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Academic Procrastination Scale-Short (APS-S): psychometric validation of the Spanish version in Honduran undergraduate students

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Abstract

Background Academic procrastination is a common self-regulatory failure among university students, negatively affecting academic performance and psychological well-being. Despite its relevance, there is a lack of validated tools to assess this construct in Central American contexts. This study evaluated the psychometric properties of the Academic Procrastination Scale – Short (APS-S) in Honduran undergraduate students.

Methods A total of 791 university students participated in a cross-sectional survey. After excluding 34 cases flagged as insufficient effort/careless responding (IE/C), the final analytic sample comprised 757 students. The psychometric evaluation included confirmatory factor analysis, internal consistency estimates (Cronbach's alpha and McDonald's omega), item-level analysis, differential item functioning (DIF), and associations with external variables (self-esteem, conscientiousness, sex, and age).

Results The APS-S demonstrated a unidimensional structure with excellent fit in the congeneric model. Factor loadings were high and homogenous, and internal consistency was strong ($\alpha=0.85$; $\omega=0.85$). No substantial DIF was found across sex or age. The scale showed significant associations with self-esteem and, particularly, conscientiousness. The detection and exclusion of IE/C responses enhanced the internal validity of the findings, with prevalence rates of IE/C aligning with prior studies.

Conclusions The APS-S is a reliable and valid instrument for measuring academic procrastination in Honduran university students. Its application may support future research and inform tailored interventions. This study contributes to the growing body of cross-cultural validation literature and highlights the importance of addressing response biases in self-report assessments.

Keywords Academic procrastination, Personality, Self-esteem, Validity, Measurement invariance, Structural equations modeling, Higher education, Innovational education

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Introduction

Procrastination refers to the voluntary and unnecessary delay in initiating or completing planned tasks within a specific timeframe, even when individuals recognize that such delay is contrary to their best interests [1, 2]. It is commonly conceptualized as a self-regulation failure associated and has been associated with a wide range of adverse outcomes [3]. Prior research has linked procrastination to unhealthy behaviors [4], stress [5], anxiety [6], depression [7], poor sleep quality [8], and lower subjective well-being [9]. While some individuals, often described as chronic procrastinators, tend to procrastinate across most life domains, others display this behavior primarily in specific contexts, such as work or academic settings [10].

Within educational settings, academic procrastination (AP) is defined as the intentional and unnecessary delay in completing academic tasks [11]. Procrastination appears particularly prevalent in academic environments, with reported rates up to three times those in the general population [12]. It is estimated that approximately 90% of university students procrastinate for at least one hour per day [13]. Academic procrastination has been associated with several adverse academic outcomes, including increased dropout intentions [14], academic dishonesty [15], lower academic engagement [16], and reduced academic motivation [17]. Most notably, it has been consistently linked to lower academic performance [18–20].

The high prevalence of procrastination and its adverse consequences underscore the importance of understanding the factors that contribute to students' delay in task completion. In Latin American contexts, these factors may manifest differently than in non-Latin American settings due to distinct cultural, social, and economic characteristics [21]. Although academic procrastination has been examined in several Latin American countries in recent years [22–24], to the best of our knowledge, no studies have specifically investigated this behavior among university students in Honduras. Moreover, no validated instruments are currently available to assess academic procrastination in this population. This lack of validation studies limits researchers' and practitioners' ability to examine how cultural and social factors shape the prevalence and expression of academic procrastination across contexts [25–28].

Despite growing interest in academic procrastination, relatively few instruments have been developed specifically to assess this construct. As a result, many studies rely on general procrastination measures that either lack items tailored to academic contexts or include only a small number of academically relevant items [12, 29]. For example, widely used instruments such as the Tuckman Procrastination Scale [30] assess procrastination using predominantly general items. Similarly, the General

Procrastination Scale [31] includes only four academically relevant items out of a total of 20.

To address the need for a domain-specific measure, McCloskey [32] developed the Academic Procrastination Scale (APS), a 25-item unidimensional self-report instrument, using a sample of 681 undergraduate students. Although the APS demonstrated adequate psychometric properties, the presence of redundant items led to the development of a five-item short form, the Academic Procrastination Scale–Short (APS-S), based on item-total correlations exceeding 0.70. Yockey [29] subsequently validated the APS-S in a sample of U.S. college students, reporting good internal consistency ($\alpha=0.87$) and evidence of convergent validity with other procrastination measures, including the Tuckman Procrastination Scale [30] and the Procrastination Assessment Scale–Students [33]. Since then, the APS-S has been validated in several cultural contexts, including university students in Spain [34], Turkey [35], and Brazil [36], as well as among Spanish children and adolescents [37].

Although existing evidence suggests that the APS-S exhibits promising psychometric properties, several important gaps remain. Key findings from prior validation studies are summarized in Table 1. These studies reveal notable methodological and conceptual limitations that the present research aims to address. While most investigations have reported basic distributional statistics (e.g., means, standard deviations, skewness, and kurtosis), relatively few have examined more detailed psychometric properties that would clarify each item's contribution to the construct. For instance, limited attention has been given to associations with external variables or to the efficiency of response options [38]. Moreover, with only two exceptions [36, 39], most studies relied on maximum likelihood estimation. This method is susceptible to violations of normality and may lead to biased parameter estimates and standard errors.

In addition, none of the reviewed studies assessed the prevalence of insufficient effort or careless responding (IE/C), a response pattern known to introduce irrelevant variance and distort statistical and psychometric estimates [40, 41]. This issue is particularly relevant in student learning contexts [42]. Another concern involves the widespread reliance on Cronbach's alpha for reliability estimation, despite its restrictive assumptions, such as tau-equivalence. Many studies have not justified the use of alpha over more flexible reliability coefficients suitable for congeneric models, which allow factor loadings to vary [43]. Comparing alpha and omega coefficients may therefore provide a more theoretically appropriate assessment of internal consistency for the APS-S. Finally, although some studies have examined measurement invariance, these analyses have typically been limited to gender as the sole grouping variable.

Table 1 Summary of validation studies using the Academic Procrastination Scale-Short (APS-S)

	Country (n)	Item analysis	Group equiv.	Reliability	Retest	Dimensionality	Response bias
Yockey, 2016 [29]	USA (282)	N.R.	N.R.	α : 0.87	N.R.	PCA	N.R.
Chakraborty & Chechi, 2019 [117]	India (97)	Partial	N.R.	GLB=0.62	N.R.	CFA: ML	N.R.
Brando-Garrido et al., 2020 [34]	Spain (178)	Partial	No	α = 0.87	$r=0.89$	CFA: ML	N.R.
Balkis & Duru, 2022 [35]	Turkey (970)	Partial	Sex: Scalar	α = 0.88	N.R.	CFA: ML	N.R.
Alegre Bravo et al., 2022 [39]	Peru (4534)	Partial	Sex: Strict	ω = 0.84	N.R.	CFA: WLSMV	N.R.
Karla Silva Soares et al., 2022 [36]	Brazil Study 1: (384) Study 2: (857)	Partial	N.R.	Study 2: ω = 0.76	N.R.	Study 1: EFA: RDWLS Study 2: CFA: DWLS IRT: GRM	N.R.
(Rasyid et al., 2023) [95]	Indonesia (452)	N.R.	N.R.	α = 0.86	N.R.	CFA: N.R.	N.R.

N.R. not reported, α Cronbach's alpha, ω omega, PCA principal component analysis, CFA confirmatory factor analysis, ML maximum likelihood, IRT item response theory, GLB greatest lower bound, EFA exploratory factor analysis, WLSMV weighted least squares with mean and variance adjustment, DWLS diagonally weighted least squares, RDWLS robust diagonally weighted least squares, GRM graded response model

Building on these psychometric considerations, various studies have examined the relationship between academic procrastination and personality traits within the Five-Factor Model. For example, van Eerde [44] reported significant correlations between procrastination and all five personality traits, with conscientiousness showing the strongest negative relationship ($r = -0.65$). Subsequent studies have replicated these findings [45–47], consistently indicating that students with a higher level of conscientiousness tend to procrastinate less. In contrast, academic procrastination has also been found to be negatively associated with self-esteem [35, 48–51].

The present study

It may be problematic to assume that an instrument developed for a culturally distinct population is equally appropriate for use in new contexts [52], a practice often described as an inappropriate induction of measurement validity [38, 53, 54]. For instance, the mere translation of the APS-S into Spanish [34] does not assure its validity and reliability across all Spanish-speaking contexts, given the considerable geographic and sociolinguistic variation within the language [55]. Moreover, the growing body of cross-cultural research underscores the importance of using psychometrically sound instruments validated across diverse cultural and linguistic settings [56, 57].

Although the original APS-S and its adaptations have consistently supported a unidimensional factor structure, international guidelines on test adaptation emphasize the need to reevaluate an instrument's structure when it is applied in new cultural contexts to ensure cross-version equivalence [58–60]. Furthermore, researchers often assume that psychological tests function equivalently across subgroups such as sex, age, or socioeconomic status [61]. However, this assumption requires empirical verification through measurement invariance testing, which examines whether an instrument is calibrated equivalently across groups [62, 63].

Given the limitations identified in previous validation studies, several research gaps remain that may restrict the generalizability of existing findings to new populations. Accordingly, the present study aims to examine the psychometric properties of the APS-S in a sample of university students in Honduras. This research contributes at both local and intercultural levels. At the local level, validating a measure of academic procrastination enables the estimation of prevalence rates and the identification of associated factors, which is particularly important given the scarcity of validated psychological instruments in Honduras. From an intercultural perspective, data from Honduran students can be incorporated into cross-cultural comparisons, contributing to the evaluation of the construct's potential etic properties. Additionally, by addressing the limited availability of item-level information, the absence of analyses of insufficient-effort responding, and the restricted evidence on group invariance, this study provides a more comprehensive psychometric evaluation of the APS-S, thereby filling critical gaps in the existing literature.

Based on these objectives, the following hypotheses were formulated regarding the psychometric validation of the APS-S in a university student population:

- H1. The APS-S will exhibit a unidimensional structure, consistent with prior research supporting a single-factor measurement model (see Table 1).
- H2. The internal consistency of the APS-S will be high ($\alpha > 0.85$). A recent reliability generalization meta-analysis reported a global reliability estimate of $\alpha = 0.89$ for the APS-S [64], which is used here as a reference while acknowledging potential sampling variability.
- H3. Measurement invariance will be supported across sex groups (i.e., male and female students).
- H4. APS-S scores will be negatively associated with self-esteem and conscientiousness. Previous studies

consistently indicate that academic procrastination covaries negatively with these constructs [44, 51, 65], and a similar pattern is expected in the present sample.

H5. Associations between APS-S scores and time spent on the internet or mobile phone will be weak or nonsignificant. In line with the scale validation objective, these variables were considered as potential academic distractors. Although both behaviors have been linked to procrastination in prior research [23, 66, 68], they have typically been examined within a problematic-use framework characterized by excessive and persistent engagement. In contrast, the present study adopts a dimensional approach, examining their associations with APS-S scores without assuming pathological use.

Materials and methods

Study design and participants

This cross-sectional study was conducted using an online survey administered between May and June 2023 at a public university in Honduras. A non-probability convenience sampling strategy was employed, based on researcher access and logistical feasibility. The target population comprised undergraduate students across all academic semesters. Eligible participants were enrolled at the Universidad Pedagógica Nacional Francisco Morazán, a key institution within the national education system. Notably, this university is the only public higher education institution in Central America dedicated exclusively to the training of teachers and educational

administrators at all academic levels. It serves a substantial proportion of students from Indigenous backgrounds and is widely recognized for offering some of the most affordable tuition rates in the country. Inclusion criteria required participants to be currently enrolled university students, physically present at the time of data collection, 17 years of age or older, and willing to provide informed consent.

Participants were excluded if they declined to participate voluntarily or were identified as providing insufficient effort or careless responses. A total of 791 students participated in the study. The sample had a mean age of 26.9 years ($SD=5.8$; range=17–64) and was predominantly female (see Table 2). The sample size was determined based on considerations of maximum variability and parameter stability, following recommendations by Wolf et al. [69]. Given that the present study included more than 700 participants, the stability of the estimated parameters can be considered adequate. As noted by Wolf et al. [69], determining a minimum sample size is highly context-dependent and cannot be generalized from simple rules of thumb or simulation studies based on a limited range of conditions.

The survey link was distributed in class by course instructors; however, because classroom attendance varied and the link could be further shared among students, the exact number of individuals who received the invitation is unknown. Consequently, it was not possible to calculate a valid response rate for this study.

Instruments

Sociodemographic questions

The initial section of the questionnaire collected basic demographic data to characterize the sample. Participants were asked to report their age and sex and provide proxy estimates of daily smartphone and internet use, both measured using four-point ordinal scales. These variables were included to describe the sample composition and explore potential associations with academic procrastination.

Academic Procrastination Scale-Short (APS-S)

The Spanish version of the Academic Procrastination Scale-Short (APS-S), adapted by Brando Garrido et al. [34], consists of five items designed to assess the tendency to delay academic responsibilities. Respondents rate their agreement with each item on a 5-point Likert scale, ranging from 1 (total disagreement) to 5 (total agreement). An example item is: "I put off projects until the last minute." Total scores range from 5 to 25, with higher scores reflecting greater levels of academic procrastination. The instrument has shown adequate psychometric properties. Yockey [29] validated the APS-S in a sample of U.S. undergraduate students, reporting an

Table 2 Demographic characteristics of the participants ($n=791$)

	<i>n</i>	%	Sex differences
Sex			
Male	180	22.7	
Female	611	77.2	
Daily Internet use			
Less than 1 h	31	3.9	$W=51,011^{ns}$
1 to 2 h	144	18.2	$r=-0.07 (-0.17, 0.02)^a$
3 to 4 h	192	24.2	
More than 4 h	424	53.6	
Daily smartphone use			
Less than 1 h	46	5.8	$W=55,120^{ns}$
1 to 2 h	132	16.6	$r=0.00 (-0.09, 0.10)^a$
3 to 4 h	192	24.2	
More than 4 h	421	53.2	
	<i>M</i>	<i>SD</i>	
Age	26.29	8.02	$W=56,390^{ns}$ $r=0.03 (-0.07, 0.12)^a$

W Wilcoxon signed-rank test statistic, *r* rank-biserial correlation coefficient

^a 95% confidence interval; ^b Statistical test and effect size

^{ns} $p > 0.10$

internal consistency of $\alpha=0.87$ and significant correlations with the Tuckman Procrastination Scale ($r=0.79$, $p<0.001$) and the Procrastination Assessment Scale—Students ($r=0.54$, $p<0.001$), supporting its convergent validity.

Big Five Inventory-2–Short Form – Conscientiousness (BFI-2-S-CON) [70]

The conscientiousness dimension was assessed using the conscientiousness subscale from the BFI-2-S. The Spanish version validated by Gallardo-Pujol et al. [71] was employed. This self-report scale consists of six items—three positively worded (items 4, 9, and 11) and three negatively worded (items 17, 23, and 25)—rated on a 5-point Likert-type scale ranging from 1 (Strongly disagree) to 5 (Strongly agree). In the present sample, the model showed acceptable fit indices (χ^2 using the Unweighted Least Squares with Mean and Variance adjusted estimator [ULSMV- χ^2]=127.28, degrees of freedom [df]=9; Comparative Fit Index [CFI]=0.944; Standardized Root Mean Square Residual [SRMR]=0.088). All factor loadings exceeded 0.50 (item loadings: 0.57, 0.64, 0.62, 0.68, 0.63, 0.66), and internal consistency was $\omega=0.765$.

Brief Rosenberg Self-Esteem Scale – Positive Items (BRSES) [72]

General self-esteem was measured using the Spanish version of the Rosenberg Self-Esteem Scale, adapted by Gómez Lugo et al. [73]. Although the original 10-item model demonstrated acceptable fit in the present sample (ULSMV- $\chi^2=343.85$, $df=35$; CFI=0.987; SRMR=0.091; $\omega=0.871$), only the five positively worded items (1, 3, 5, 7, and 10) were retained. This decision was based on concerns about method effects in previous dimensionality studies [74, 75] and is consistent with the brief positive-item version proposed and validated by Monteiro et al. [75], who demonstrated that focusing exclusively on positively worded items yields a psychometrically sound, parsimonious, and concise measure of self-esteem presence. In addition, the absence of prior validation studies in Honduran populations supported the use of this more conservative approach. The resulting model showed excellent fit (ULSMV- $\chi^2=13.27$, $df=9$; CFI=0.999; SRMR=0.029) and high internal consistency ($\omega=0.905$), with factor loadings ranging from 0.79 to 0.90.

Hours of daily smartphone use

A proxy measure was developed to estimate students' average daily smartphone usage. Responses were captured on a four-point ordinal scale: Less than 1 h, 1–2 h, 3–4 h, and More than 4 h. This format aimed to ensure consistency with other self-report measures in the survey. The use of ordinal categories to assess smartphone

use has also been applied in previous studies with university students to examine its relationship with problematic usage patterns and addiction levels. For instance, one study categorized smartphone use into ranges such as “Less than 1 hour” to “More than 6 hours” to evaluate its association with smartphone addiction [76].

Hours of daily internet use

A proxy measure was developed to estimate participants' average daily time spent browsing the internet. Responses were recorded using a four-point ordinal scale: Less than 1 hour, 1–2 hours, 3–4 hours, and More than 4 hours. This format was chosen to maintain consistency with the other self-report instruments in the survey. Previous studies have also used ordinal scales to assess daily internet use, categorizing respondents according to hours spent online for academic or leisure purposes. For example, a recent study developed a composite index based on internet use frequency and average daily hours, grouping users into time bands such as less than 1 hour, 1–2 hours, 3–4 hours, and more than 4 hours for comparative analysis across behavioral and psychosocial variables [77].

Procedure

Data collection

An online survey was created using Google Forms and disseminated to undergraduate students enrolled in general education courses at the Universidad Pedagógica Nacional Francisco Morazán. The first page of the questionnaire provided a brief description of the study's objectives and informed participants that their participation was voluntary and anonymous. Informed consent was obtained through a mandatory item before respondents were allowed to proceed with the survey.

The study protocol was reviewed and approved by the Research Ethics Committee of the Francisco Morazán National Pedagogical University (approval code: 2023-003). All procedures complied with institutional and international ethical standards, including the principles outlined in the Declaration of Helsinki [78] and the Belmont Report [79]. In addition, the study was conducted in accordance with the validity framework proposed by the American Educational Research Association (AERA), the American Psychological Association (APA), and the National Council on Measurement in Education (NCME) [80].

Data analysis

Detection of insufficient effort/careless responding (IE/C)

To identify potential cases of insufficient effort or careless responding, the procedure considered the following: (a) APS-S items were presented immediately after seven demographic questions; (b) the scale is theoretically unidimensional; and (c) given this unidimensionality,

consistent responding (e.g., repeated use of extreme scale points) may reflect genuine levels of the latent trait rather than careless patterns. Thus, traditional consistency-based indices such as the *longstring* index or low within-person response variance were avoided due to the risk of false positives.

Instead, two inconsistency-based indicators were used: Mahalanobis distance (D^2) [81] and intra-individual response variability (IRV) [82]. Empirical cutoffs were applied: a threshold of 15.08 for D^2 (χ^2 distribution with $df=5$, $\alpha=0.01$) and +2 standard deviations for IRV, as recommended in prior recommendations [82, 83]. It should be noted that cutoff values are sample-dependent and therefore may vary across datasets.

Item-level analysis

A quantitative extended item analysis was conducted within a content validity framework at the item level [38]. Basic distributional properties (mean, standard deviation, skewness, and kurtosis) were examined, along with the associations between individual items and relevant external variables. Focusing on item-level (ordinal) variables allowed the analysis to align with the objectives of item analysis based on observed data, while avoiding assumptions of linearity and bivariate normality required by Pearson correlations or latent-variable approaches (e.g., polychoric correlations).

Internal structure

Following the guidelines established by the Standards for Educational and Psychological Testing [80], the internal structure of the scale was examined with respect to dimensionality, measurement invariance across groups, and reliability.

Dimensionality A unidimensional model was tested in accordance with the theoretical framework and the parsimonious structure of the APS-S. Given the small number of items and the similar magnitude of factor loadings reported in previous studies, a multidimensional solution was not anticipated. To assess the robustness of the unidimensional structure, two models were compared: a congeneric model, in which factor loadings were freely estimated, and a tau-equivalent model, in which factor loadings were constrained to be equal. The ULSMV estimator was employed because it provides more accurate standard errors and factor loading estimates for ordinal data [84]. Model fit was evaluated using the CFI (>0.95) and the SRMR (<0.05). The RMSEA was not reported, as it can yield misleading results in models with a small number of degrees of freedom, such as the APS-S [85].

Measurement invariance across groups This property was tested using a CFA-SEM parameterization,

specifically through a product indicator-based multiple-indicator multiple-cause (PI-MIMIC) model [86–88]. Measurement invariance was evaluated at the item level (i.e., differential item functioning, DIF) within the SEM framework, taking advantage of the established equivalence between metric invariance and the absence of non-uniform DIF (DIF_{nonunif}), and between scalar invariance and the absence of uniform DIF (DIF_{unif}) [86–88]. DIF is interpreted as the presence of items that yield different response probabilities at the same level of the underlying trait or total score. In other words, when two students from different groups have identical latent scores, their expected item responses should not differ; deviations from this expectation indicate DIF.

Within item-level invariance analyses, the source of DIF may stem from factor loadings (DIF_{nonunif}) or intercepts (DIF_{unif}). This modeling approach allows for the estimation of interactions between latent variables and both categorical (e.g., sex) and continuous covariates (e.g., self-esteem and conscientiousness scores). These continuous covariates were included because they exhibited moderate associations with each APS-S item. Similar to other exogenous variables (such as sex), such covariates may account for systematic differences in item responses, conditional on their intensity levels (e.g., high vs. low self-esteem or conscientiousness). Accordingly, this framework facilitates the detection of both DIF_{unif} (associated with item difficulty or intercept differences) and DIF_{nonunif} (associated with item discrimination or loading differences).

For each item, a likelihood ratio test (LRT; χ^2 with $df=2$) was performed, comparing a freely estimated model (with parameters for the covariate effect and its interaction with the latent trait) against a constrained model (with those parameters constrained to zero). As part of this procedure, observed indicators (i.e., items) were double-mean-centered to reduce collinearity [86–88]. The standardized expected parameter change (SEPC) [89], derived from the unstandardized EPC [90], was computed as an effect size approximation. The SEPC represents the standardized change in item parameters upon releasing the zero constraint. Values of $SEPC \geq 0.20$ are indicative of meaningful model misspecification [91, 92], whereas $SEPC \geq 0.10$ may indicate a moderate effect [93]. The PI-MIMIC models were estimated using robust maximum likelihood [94] with double-mean-centering of observed variables and their interaction terms [88] Fig. 1.

Reliability Internal consistency was assessed using two procedures: (a) estimation of both Cronbach's alpha and McDonald's omega coefficients, and (b) comparison of the obtained alpha coefficient with those reported in previous validation studies [29, 34, 35, 95].

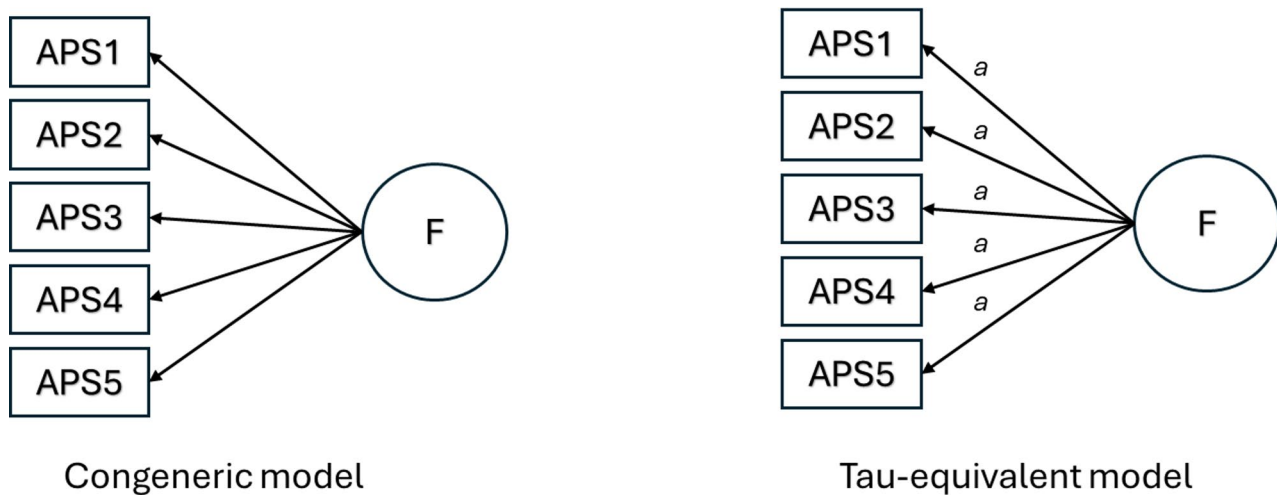


Fig. 1 Structural representations of dimensionality models: congeneric and tau-equivalent. Note. APS1–APS5 = APS-S items; F = latent factor. a = constant loading specifying equality constraints across items

Associations with other variables

Pearson's correlation coefficients were used to examine the relationship between APS-S scores and: (a) other multi-item constructs—specifically, the Brief Rosenberg Self-Esteem Scale (BRSES; derived from the positively worded items of the Rosenberg Self-Esteem Scale) and the BFI-2-S-CON); (b) sociodemographic variables (sex, age); and (c) single-item indicators of technology use (daily hours of internet and smartphone use). As part of a sensitivity analysis, Spearman's rank-order correlations were computed to assess potential nonlinear monotonic associations and the influence of outliers. Variables that showed statistically significant correlations with APS-S scores were subsequently entered into structural equation models (SEM) to estimate the effect of each predictor while accounting for latent relationships.

The analyses were conducted using the following R packages: *careless* (version 1.2.2) [96], *correlation* (version 0.8.3) [97], *DescTools* (version 0.99.60) [98], *Item-analysis* (version 0.0.1) [99], *lavaan* (version 0.6–21) [100], *MVN* (version 6.3) [101], *piRFA* (version 0.1.0) [102], *rcompanion* (version 2.4.36) [103], *semTools* (version 0.5-7) [104], and *writexl* (version 1.5.3) [105].

Results

Insufficient effort or careless responding (IE/C)

Based on the D^2 index, 33 potential cases were identified (4.3%), while the IRV index flagged 18 cases (2.3%). The association between both indices was strong, as indicated by a high Pearson correlation in terms of linear correlation ($r=0.81$, 95% confidence interval (CI) [0.78–0.73]) and substantial categorical agreement ($\chi^2=352.70$, $df=1$, $p<0.001$; Cramer's $V=0.688$, 95% CI [0.552–0.804]). A total of 34 participants (4.2%) were flagged

by both methods. These cases were removed from subsequent analyses, resulting in a final valid sample of 757 participants.

Item-level analysis

The average item response was approximately 2.20 (see Table 3), suggesting a moderately low level of endorsement. Although response patterns significantly differed across items (Friedman $\chi^2=219.07$, $df=4$, $p<0.01$), responses showed substantial internal similarity (Kendall's $W=0.607$, 95% CI [0.426–0.631]). Apart from item 4, distributional moments (standard deviation, skewness, and kurtosis) were highly similar across items. Multivariate (Henze-Zirkler = 17.844, $p<0.01$) and univariate (Anderson-Darling > 30.0, $p<0.01$) normality assumptions were not supported. Regarding associations with external variables, APS-S items consistently correlated negatively and significantly with self-esteem (BRSES; $M_r = -0.22$) and conscientiousness (BFI-2-S-CON; $M_r = -0.46$). In contrast, associations with other variables were negligible: age ($M_r = -0.01$), sex ($M_r = -0.03$), hours of daily internet use ($M_r = -0.01$), and hours of daily smartphone use ($M_r = -0.01$).

Internal structure

Dimensionality

A unidimensional congeneric model (without equality constraints on factor loadings) showed excellent fit: ULSMV- $\chi^2=10.77$, $df=5$; CFI=0.998; SRMR=0.031. The tau-equivalent model (equal factor loadings) also showed good fit: ULSMV- $\chi^2=28.51$, $df=9$; CFI=0.993; SRMR=0.050. However, the difference between models was statistically significant ($\Delta\chi^2=33.87$, $\Delta df=4$, $p<0.001$), suggesting that freely estimating factor loadings may be preferable for the APS-S. All items showed

Table 3 Item-level analysis of the Academic Procrastination Scale–Short (APS-S)

	Frequencies					
	APS1	APS2	APS3	APS4	APS5	
Response options						
1	283	342	246	418	299	
2	161	127	185	170	175	
3	204	121	165	94	160	
4	69	63	81	51	71	
5	40	104	80	24	52	
Descriptives						
<i>M</i>	2.23	2.28	2.42	1.80	2.21	
<i>SD</i>	1.19	1.44	1.32	1.09	1.24	
Skew	0.60	0.74	0.56	2.19	0.73	
Kurtosis	−0.58	−0.86	−0.80	0.77	−0.50	
AD	40.94**	58.66**	35.38**	79.06**	44.12**	
Association coefficients						
	APS1	APS2	APS3	APS4	APS5	95% CI ^c
Age ^a	−0.030	−0.006	−0.028	−0.023	−0.011	−0.086, 0.048
Sex ^b	−0.03	−0.01	−0.05	−0.04	−0.06	−0.126, 0.056
Smartphone ^a	0.02	−0.05	−0.04	−0.00	0.01	−0.010, 0.011
Internet ^a	−0.03	−0.02	0.02	−0.01	−0.07*	−0.012, 0.008
BRSES ^a	−0.234**	−0.205**	−0.273**	−0.224**	−0.176**	−0.304, −0.163
BFI-2-S-CON ^a	−0.498**	−0.421**	−0.513**	−0.497**	−0.404**	−0.540, −0.420

APS1–APS5 Academic Procrastination Scale items, AD Anderson–Darling test, Smartphone daily hours of smartphone use, Internet daily hours of internet use, BRSES Brief Rosenberg Self-Esteem Scale, BFI-2-S-CON Big Five Inventory–2, Short Form Conscientiousness subscale, *M* mean, *SD* standard deviation, *Skew* skewness

^a Spearman rank-order correlation; ^b rank-biserial correlation; ^c average confidence limits across item-level correlations

* $p < 0.05$; ** $p < 0.01$

loadings greater than 0.70 (mean [*M*] = 0.77; see Table 4), with a ratio between the highest and lowest loading of 1.18, indicating high loading similarity (standard deviation [*SD*] = 0.05).

Sensitivity analysis

To evaluate the robustness of the estimates, particularly the factor loadings, which constitute the primary parameters for assessing item-level construct validity, the dimensionality analysis was re-estimated using the complete sample, including cases with potential careless responding. Overall, only minor differences were observed. Model fit remained high (CFI = 0.998; SRMR = 0.029). Factor loadings showed small relative changes (0.694, 0.739, 0.796, 0.820, and 0.714), corresponding to percentage differences of 9%, −1%, 2%, 5%, and 2%, respectively. Similarly, residual variances exhibited modest relative reductions (0.425, 0.462, 0.345, 0.258, and 0.471), with percentage changes of −18%, 2%, −6%, −21%, and −4%.

Measurement invariance across groups

Item functioning analyses using Conscientiousness as a covariate (BFI-2-S-CON) revealed significant DIF in two items (global $\chi^2 > 11.00$, $p < 0.01$; see Fig. 2). The DIF detected was non-uniform ($p < 0.002$; see Table 4), though the effect sizes were small (SEPC < |0.10|). For

the sex covariate, total DIF tests for all items were non-significant ($\chi^2 < 2.00$, $p > 0.10$). Consistently, neither uniform ($\chi^2 < 1.80$, $p > 0.10$) nor non-uniform tests ($\chi^2 < 1.90$, $p > 0.10$) provided evidence for item-level DIF. Regarding self-esteem (BRSES), two items emerged with potential DIF—one flagged in the global test (item 3) and another in the uniform DIF test. However, these findings are likely spurious, given that the global test was nonsignificant. For item 3, the observed effect size was also small (SEPC < |0.10|).

Reliability

The tau-equivalent model yielded a Cronbach's alpha of 0.853; the congeneric model yielded McDonald's omega of 0.847. The difference between these coefficients was minimal. To provide comparative context, alpha coefficients from previous APS-S studies [29, 34, 35, 95] were examined, yielding a mean alpha of 0.87 (*SD* = 0.008, total *N* = 1,882). A chi-square test for heterogeneity of alpha values across studies was nonsignificant: $\chi^2 = 1.27$, *df* = 3, $p = 0.73$.

Associations with other variables

Latent correlations between general self-esteem (BRSES) and conscientiousness (BFI-2-S-CON) were statistically significant in the full sample as well as in the male and female subgroups (see Table 5, “Latent correlation”

Table 4 Factor loadings and differential item functioning (DIF) for the Academic Procrastination Scale–Short (APS-S)

CFA	Covariate: Conscientiousness (BFI-2-S-CON)						Covariate: Sex						Covariate: Self-esteem					
	Total (df = 2)		DIF _{unif} (df = 1)		DIF _{numif} (df = 1)		Total (df = 2)		DIF _{unif} (df = 1)		DIF _{numif} (df = 1)		Total (df = 2)		DIF _{unif} (df = 1)		DIF _{numif} (df = 1)	
	X ²	X ²	SEPC	X ²	X ²	SEPC	X ²	X ²	SEPC	X ²	X ²	SEPC	X ²	X ²	SEPC	X ²	X ²	SEPC
APS1	0.758	15.31**	3.96 ^{ns}	-0.053	12.87**	0.097	1.93 ^{ns}	0.12 ^{ns}	-0.004	1.88 ^{ns}	0.034	4.55	0.04	-0.010	4.49	0.055	0.66	-0.022
APS2	0.734	1.39 ^{ns}	1.37 ^{ns}	0.038	0.08 ^{ns}	0.000	0.86 ^{ns}	0.86 ^{ns}	-0.022	0.01 ^{ns}	-0.001	1.18	0.66	-0.022	0.76	-0.022	10.35**	-0.072
APS3	0.809	4.57 ^{ns}	4.17 ^{ns}	-0.056	0.81 ^{ns}	0.022	0.03 ^{ns}	0.01 ^{ns}	0.003	0.03 ^{ns}	-0.005	10.58*	10.58*	-0.072	1.22	-0.012	7.19**	0.056
APS4	0.862	11.8*	0.41 ^{ns}	-0.006	11.8**	-0.077	0.52 ^{ns}	0.01 ^{ns}	-0.002	0.48 ^{ns}	-0.017	8.31	1.32	0.025	0.40	-0.024	1.49	0.40
APS5	0.728	7.5 ^{ns}	7.44 ^{ns}	0.090	0.28 ^{ns}	-0.002	1.78 ^{ns}	1.66 ^{ns}	0.031	0.23 ^{ns}	-0.011	1.49	1.32	0.025	0.40	-0.010	1.49	0.40

DIF_{unif} uniform differential item functioning, DIF_{numif} non-uniform differential item functioning, df degrees of freedom, CFA factor loadings from confirmatory factor analysis (congeneric model), x² chi-square test for global DIF detection (uniform and non-uniform), SEPC standardized expected parameter change (all variables standardized)

** $p < 0.002$ (Bonferroni-adjusted)

* $p < 0.01$ (Bonferroni-adjusted)

^{ns} not statistically significant

header). These associations can be regarded as essentially linear (Fig. 3). Although slight differences were observed between subgroups, they fell within the range of sampling error. This was indicated by the standardized difference index (q), which quantifies the degree of discrepancy between group estimates (BRSES: $q = 0.011$, $p = 0.40$; BFI-2-S-CON: $q = 0.131$, $p = 0.08$). Sex and age were not significantly associated with APS-S scores.

Given these correlational findings, Internet and smartphone use variables were excluded from subsequent analyses because they showed near-zero, non-statistically significant correlations with APS-S scores. In contrast, BRSES and BFI-2-S-CON were retained as predictors in a latent regression model of APS-S (Fig. 3). Differences in regression coefficients (ΔB) and their statistical significance were evaluated using Z-tests to compare effects across groups. Group comparisons revealed no statistically significant differences in the regression coefficients ($\Delta B = 0.15$, $Z = 0.88$, $p = 0.37$; 95% CI [-0.19 to 0.50]; see Table 5, “Latent regression”). By contrast, Conscientiousness (BFI-2-S-CON) showed a statistically significant negative association with APS-S scores. This effect exceeded sampling error and remained significant in the total sample and in the male and female subgroups. The difference in regression coefficients between males and females was not statistically significant ($\Delta B = -0.59$, $Z = -0.97$, $p = 0.33$; 95% CI [-1.79 to 0.60]).

Discussion

This study examined the psychometric properties of the APS-S in a previously unexplored context: university students in Honduras. Given the established associations between academic procrastination, student performance, and academic adjustment, assessing procrastination levels in this population holds clear local relevance while also contributing to the broader literature. Beyond its regional importance, the findings support the etic nature of academic procrastination as a construct that appears to generalize across cultural contexts.

Although general measures of procrastination are commonly administered to student populations, several authors have argued that procrastination is a domain-sensitive behavior that may manifest differently across academic, occupational, and everyday life contexts (Bäulke et al., 2024; Hen & Goroshit, 2018). Accordingly, domain-specific instruments such as the APS-S are better positioned to capture context-dependent motives, triggers, and consequences that general scales may overlook. Prior research indicates that academic procrastination is more strongly associated with academic performance, study behaviors, and education-specific stressors than with general procrastination tendencies, suggesting that contextually focused measures offer greater predictive validity for academic outcomes. Thus, while general

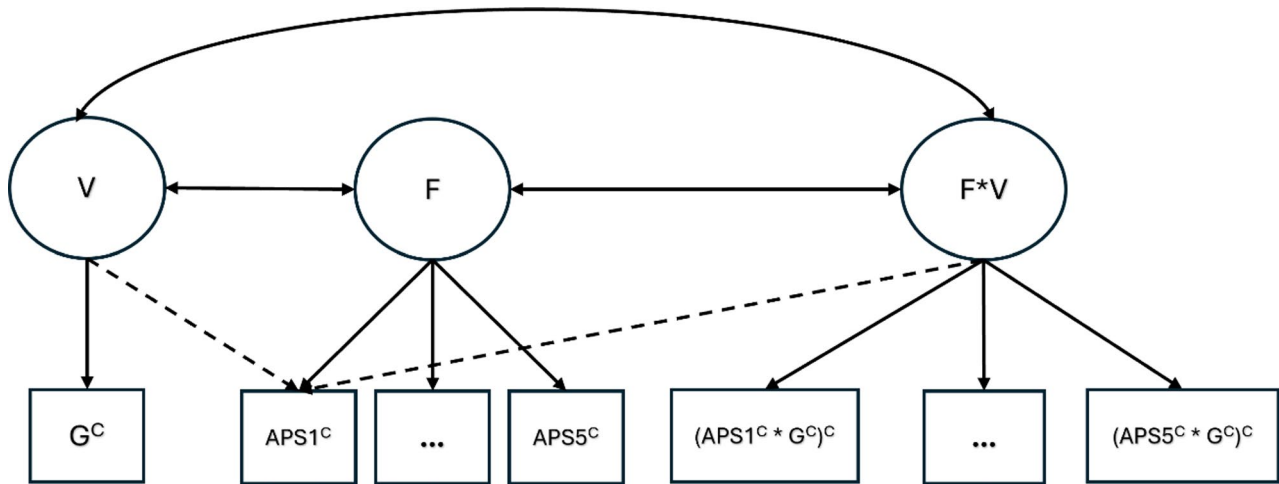


Fig. 2 PI-MIMIC model specification for testing group equivalence. Note. V = latent variable representing covariate G (e.g., sex); G = observed covariate indicator; F = latent factor; APS1^c–APS5^c = centered observed indicators (items). F*V = latent interaction factor. Dashed lines = DIF detection paths (uniform from V; non-uniform from F*V); solid lines = causal path from latent factor to observable indicator; double-headed arrows = latent covariances

Table 5 Latent correlations and regression estimates among academic procrastination (APS–S), self-esteem (BRSES), and conscientiousness (BFI-2-S-CON)

	Total sample		Female		Male	
Latent correlation						
BRSES	–0.283 **		–0.282 **		–0.293**	
BFI-2-S-CON	–0.744 **		–0.772		–0.641**	
Daily Internet use	–0.028		–0.037		–0.031	
Daily smartphone use	–0.010		0.076		–0.033	
Sex	0.052		–		–	
Age	–0.012		–0.027		0.033	
Latent regression						
	B (SE)	β	B (SE)	β	B (SE)	β
BRSES	0.069 (0.07)	0.04	0.10 (0.08)	0.07	–0.04 (0.15)	–0.03
BFI-2-S-CON	–1.82** (0.27)	–0.76	–1.98** (0.32)	–0.80	–1.39** (0.51)	–0.62

APS–S Academic Procrastination Scale–Short, BRSES Brief Rosenberg Self-Esteem Scale, BFI-2-S-CON Big Five Inventory–2, Short Form Conscientiousness subscale, Short Form Conscientiousness subscale, SE standard error

** $p < 0.01$

procrastination scales provide a broad assessment of delay tendencies, academically specific instruments yield more actionable, context-relevant insights to understand students’ behavior and inform educational interventions.

Item-level analysis of the APS-S revealed a characteristic pattern of similarity in the statistical attributes assessed. This pattern indicates that the behaviors represented by the items tend to covary to a similar degree in students’ experience of procrastination. However, this does not imply item redundancy, as each item was designed to capture a distinct procrastination-related behavior. Regarding response scaling, item responses tended to fall at the moderately low end of the construct, as indicated by the “total disagreement” response option, and showed positively skewed distributions. This similarity was also reflected in the strength, negative direction, and statistical significance of the items’ associations with external variables. In a unidimensional measure such as

the APS-S, this pattern aligns with findings from other unidimensional scales [106, 107], suggesting a homogeneous content structure across several statistical and psychometric attributes, and potentially interchangeable elements for future revisions of the APS-S.

Two constructs that showed associations with the APS-S items beyond sampling error were general self-esteem (BRSES) and conscientiousness (BFI-2-S-CON), with the latter exhibiting a stronger relationship. According to prior literature [44–47, 108–110], this finding at the construct level is consistent with total APS-S scores, but the current study extends this pattern to the individual item level. Additionally, although self-esteem and conscientiousness were the strongest correlates of APS-S items, no substantial DIF was observed with respect to these variables. This finding suggests that correlation patterns do not necessarily predict the presence of DIF, highlighting the importance of treating these two

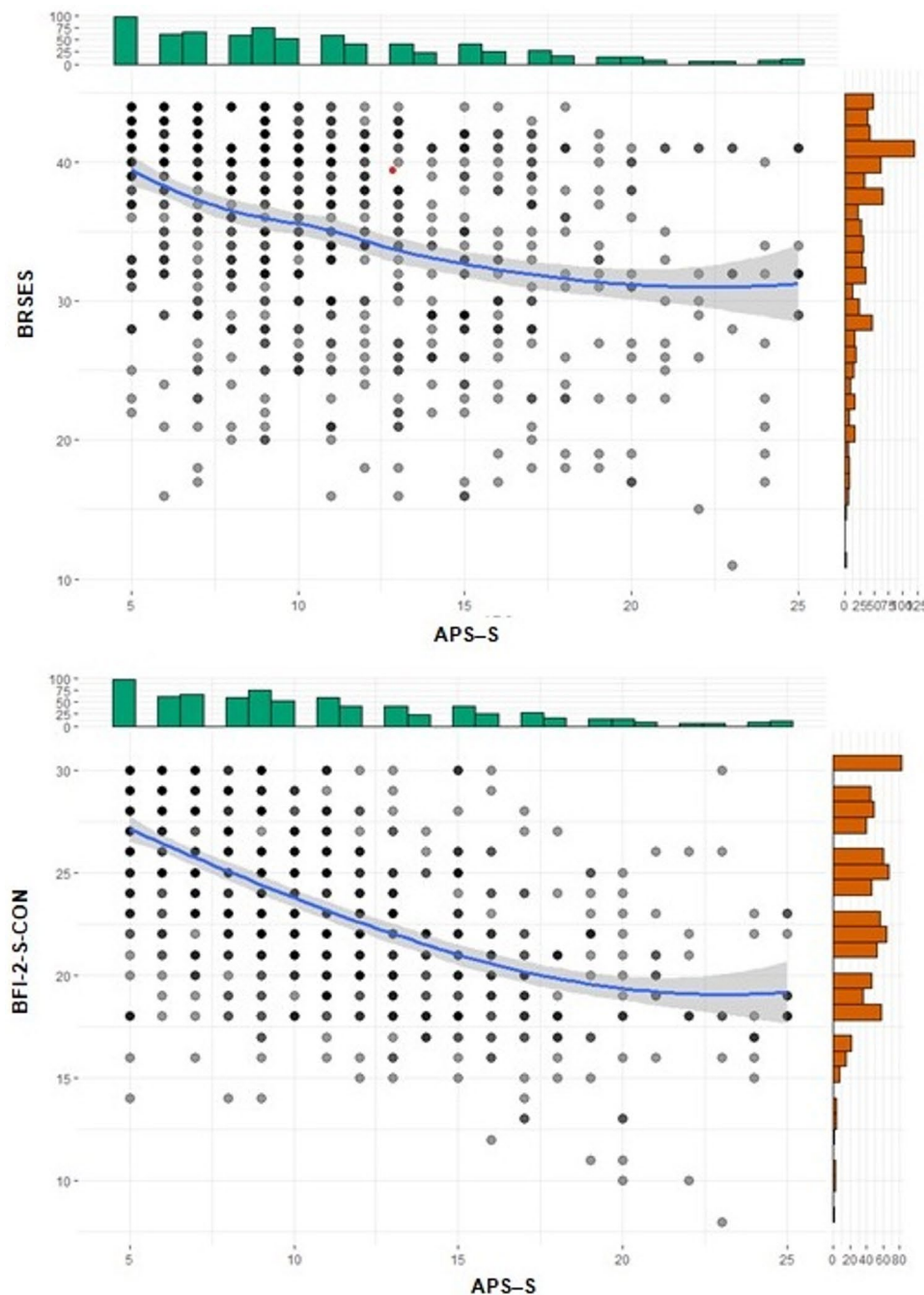


Fig. 3 Association between academic procrastination (APS-S) with self-esteem (BRSES) and conscientiousness (BFI-2-S-CON). Note. Points represent individual observations; blue lines indicate LOESS-smoothed trends with 95% confidence bands. Marginal histograms display the distributions of scores for each variable

psychometric aspects separately in future adaptations of the APS-S.

In assessing internal structure, a congeneric unidimensional model adequately accounted for item variance. This type of unidimensionality allows for factor loadings of varying magnitudes, in contrast to a tau-equivalent model that assumes equal loadings across items. Although the difference between the congeneric

and tau-equivalent models was statistically significant, it did not appear to have a meaningful practical impact on reliability estimation, as the difference between Cronbach's alpha and McDonald's omega was minimal. The magnitude of factor loadings observed in this study was consistently high, with all values exceeding 0.60. Established thresholds typically interpret such values as large [111] or approximately large loadings [112]. This pattern

of strong factor loadings suggests that each item functions as a robust individual indicator for distinguishing between students with low and high levels of academic procrastination.

Concerning reliability, the slight difference between omega and alpha, coupled with the simplicity of calculating alpha, suggests that Cronbach's alpha may be an appropriate and practical estimator for APS-S scores. Another important finding is that the reliability estimate obtained in this study ($\alpha = 0.85$) appears consistent with those reported in previous psychometric investigations. A meta-analytic approximation conducted here indicated low variability among prior studies [29, 34, 35, 95].

With this level of reliability, the APS-S may be suitable for research and individual evaluations. In the latter, high reliability is especially desirable to minimize measurement error. Its scores could inform personalized academic interventions, particularly in identifying students at higher risk of maladaptive procrastination behaviors. Given its highly reliable score and ease of administration, the APS-S holds promise as a practical screening tool in both educational and clinical settings, where early identification and targeted support are critical.

The analysis of measurement equivalence across groups was conducted using a DIF framework within an SEM approach. Two potential sources of DIF—Conscientiousness and self-esteem—were evaluated, given their potential explanatory rather than merely descriptive role in academic procrastination.

The DIF analyses, including uniform and non-uniform types, revealed no statistically significant differences in item functioning across sex and age groups. Specifically, neither of the χ^2 statistics was significant for either form of DIF, indicating that item performance was consistent across groups. These results support the measurement equivalence of the APS-S, demonstrating that the instrument assesses the intended construct similarly across demographic subgroups. The absence of DIF suggests that participant responses were not biased by sex or age, thus reinforcing the validity of the scale. This lack of measurement bias ensures that findings can be generalized to diverse populations. Moreover, the evidence confirms the appropriateness of the APS-S for future research, without concerns about demographic-related interpretive distortions.

Conscientiousness (BFI-2-S-CON) emerged as a stronger correlate than self-esteem regarding the association between the APS-S and individual-difference variables. This result aligns with the conceptual nature of both constructs, which are theoretically linked to task performance and responsibility in academic settings [20, 110, 113, 114]. The observed association was also supported by item-level analyses, in which all APS-S items showed a homogeneous relationship with the BFI-2-S-CON score.

This consistent pattern underscores the APS-S's theoretical coherence and internal validity concerning conscientious behavior.

Limitations

Several limitations should be considered when interpreting the results of this study. First, participants were recruited through convenience sampling at a single public university in Honduras, which may limit the generalizability of the findings. Institutional characteristics specific to this university may influence both the socioeconomic profile of the student body and the observed patterns of academic procrastination. Additionally, the sample was predominantly female, which may further restrict generalizability across gender groups. Although no evidence of differential item functioning by sex was observed, future studies should aim to recruit more gender-balanced samples to confirm the stability of the results across more equitable demographic distributions. Furthermore, information regarding participants' academic field and year of study was not collected. These variables may be relevant, as different disciplines and stages of study often entail varying workloads, assessment structures, and motivational demands that can influence procrastination behaviors. Future research should incorporate these academic characteristics to examine their potential moderating effects and to provide a more nuanced understanding of academic procrastination across educational contexts.

To further enhance external validity, future research should recruit more diverse and representative samples of university students across Honduras. In particular, broader, more heterogeneous samples—especially those with greater age variability—would enable examination of the stability of sex-related predictors across age groups. Moreover, assessing the consistency of the scale's factor structure and its associations in multicultural or cross-national samples would provide additional evidence supporting the generalizability of the instrument.

Additional limitations stem from the exclusive reliance on self-report measures. Such measures are susceptible to response biases, including social desirability. Furthermore, recent evidence indicates that self-reported internet use is often inaccurate, with substantial over- or underestimation and low concordance with objective tracking data [115]. More broadly, these issues highlight the inherent limitations of self-report methodologies in behavioral research and underscore the value of incorporating complementary data sources, such as teacher ratings, peer reports, or behavioral tracking, to obtain more objective and reliable assessments in future studies of academic procrastination. Finally, the test-retest reliability of the APS-S was not evaluated. Future research should examine its temporal stability in Honduran university populations.

Despite these limitations, the study presents several methodological strengths. It extends the available evidence on the APS-S by providing psychometric data from a previously understudied Central American context. The study also applied a rigorous validation strategy including dimensionality testing, complementary reliability estimates, item-level analyses, and differential item functioning assessment within an SEM framework. In addition, the detection and removal of insufficient effort or careless responses strengthened the internal validity of the results. These features enhance confidence in the robustness and interpretability of the findings.

Practical implications

This study offers several practical implications. First, the validated scale provides a valuable tool for identifying and understanding academic procrastination behaviors among Honduran university students. Its application may support the development of targeted, context-sensitive interventions that address students' specific behavioral patterns and motivational needs. Although the present study focused on university students, the underlying principles and methodological approach may be extended to other learner populations, including high school, vocational, and adult learners in continuing education programs. With appropriate adaptation, the scale could be used to assess academic procrastination across diverse educational contexts and to inform the design of interventions tailored to specific learning environments. Furthermore, the validated instrument and rigorous psychometric framework may facilitate cross-cultural research in other Spanish-speaking populations, supporting comparative studies and the development of culturally sensitive interventions beyond higher education.

Second, a notable strength of the study lies in its assessment of insufficient effort/careless responding (IE/C), a response pattern known to compromise the validity of self-report data [42, 116]. While still underutilized in research involving Spanish-speaking populations, recent studies conducted in Latin American contexts, such as those by Merino-Soto et al. [107] and Cabedo-Peris et al. [106], have begun to address this issue. In the present study, the identification and removal of IE/C responses, while reducing the final sample size, enhanced the internal validity of the findings and yielded prevalence rates consistent with those reported in prior literature.

Third, the comprehensive approach to validity assessment adopted in this study highlights the importance of transparency and methodological rigor in psychometric research. By aligning with best practices recommended by professional organizations and established methodological guidelines, this approach strengthens the credibility and replicability of the findings within the scientific community.

Beyond its practical applications, this study also contributes to the theoretical understanding of procrastination as a domain-sensitive behavior. The findings indicate that context-specific measures, such as the APS-S, capture motivational and behavioral patterns that may be obscured by general procrastination scales. This supports the view that procrastination is not a uniform trait but is shaped by situational and contextual factors, thereby advancing theoretical perspectives on the mechanisms underlying academic procrastination in educational settings.

Conclusion

This study aimed to validate the APS-S in a sample of university students from Honduras, a context in which the instrument had not been previously evaluated. The results confirmed the unidimensional structure of the APS-S and provided evidence of its reliability, internal consistency, and construct validity, including associations with conscientiousness and self-esteem.

Moreover, the absence of DIF across sex and age groups supports the instrument's measurement equivalence. The incorporation of procedures to detect insufficient effort and careless responding further strengthened the internal validity of the findings. These analyses demonstrated the consistent psychometric performance of the APS-S and underscore its suitability for academic and psychological research within this population. In sum, the APS-S emerges as a psychometrically robust instrument for assessing academic procrastination among Honduran university students. Beyond this specific context, the APS-S shows promise for adaptation and application in other sociocultural settings across both the Global South and the Global North, facilitating cross-cultural comparisons and the examination of academic procrastination across diverse educational environments.

Abbreviations

AD	Anderson–Darling test
AP	Academic procrastination
APS	Academic Procrastination Scale
APS-S	Academic Procrastination Scale – Short
BFI-2-S-CON	Big Five Inventory-2 – Short Form: Conscientiousness
BRSES	Brief Rosenberg Self-Esteem Scale – Positive Items
CI	Confidence interval
CFI	Comparative fit index
D ²	Mahalanobis distance
ΔB	Difference in unstandardized regression coefficients
df	Degrees of freedom
DIF	Differential item functioning
DWLS	Diagonally weighted least squares
DIF _{unif}	Uniform DIF
DIF _{nonunif}	Non uniform DIF
EFA	Exploratory factor analysis
EPC	Expected parameter change
GLB	Greatest lower bound
GRM	Graded response model
IE/C	Insufficient effort or careless responding
IRT	Item response theory
IRV	Intra-individual response variability

LRT	Likelihood ratio test
M	Mean
ML	Maximum likelihood
PCA	Principal component analysis
PI-MIMIC	Product indicator-based multiple-indicator multiple-cause model
q	Standardized difference index
r	Rank-biserial correlation coefficient
RDWLS	Robust diagonally weighted least squares
SD	Standard deviation
SE	Standard error
SEPC	Standardized expected parameter change
SEM	Structural equation modeling
SRMR	Standardized root mean square residual
ULSMV- χ^2	Chi-square statistic from the unweighted least squares estimator with mean and variance adjustment
W	Wilcoxon signed-rank test statistic
WLSMV	Weighted least squares with mean and variance adjustment
Z-test	Test statistic for assessing differences in regression coefficients

Supplementary Information

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Supplementary Material 1.

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Authors' contributions

CMS, SHF, FLS, IMA, and ISPZ conceived the study. ISPZ collected the data. CSM and SHF analyzed and interpreted the data. CSM, SHF, and GMC wrote the drafts of the manuscript. GMC acquired funding and supervised the project. CMS, SHF, FLS, IMA, and GMC contributed to the manuscript revision. All authors read and approved the submitted version.

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Data availability

The authors will make the raw data supporting this article's conclusions available without undue reservation. Correspondence and requests for materials should be addressed to Guillermo Chans.

Declarations

Ethical approval and consent to participate

The Institutional Review Board of the Research Ethics Committee of Universidad Pedagógica Nacional Francisco Morazán approved the protocol (no. 2023-003). The procedures used in this study adhere to the tenets of the Declaration of Helsinki. Respondents provided written consent for review and signature prior to the interviews.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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