation, Visualization, Writing – original draft, Writing – review & editing. **María del Carmen Pérez-Fuentes:** Formal analysis, Methodology, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix 1

Appendix 1

CAADE questionnaire in its original language for the Spanish context.

Ítems	Nunca	Algunas veces	Bastantes veces	Siempre
1. En general, cumplo con mis deberes y obligaciones	1	2	3	4
2. Estoy interesado/a por el trabajo que tengo que hacer	1	2	3	4
3. Establezco un horario para realizar mis tareas por iniciativa propia	1	2	3	4
4. Soy puntual en lo que respecta a mis obligaciones	1	2	3	4
5. Me siento motivado/a para cumplir con mis obligaciones	1	2	3	4
6. En general, planifico mi tiempo por iniciativa propia	1	2	3	4
7. Cumplo las normas establecidas	1	2	3	4
8. Disfruto al cumplir con mis responsabilidades	1	2	3	4
9. Establezco un horario para llevar a cabo mis responsabilidades	1	2	3	4
10. Cumplo con todas las tareas exigidas	1	2	3	4
11. Me siento bien cuando asumo mis responsabilidades	1	2	3	4
12. Pienso cómo planificar mi tiempo de la mejor manera posible	1	2	3	4
13. En general, me comporto bien	1	2	3	4
14. Me agrada cumplir con mis obligaciones	1	2	3	4
15. Reorganizo mis tareas ante imprevistos	1	2	3	4
16. Me siento satisfecho/a con mi trabajo realizado	1	2	3	4
17. Organizo/planifico mi trabajo	1	2	3	4

Appendix 2

CAADE questionnaire in English for the Spanish context.

Ítems	Never	Sometimes	Enough times	Always
1. In general, I fulfill my duties and obligations	1	2	3	4
2. I'm interested in the work I have to do	1	2	3	4
3. I set a schedule to perform my tasks on my own initiative	1	2	3	4
4. I'm punctual about my duties	1	2	3	4
5. I am motivated to fulfill my obligations	1	2	3	4
6. In general, I plan my time on my own initiative	1	2	3	4
7. I meet the established standards	1	2	3	4
8. I enjoy fulfilling my responsibilities	1	2	3	4
9. I set a schedule to carry out my responsibilities	1	2	3	4
10. I fulfill all the required tasks	1	2	3	4
11. I feel good when I take on my responsibilities	1	2	3	4
12. I think about how best to plan my time	1	2	3	4
13. In general, I behave well	1	2	3	4
14. I like to fulfill my obligations	1	2	3	4
15. I reorganize my tasks in case of unforeseen events	1	2	3	4
16. I am satisfied with my work	1	2	3	4
17. I organize/plan my work	1	2	3	4

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