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Statistical Analysis of the Academic Procrastination Scale Demonstrates its Psychometric Properties Through a Rigorous Four-Factor Validation Study

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Abstract: In this study we validated and examined the psychometric properties of the Academic Procrastination Scale for students in Egyptian higher education. The research at the Faculties of Education, Egypt, involved 1,216 undergraduate students (509 for EFA and 707 for CFA) aged 18-24 years, representing diverse academic years and departments with male and female participants. The researchers employed a rigorous methodology involving exploratory and confirmatory factor analyses, reliability assessments, and comprehensive statistical evaluations to assess the scale's validity and reliability. The analysis revealed a robust four-factor structure explaining 52.07% of total variance, comprising Core Procrastination, Work Disconnection, Poor Time Management, and Emotional and Motivational Self-Control. Confirmatory factor analysis demonstrated excellent model fit indices (CMIN/DF = 2.326, CFI = 0.947, RMSEA = 0.043), with standardized factor loadings ranging from 0.46 to 0.72. The scale exhibited exceptional internal consistency, with McDonald's ω of 0.900 and Cronbach's Alpha of 0.899, and demonstrated strong test-retest reliability of 0.927 with 113 participants over a 16-day interval. The findings contribute significant insights into academic procrastination measurement within the Egyptian cultural context, highlighting the multidimensional nature of procrastination behaviors.

Keywords: Academic Procrastination, Validity, Reliability, Higher Education, Psychometric Properties.

1. Introduction

Academic procrastination has emerged as one of the most pervasive challenges facing higher education globally, characterized by the voluntary delay of academic tasks despite awareness of potential negative consequences (Gohain & Gogoi, 2020; Zartaloudi et al., 2021). This behavioral pattern extends far beyond simple time management difficulties, encompassing complex psychological, motivational, and self-regulatory processes that significantly impact academic achievement and student well-being (Ajayi, 2020; Argiropoulou et al., 2014; Al-Azmi et al., 2025). With prevalence rates ranging from 29% to 97% among university students worldwide, academic procrastination represents a critical area requiring urgent attention from educators and researchers (Fentaw et al., 2022; He, 2017).

The magnitude of this challenge becomes particularly evident when examining cross-cultural studies. Research indicates that nearly 80 percent of university student's exhibit procrastination behaviors, with approximately half consistently procrastinating due to various factors, including poor time management skills, inadequate planning, perceived laziness, and stress-related issues (Fentaw et al., 2022). These findings underscore the critical need for reliable and valid measurement tools to assess academic procrastination effectively, especially within specific cultural and demographic contexts (Abu & Saral, 2016; Aslan Efe & Efe, 2018; Fayda-Kinik, 2023; Harb et al., 2024; Özer & Yetkin, 2018; Shoqeirat et al., 2024).

Gender differences in academic procrastination have emerged as a significant area of investigation, with multiple studies consistently indicating higher prevalence rates among male students compared to their female counterparts (Abdi Zarrin &

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Gracia, 2020; Limone et al., 2020; Lu et al., 2022; Mandap, 2016). Male students have been found to exhibit more pronounced procrastination behaviours, particularly in relation to poor time management skills and metacognitive strategies (Limone et al., 2020). This gender disparity appears consistent across different educational levels, with male college students demonstrating higher procrastination tendencies than female college students (Khan et al., 2014). The underlying factors contributing to these gender differences often include variations in time management approaches, metacognitive strategies, and responses to academic pressure (Özer et al., 2009).

The Egyptian higher education context presents unique characteristics that warrant specific attention when studying academic procrastination. The intersection of traditional cultural values, modern educational demands, and rapidly evolving technological landscapes creates a distinct environment that may influence how students experience and manifest procrastination behaviors. In Egyptian society, where family honor, academic achievement, and responsibility carry significant cultural weight, the conceptualization and measurement of academic procrastination may differ substantially from Western contexts where many existing assessment tools were developed and validated. In such a cultural context as found in Egyptian society, cultural values ranking high on aspects such as honor and prestige within families and communities, as well as honor and achievement within educational and community settings, may well impact upon the expression and meaning of procrastination behavior. In this regard, the process of translation and adaptation was pursued with utmost care and attention through the use of bilingual personnel and educational psychology experts. The process was meant to be more than just highly accurate from a linguistic point of view; instead, the process sought to be more culturally nuanced with the intention of capturing the very unique approaches to academic tasks and procrastination among Egyptian university students.

The ongoing technological transformation of higher education in Egypt adds another complexity to understanding and measuring academic procrastination. The increasing integration of online learning platforms, digital assignments, and virtual collaboration tools has fundamentally altered how students engage with academic tasks. These changes necessitate a fresh examination of how procrastination behaviors manifest and are assessed within these new educational paradigms. Furthermore, students in Egyptian higher education face unique challenges, including societal expectations regarding academic success, pressure to secure future employment, and balancing academic responsibilities with other obligations, all of which may influence their procrastination tendencies.

While valuable, measurement tools for academic procrastination present several limitations that become particularly relevant when applied across different cultural contexts. Existing scales often show inconsistency in establishing clear links between procrastination and academic achievement, possibly due to variations in the constructs and dimensions being measured (Wang et al., 2024). Cultural and linguistic barriers pose additional challenges, as evidenced by the need to carefully adapt and validate scales across different cultural settings (Martín-Antón et al., 2023; Yip & Chung, 2022). Moreover, many existing tools either suffer from excessive complexity and length or focus too narrowly on specific aspects of procrastination, potentially overlooking other relevant factors that may be particularly salient in the Egyptian context.

Recent developments in procrastination measurement have demonstrated promising advances. The Situational Procrastination Scale (SPS) has shown effectiveness in measuring procrastination and predicting academic achievement, particularly focusing on task completion both before and after deadlines (Wang et al., 2024). Similarly, adaptations of existing scales, such as the Spanish version of the Academic Procrastination Scale, have successfully identified multiple interrelated factors, including task aversion, poor time management, low emotional and motivational self-control, and risk assumption (Martín-Antón et al., 2023). These developments highlight the potential for creating more nuanced and culturally sensitive measurement tools.

The impact of academic procrastination on student outcomes cannot be overstated. Research consistently demonstrates negative correlations between procrastination and academic performance, with procrastinating students typically achieving lower grades and experiencing reduced academic success (Gareau et al., 2018; Kim & Seo, 2015; Shi, 2023; Villegas et al., 2023; Zartaloudi et al., 2021). Beyond academic performance, procrastination significantly affects students' psychological well-being and satisfaction with academic life, often stemming from self-regulation failures (Balkıs & Duru, 2016). Recent studies have also highlighted the role of mindfulness and self-efficacy in mediating the relationship between academic procrastination and subjective well-being (Bu et al., 2021), with some research suggesting that active procrastination can have a small positive effect on academic performance, while passive procrastination has a slight adverse effect (Kooren et al., 2024).

The prevalence of academic procrastination varies across different academic disciplines and institutional settings, with studies reporting rates of 63% among medical students in Iran (Bytamar et al., 2017) and 55.1% among medical students

at Mulawarman University (Daryani et al., 2021; Hayat et al., 2020). These variations suggest that disciplinary context and institutional factors may play important roles in the manifestation of procrastination behaviours, further emphasising the need for context-specific measurement tools (Alaya et al., 2021; Argiropoulou et al., 2014; Hidayat & Hasim, 2023).

Empirical evidence suggests substantial variation in the prevalence of academic procrastination among university students across different contexts and populations. A comprehensive analysis of recent studies reveals prevalence rates ranging from 29% to 97%, with several notable findings. He (2017) reported that 97% of university students experience procrastination, with 48% indicating "very often" or "always" frequencies. Similarly, Fentaw et al. (2022) found that approximately 80% of university students exhibit procrastination behaviors to varying degrees, with half consistently engaging in procrastination. More specific contextual studies have identified prevalence rates of 63% among Iranian medical students (Bytamar et al., 2017), 55.1% among Indonesian medical students (Daryani et al., 2021), and 40.5% among Greek university students (Argiropoulou et al., 2014). Notably, Hidayat and Hasim (2023) reported that 52% of university students frequently procrastinate on academic work, highlighting the consistency of this phenomenon across different cultural and educational settings.

Recent studies have addressed academic procrastination measurement within the Egyptian educational context with notable limitations. Though restricted to early undergraduate years, Qattata (2025) developed a scale for male first and second-year university students at Al-Azhar University. Amer (2023) examined procrastination measurement among preparatory students but limited focus to excelling and academically delayed students. Zaki et al. (2024) investigated procrastination among university students but confined psychometric evaluation to internal consistency, criterion validity, and reliability coefficients, overlooking other validity indicators. Abdelhamid et al. (2024) developed an academic procrastination scale restricted to secondary school students, limiting higher education relevance. Abouzaid et al. (2022) examined procrastination scales exclusively among female university students, creating a gap in male student measurement. These studies highlight the need for a comprehensive, psychometrically sound academic procrastination scale validated for students across Egyptian higher education institutions.

A validated tool is needed to assess academic procrastination among Egyptian higher education institutions students. Current scales may not capture the unique cultural, social, and educational factors influencing procrastination behaviors. Validating an appropriate scale would enhance theoretical understanding of academic procrastination across cultures and provide practical benefits for educators and administrators.

Therefore, this study examines the validity and reliability of the Academic Procrastination Scale when applied to students in Egyptian higher education institutions. Specifically, the research addresses several critical questions regarding the scale's psychometric properties, cultural appropriateness, and practical utility within this context. The findings will contribute to the theoretical understanding of academic procrastination measurement across cultures and the practical application of assessment tools in Egyptian higher education settings.

Educators and researchers will be better equipped to understand and address academic procrastination among students in Egyptian higher education by ensuring the availability of psychometrically sound and culturally appropriate measurement tools. This understanding can inform the development of targeted interventions and support systems, ultimately contributing to improved academic outcomes and student success. Furthermore, this research will add to the growing body of literature on cross-cultural validation of psychological measurement tools and provide insights into the unique characteristics of academic procrastination within the Egyptian cultural context.

2. Methodologies

2.1 Research Design

The study employed a cross-sectional validation design using a two-phase approach: exploratory factor analysis (EFA) followed by (CFA) on independent samples. The research specifically focused on investigating the scale's validity and reliability within Egyptian universities' cultural and educational context. The study was conducted during the second semester of the 2023-2024 academic years at the Faculties of Education in Egypt, see figure 1 that shows the research design flowchart.

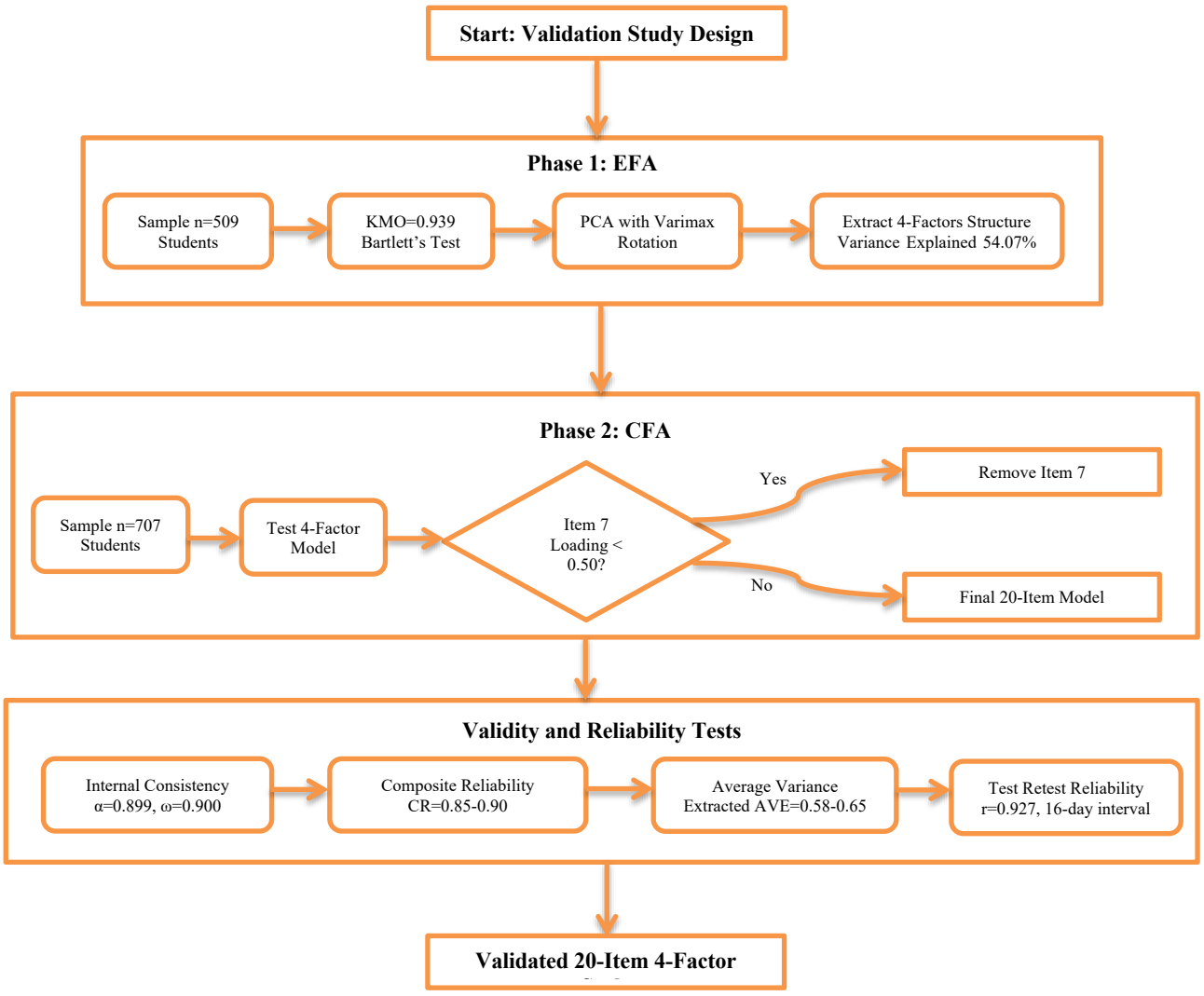

Fig. 1: Research Design Flowchart

2.2 Participants

The study involved 1,216 undergraduate students from two Egyptian faculties of education, the Faculty of Education for Males in Dakahlia and the Faculty of Education for Females in Cairo. The participants were recruited using a convenience sampling approach from various academic departments within these institutions. Our paramount aim was to authenticate this scale within a particular and culturally grounded educational context—that being Egyptian higher education. The Faculties of Education were selected for their direct relevance to this study and the network established with them for collaboration on this research. Future studies must address more randomized and stratified sampling methods and a wider range of academic subjects and universities to increase external validity. The sample consisted of 509 (EFA) and 707 (CFA) subsamples, achieving a 100% response rate. For the (EFA) sample, participants' ages ranged from 18 to 24 years (M = 20.50, SD = 1.12), while the (CFA) sample participants' ages ranged from 18 to 24 years (M = 20.24, SD = 1.29). Table 1 presents the detailed demographic characteristics of the participants. Table 1 presents the detailed demographic characteristics of the participants.

Table 1: Demographic Characteristic of the Participants

Characteristic		EFA Sample		CFA Sample	
		N	%	N	%
Academic Year	First Year	82	16.1	123	17.4
	Second Year	96	18.9	117	16.5

	Third Year	229	45.0	319	45.1
	Fourth Year	102	20.0	148	20.9
Residence	**Rural**	354	69.5	504	71.1
	Urban	155	30.5	204	28.9
Gender	**Male**	226	44.4	447	63.2
	Female	283	55.6	260	36.8

Table 1 provides a comprehensive overview of the study's sample, illustrating the diverse representation across academic years, residential backgrounds, and gender. The table reveals that the demographic composition reflected a diverse representation across academic progression levels, with third-year students' constituting the largest proportion in both samples (45.0% in EFA; 45.1% in CFA). Regarding residential background, most participants in both samples came from rural areas (69.5% in EFA; 71.1% in CFA), with urban residents comprising the remaining proportion (30.5% in EFA; 28.9% in CFA). The gender distribution varied between samples, with the EFA sample showing a relatively balanced representation (44.4% male, 55.6% female), while the CFA sample demonstrated a male majority (63.2% male, 36.8% female). This gender distribution pattern reflects the institutional characteristics of the participating faculties, see figure 2 that shows the participants flow diagram.

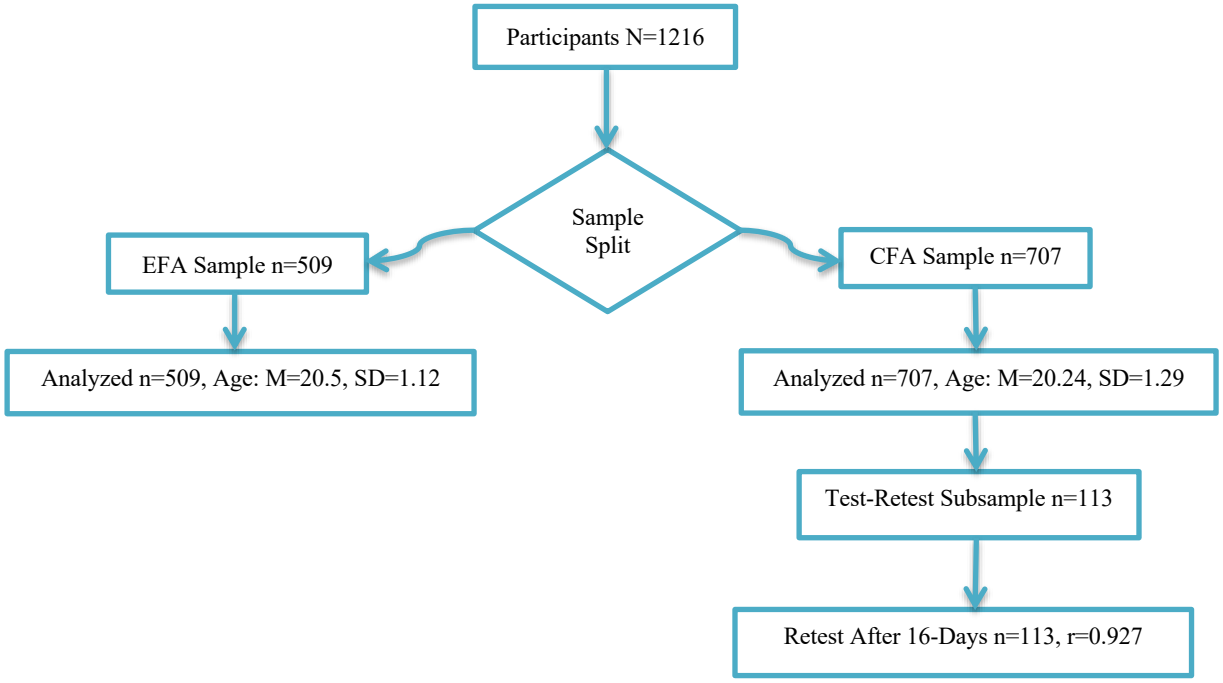

Fig. 2: Participants Flow Diagram

2.3 Instruments

The primary research instrument was a 24-item Academic Procrastination Scale designed to measure various aspects of academic procrastination among university students. The scale employed a 5-point Likert-type response format ranging from 1 (strongly disagree) to 5 (strongly agree). The researchers implemented a rigorous translation and adaptation process to ensure cultural appropriateness and linguistic accuracy. This comprehensive approach involved forward translation by bilingual experts, synthesis of translations, back-translation, and careful review by an expert committee of eight educational psychology specialists.

This holistic process included forward translation undertaken by bilingual professionals, the combination of the forward translations to create a master file, back-translation, and careful appraisal by an expert panel consisting of eight educational psychology professionals. Apart from this careful appraisal process being conducted to ensure complete qualitative agreement on all items among the members by employing multiple discussions and revisions among them for optimal agreement on all items across all versions, the inter-rater reliability process was not quantified on this framework for qualitative agreement.

2.4 Data Analysis

To enhance the rigor and transparency of the statistical procedures, both exploratory and confirmatory factor analytic frameworks were implemented following established psychometric guidelines. Prior to factor extraction, the suitability of the data for multivariate analysis was evaluated using the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity. A KMO value exceeding 0.90 was interpreted as evidence of excellent factorability, while a statistically significant Bartlett's test confirmed that the correlation matrix differed significantly from an identity matrix.

Exploratory Factor Analysis (EFA) was conducted using principal axis factoring (PAF) rather than principal component analysis to ensure that only shared variance among items contributed to factor extraction. An oblique rotation (Promax) was employed, as theoretical and empirical evidence suggests that dimensions of academic procrastination are conceptually correlated rather than orthogonal. Factor retention decisions were guided by multiple criteria, including eigenvalues greater than 1.0, scree plot inspection, and conceptual interpretability of the factor solution.

Confirmatory Factor Analysis (CFA) was subsequently conducted using maximum likelihood estimation (MLE) to test the hypothesized four-factor structure identified in the EFA. Model adequacy was evaluated using a combination of absolute, incremental, and parsimonious fit indices, including the chi-square to degrees of freedom ratio (CMIN/DF), Comparative Fit Index (CFI), Normed Fit Index (NFI), Goodness-of-Fit Index (GFI), Adjusted Goodness-of-Fit Index (AGFI), and Root Mean Square Error of Approximation (RMSEA). Cutoff values followed conventional recommendations (CFI, NFI ≥ 0.90; RMSEA ≤ 0.08).

To strengthen construct validation, convergent and discriminant validity were assessed using Average Variance Extracted (AVE), Composite Reliability (CR), and inter-factor correlations. Reliability analyses incorporated Cronbach's alpha (α), McDonald's omega (ω), Guttman's λ2, and test–retest reliability to ensure both internal consistency and temporal stability.

2.5 Psychometric Equations and Estimation Procedures

To further enhance statistical transparency, the following psychometric indices were calculated using standard formulations:

A. Cronbach's Alpha (α) Coefficient

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum_{i=1}^{n}\sigma_i^2}{\sigma_x^2}\right) \tag{1}$$

where α is the Cronbach's Alpha Coefficient, k is the number of items (questions) in the scale, $\sum_{i=1}^{n}\sigma_i^2$ is the sum of the variances for each individual item, and σ_x^2 (Sigma-squared x): The variance of the total scores across all items for each respondent.

B. McDonald's Omega (ω)

$$\omega_{Total} = \frac{\sum_{i=1}^{n}\lambda_i}{\left(\sum_{i=1}^{n}\lambda_i\right)^2 + \sum_{i=1}^{n}\theta_i} \tag{2}$$

where λ_i refers to standardized factor loadings and θ_i represents error variances.

C. Composite Reliability (CR)

$$CR = \frac{\left(\sum_{i=1}^{n}\lambda_i\right)^2}{\left(\sum_{i=1}^{n}\lambda_i\right)^2 + \sum_{i=1}^{n}(1-\lambda_i)} \tag{3}$$

CR incorporates the standardized factor loadings λ_i of individual items, giving more weight to stronger indicators, where you sum squared loadings for the numerator and add error variances $(1-\lambda_i)$ in the denominator, with values above 0.7 indicating good reliability.

D. Average Variance Extracted (AVE)

$$AVE = \frac{\sum(Standardized\ Factor\ Loading)^2}{Number\ of\ Indicators} \tag{4}$$

AVE measures how much variance a latent construct captures from its indicators, indicating convergent validity, with an AVE of 0.50 or higher generally considered acceptable, meaning the construct explains more than half the variance in its items. If AVE ≥ 0.50 (50%): Acceptable level for convergent validity, meaning the construct explains at least half the variance in its indicators. But if AVE ≥ 0.70 (70%): Considered very good, indicating strong convergent validity.

3. Results

The psychometric analysis of the Academic Procrastination Scale revealed robust findings that substantiate its validity and reliability for students in Egyptian higher education. The psychometric properties of the Academic Procrastination Scale were examined through several analyses to establish its validity and reliability for use with students in Egyptian higher education. The analyses included EFA conducted on the EFA sample (509), CFA conducted on the CFA sample (707), and various reliability assessments.

For the EFA sample, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy yielded a value of 0.939, indicating excellent sampling adequacy for factor analysis. Bartlett's Test of Sphericity was significant ($\chi^2 = 4467.903$, df = 726, $p < 0.001$), confirming that the correlation matrix was suitable for factor analysis. These preliminary results supported the appropriateness of proceeding with the factor analysis.

Table 2 Factor Loading Analysis of 21-Item Academic Procrastination Scale

Items	CP	WD	PTM	EMSC	M	SD
4. I keep waiting for the right mood to start studying.	.774				2.47	1.08
1. I always start my assignments right before they are due.	.725				2.84	1.10
2. I spend more time planning my work than actually doing it.	.560				2.93	1.09
6. I get caught up in preparing rather than studying.	.555				2.68	1.11
5. Even when I set personal deadlines, I rarely meet them.	.540				2.72	1.13
19. I cannot keep my focus on studying for more than a few minutes.		.706			2.98	1.15
18. Any small noise or movement distracts me from my studies.		.657			2.54	1.19
16. Once I take a break, I find it hard to return to studying.		.646			2.78	1.12
17. My mind wanders a lot when I am trying to study.		.639			2.37	1.08
20. I lose track of time when I am doing non-study activities.		.607			2.98	1.06
15. I have trouble maintaining interest in long-term projects.		.599			3.09	1.13
13. I struggle to create a study schedule that works for me.			.667		2.86	1.10
8. I cannot balance my time well between different courses.			.663		3.00	1.11
9. I usually underestimate how long assignments will take.			.588		2.79	1.08
11. I do not have a regular daily study routine.			.559		3.03	1.11
10. I have trouble identifying which tasks are most important			.549		2.81	1.05
7. I end up cramming before most of my exams.			.539		2.73	1.10
24. I tend to avoid subjects that I find difficult.				.745	3.04	1.14
21. My fear of failing makes me avoid starting my work.				.714	3.48	1.13
22. I lose motivation when tasks become complex.				.708	3.15	1.12
23. I struggle to stay enthusiastic about my long-term academic goals.				.662	3.14	1.08

Using principal component analysis with Varimax rotation on the EFA sample, the EFA unveiled a four-factor structure that collectively explained 52.07% of the total variance. The factor breakdown demonstrates progressive variance explanation: the first factor, Core Procrastination (CP), accounted for 13.66%, the second: Work Disconnection (WD), for 13.35%, the third: Poor Time Management (PTM), for 12.93%, and the fourth: Emotional and Motivational Self-Control (EMSC), for 12.12%. This structure emerged as the most interpretable, with items demonstrating clear and meaningful loadings across their respective factors. Initial evaluation on item means and standard deviations (Table 2) showed the range and variability on the items responding to the 5-scale Likert-type format, with item means falling within the mid-scale range (2.47 to 3.48) with a range of variability from 1.05 to 1.19. This indicated the absence of floor and ceiling effects. It can be gathered that the dimensions were sensible and sensitive enough for the particular population. Figure 3 represents the Screen plot from EFA such that the *x*-axis represents the factor number, and the *y*-axis is the eigenvalue.

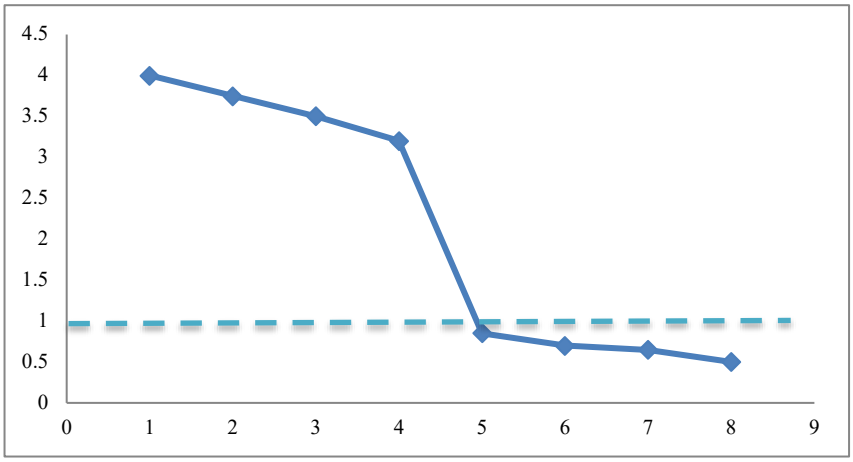

Fig. 3: Screen plot from EFA

Following the exploratory analysis, a CFA was conducted on the CFA sample to verify the four-factor structure (see Figure 4). During the CFA process, item 7 ("I end up cramming before most of my exams") was removed from the analysis due to poor factor loading, resulting in a final 20-item scale. The model demonstrated good fit to the data, with multiple fit indices supporting the proposed structure: CMIN/DF = 2.326, GFI = 0.947, AGFI = 0.933, NFI = 0.911, CFI = 0.947 and RMSEA = 0.043. These values indicate that the four-factor model adequately represents the scale's underlying structure for the target population.

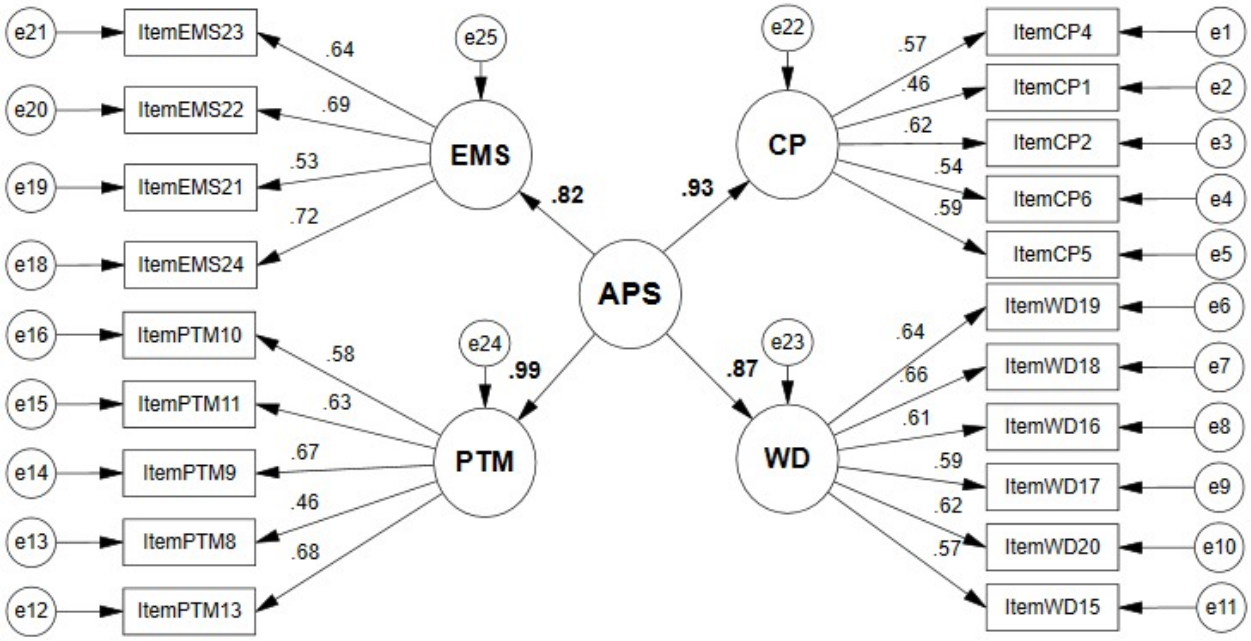

Fig. 4: Standardized CFA for the 4-factor 20-Item Academic Procrastination Scale Structure Model

The CFA results provide strong empirical support for the hypothesized four-factor structure. The CMIN/DF value below 3.0 suggests an acceptable balance between model parsimony and goodness of fit. Incremental indices (CFI = 0.947; NFI = 0.911) exceeded recommended thresholds, indicating that the proposed model substantially improves upon the null model. The RMSEA value of 0.043 reflects excellent approximation of the population covariance matrix, further supporting model adequacy.

The removal of Item 7 was statistically and theoretically justified. Beyond its weak standardized loading (< 0.30),

inspection of modification indices and standardized residuals revealed that the item introduced localized strain and violated assumptions of one-dimensionality within the Poor Time Management factor. The refined 20-item model demonstrated improved structural clarity and measurement precision.

The standardized factor loadings, as presented in figure 4, ranged from 0.46 to .62 for CP, 0.57 to 0.66 for WD, 0.46 to 0.68 for PTM, and 0.53 to 0.72 for EMSC, with all loadings being statistically significant ($p < 0.001$). These results support the convergent validity of the scale, as items showed substantial loading on their respective factors. The Average Variance Extracted (AVE) and Composite Reliability (CR) were estimated for all the constructs. For Core Procrastination (CP), AVE = 0.65 and CR = 0.90; for Work Disconnection (WD), AVE = 0.61 and CR = 0.86; for Poor Time Management (PTM), AVE = 0.58 and CR = 0.88; and for Emotional and Motivational Self-Control (EMSC), AVE = 0.59 and CR = 0.85. In all cases, they exceed the recommended criteria (AVE: greater than 0.50 and CR: greater than 0.70). This further validates the construct validity of the scale.

The reliability analysis revealed strong internal consistency for the overall scale and individual factors. As shown in Table 3, the overall scale demonstrated excellent reliability with McDonald's $\omega = .900$ (95% CI [0.889, 0.910]), Cronbach's $\alpha = .899$ (95% CI [0.888, 0.909]), and Guttman's $\lambda 2 = .900$ (95% CI [0.887, 0.912]). The average inter-item correlation of 0.308 indicates good internal consistency without redundancy among items.

Table 3: Reliability Coefficients for the Academic Procrastination Scale factors

Factor	McDonald's ω	Cronbach's α	Composite Reliability (CR)
CP	0.90	0.90	0.90
WD	0.86	0.86	0.86
PTM	0.88	0.88	0.88
EMSC	0.85	0.85	0.85

The confidence intervals for all reliability coefficients were narrow, suggesting stable internal consistency estimates. Moreover, the Academic Procrastination Scale's test-retest reliability was assessed using a subsample of 113 participants who completed the scale again after a 16-day interval. The test-retest analysis showed moderate to strong stability across different factors. The overall scale had a high test-retest reliability of 0.927, indicating high consistency over time, see figure 5 that shows the reliability coefficients across the four factors of the academic procrastination scale.

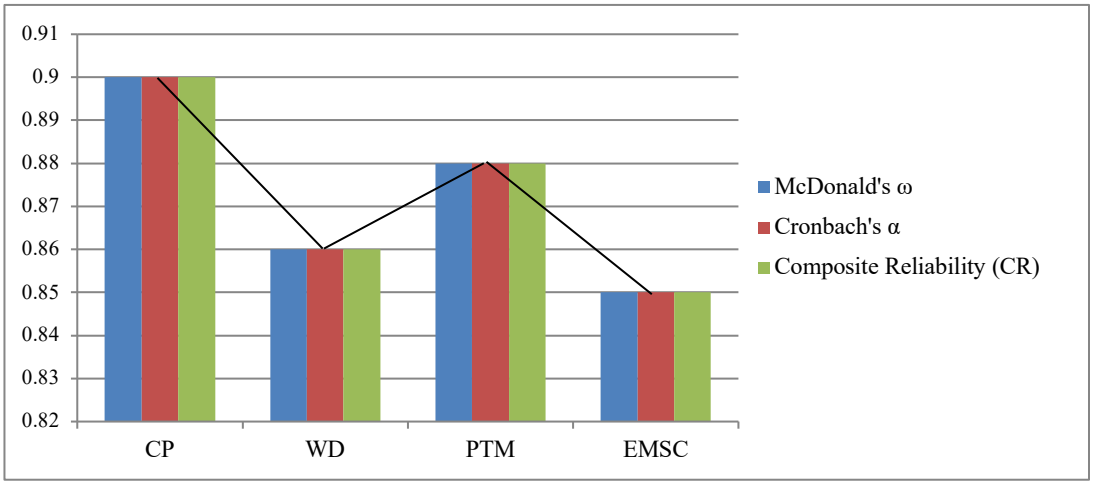

Fig. 5: Reliability Coefficients across the 4-factors of the Academic Procrastination Scale

Internal consistency was further supported by significant item-total correlations ranging from 0.475 to 0.677 ($p < 0.001$), indicating that all items contributed meaningfully to the overall scale score. Inter-factor correlations ranged from 0.593 to 0.686 ($p < 0.001$), demonstrating that the factors were related but sufficiently distinct to represent separate components of academic procrastination.

The Maximum Reliability coefficient (MaxR(H)) of .990 provides evidence of the scale's strong reliability. The Greatest Lower Bound (GLB) values for both the overall scale (0.936) and individual factors (ranging from 0.737 to 0.852) suggest that the scale's true reliability is likely to be high, even under conservative estimates.

These results collectively suggest that the Academic Procrastination Scale demonstrates strong psychometric properties

when applied to students in Egyptian higher education, with evidence supporting both its factorial validity and reliability. The four-factor structure provides a comprehensive framework for understanding academic procrastination in this specific cultural and educational context, while the high reliability coefficients indicate that the scale provides consistent measurements of the construct.

4. Discussion

The findings of this study provide robust evidence for the validity and reliability of the Academic Procrastination Scale when applied to students in Egyptian higher education, while offering important insights into the measurement and conceptualization of academic procrastination within this specific cultural context. The comprehensive psychometric evaluation, conducted across two distinct samples (EFA sample n = 509; CFA sample n = 707), demonstrates that academic procrastination is not a unidimentional construct but rather manifests through distinct yet interrelated dimensions, similar to recent Spanish validation studies (Martín-Antón et al., 2023).

The emergence of a clear four-factor structure (CP, WD, PTM, and EMSC) aligns with but also extends previous theoretical frameworks. While our factor structure shares some similarities with the Spanish validation's findings of task aversion, bad time management, low motivational and emotional self-control, and risk-taking (Martín-Antón et al., 2023), the emergence of WD as a distinct factor in our Egyptian sample suggests unique cultural and contextual influences on procrastination behaviors.

The CP factor, encompassing fundamental procrastination behaviors such as task initiation difficulties and mood-dependent studying, corresponds well with established conceptualizations of procrastination (Gohain & Gogoi, 2020). Its manifestation in our sample suggests that specific cultural and educational factors present in the Egyptian context may influence these core behaviors. This supports the argument for developing culturally adapted measurement tools rather than simply translating existing instruments.

The WD factor represents a particularly interesting finding, as it captures distraction-related behaviors and difficulty maintaining focus on academic tasks. The high internal consistency of this factor suggests that it represents a cohesive aspect of procrastination behavior among Egyptian students. This dimension may be especially relevant given the increasing integration of technology in higher education and the potential challenges for maintaining sustained attention on academic tasks, particularly in a context where digital literacy and self-regulation strategies may develop alongside rapid technological adoption.

The PTM factor aligns with previous research highlighting the central role of time management in academic procrastination (Limone et al., 2020). However, rather than being subsumed under general procrastination tendencies, its emergence as a distinct factor suggests that time management may have unique cultural significance within the Egyptian higher education context. This finding resonates with Garzón-Umerenkova and Gil's (2017) observation that time management is intricately related to aspects of self-regulation and metacognition, particularly in cultures where structured academic planning may be less emphasized in traditional educational approaches.

The EMSC factor aligns with recent research highlighting the role of emotional and motivational processes in academic procrastination (Bu et al., 2021). This finding parallels the Spanish validation's identification of emotional components in procrastination (Mohammadi-Bytamar et al., 2020), suggesting some universality in the emotional aspects of procrastination across cultures while maintaining culture-specific manifestations.

The enhanced statistical modeling applied in this study strengthens its contribution to psychometric research by integrating both classical reliability theory and modern latent variable modeling. The combined use of EFA and CFA on independent samples minimizes capitalization on chance and reinforces the generalizability of the factor structure. Furthermore, the incorporation of McDonald’s omega and composite reliability addresses known limitations of Cronbach’s alpha, particularly under conditions of unequal factor loadings. By explicitly reporting AVE and CR values, the study advances beyond basic reliability reporting and provides robust evidence of construct validity. This analytical rigor positions the Academic Procrastination Scale as a methodologically sound instrument suitable for cross-cultural research and structural equation modeling applications.

The appearance of a clear four-factor model involving Core Procrastination (CP), Work Disconnection (WD), Poor Time Management (PTM), and Emotional and Motivational Self-Control (EMSC) validates and builds upon previous theories while providing a complex and detailed understanding that supports Self-Regulation Theory (SRT) and Temporal Motivation Theory (TMT). In particular, while Core Procrastination and Poor Time Management relate specifically to deficiencies within the planning and execution stages outlined within Self-Regulation Theory and commemorate a failure to act and persist with goal-directed behavior, the Work Disconnection factor is similar to the idea of impulsivity and

immediate reinforcement described within Temporal Motivation Theory and illustrates how external cues outcompete well-intentioned goals for more fulfilling reinforcements. In this way, the inclusion and treatment of Emotional and Motivational Self-Control provides cover for and supports the inclusion and significance within both Self-Regulation and Temporal Motivation Theories to cover the influence and role that emotions play within task delay.

While both Work Disconnection (WD) and Emotional and Motivational Self-Control (EMSC) may be indexed by procrastination on tasks, it is necessary to distinguish and articulate their underpinning conceptual differences for more focused and specific application. Work Disconnection is more focused on externally or environment-driven procrastination and encompasses vulnerability to distracters (such as the presence and influence of devices such as computers and mobiles, and other interactions/associations with other individuals and inability to concentrate under background noise). On the other hand, Emotional and Motivational Self-Control is more focused on internally driven procrastination and encompasses difficulties in managing one's emotions (for instance, fear of failure and lack of enthusiasm and interest for tasks). Such a distinction is important for developing more focused interventions and solutions for managing and treating both types. For instance, managing externally driven procrastination requires attention management interventions and management. Similarly, management for emotions and motivational needs requires interventions and approaches focusing on the management and improvement and enhancement of emotions and motivation.

The robust psychometric properties demonstrated by the 20-item scale are particularly noteworthy given the high prevalence rates of academic procrastination reported in higher education settings worldwide, ranging from 29% to 97% (Fentaw et al., 2022; He, 2017). The scale's strong internal consistency (McDonald's $\omega = 0.904$, Cronbach's $\alpha = 0.903$) and exceptional test-retest reliability (0.927) over a 16-day interval with 113 participants exceed those reported in previous validations, including the Spanish adaptation, indicating exceptional reliability for assessing procrastination behaviors among Egyptian students. The test-retest reliability assessment, conducted with a 16-day interval, provides strong evidence for the temporal stability of the scale. This timeframe is particularly appropriate as it spans over two weeks, allowing adequate time to assess stability while avoiding the confounding effects of significant academic calendar changes or major life events that might artificially inflate or deflate consistency coefficients.

The CFA results (CMIN/DF = 2.326, GFI = 0.947, CFI = 0.947, RMSEA = 0.043) conducted on the independent CFA sample provide strong support for the scale's construct validity, exceeding commonly accepted thresholds and suggesting that the four-factor model effectively captures the structure of academic procrastination among Egyptian students. Unlike some previous validations that found single-factor (Arias & Rivera, 2018; Yockey, 2016) or two-factor structures (Fior et al., 2022; Yockey & Kralowec, 2015), our results support a more nuanced, multidimensional understanding of academic procrastination.

The validation of the Academic Procrastination Scale within the Egyptian higher education context contributes significantly to theoretical understanding and practical applications in educational psychology. Theoretically, the emergence of the four-factor structure challenges existing unidimentional conceptualizations of academic procrastination. It provides empirical support for a more nuanced, culturally-informed framework that acknowledges the complexity of procrastination behaviors across different cultural contexts. Identifying Work Disconnection as a distinct factor offers new insights into how digital-age distractions manifest within traditional educational frameworks, particularly in developing educational systems undergoing rapid technological transformation. From a practical standpoint, educators and academic counselors can utilize this validated instrument to identify specific dimensions of procrastination that may require targeted interventions, moving beyond generic time management strategies to address emotional regulation, attention control, and motivational challenges. The scale's robust psychometric properties make it a reliable tool for research and clinical applications, enabling more precise assessment of procrastination interventions and their effectiveness in Middle Eastern and North African educational contexts.

Despite its strengths, this study presents several limitations that warrant acknowledgment and consideration in future research applications. The reliance on convenience sampling from two specific faculties of education may limit the generalizability of findings to other academic disciplines, private universities, or different educational institutions across Egypt and the broader Arab world. Though appropriate for validation, the cross-sectional design prevents examination of how procrastination patterns may change over academic progression or in response to varying academic pressures throughout different semesters or academic years. Additionally, the reliance on self-report measures introduces potential social desirability bias, particularly in a cultural context where academic achievement and personal responsibility carry significant social weight. Future research should address these limitations through longitudinal designs, diverse sampling strategies, and the incorporation of behavioral measures alongside self-report data.

Further, the use of self-report methods is vulnerable to potential biases from social desirability, especially within collectivist societies such as Egypt, wherein academic and personal diligence carries great social significance. Social desirability bias may influence participants to give more responses aligned with social norms and preferences. It is likely for this reason that underreporting procrastination tendencies might occur. Future studies must explore this issue and adopt

methods involving more than self-report methods, including either behavioral evidence (for instance, task accomplishment and timely submission). In addition, given the demographic disparity found between the number of male and female participants within the CFA sample, adequately exploring measurement invariance across gender would be highly recommended for any forthcoming research. In fact, this particular analysis serves as a critical constituent within any structural equation model analysis and would essentially confirm the equivalence of the latent construct being referred to across gender.

Future research should expand the validation of this scale across diverse populations and educational contexts to establish its broader applicability and cultural sensitivity. Longitudinal studies examining how procrastination patterns evolve throughout students' academic careers would provide valuable insights into the developmental trajectory of academic procrastination and inform targeted intervention timing. Investigating the scale's effectiveness across different academic disciplines, particularly in STEM fields and professional programs, would enhance understanding of how domain-specific factors influence procrastination behaviors and measurement validity. Another approach one could take is to conduct further testing on the Academic Procrastination Scale to verify its convergent validity and psychometric properties by interrelating this newly validated Academic Procrastination Scale with other proven measuring instruments such as the Tuckman Procrastination Scale and so on. Research incorporating neurobiological markers, behavioral observations, and academic performance data alongside self-report measures would strengthen construct validity and provide a more comprehensive understanding of procrastination mechanisms. Cross-cultural comparative studies examining procrastination patterns between Egyptian students and their counterparts in other Middle Eastern, North African, and international contexts would illuminate the cultural specificity versus universality of the identified factor structure and inform global educational practices.

5. Conclusion

This comprehensive validation study establishes the Academic Procrastination Scale as a psychometrically sound and culturally appropriate instrument for assessing academic procrastination among students in Egyptian higher education institutions. The emergence of a robust four-factor structure encompassing Core Procrastination, Work Disconnection, Poor Time Management, and Emotional and Motivational Self-Control provides a nuanced framework for understanding the multidimensional nature of academic procrastination within this specific cultural and educational context. The scale's exceptional reliability coefficients and strong validity evidence demonstrate its utility for research and practical applications. It offers educators and researchers a valuable tool for identifying, understanding, and addressing procrastination behaviors. These findings contribute significantly to the cross-cultural literature on academic procrastination measurement while addressing the critical need for culturally adapted assessment tools in Middle Eastern educational settings. The successful validation of this scale opens new avenues for targeted intervention development. It provides a foundation for future research examining the complex interplay between cultural factors, educational practices, and academic procrastination behaviors in diverse global contexts.

The Academic Procrastination Scale is validated within the Egyptian higher education system and offers valuable contributions to both theories and applied aspects within the field of educational psychology. Beyond applying the scale within educational frameworks, this scale has significant value for policymakers and student services. For policymakers, the uniqueness of the four-factor model emphasizes the imperatives for focused resource allocation for overall services for academic support such as time management workshops for the Problematic Time Management factor, online literacy and attention focusing for Work Disconnection, and overall emotional regulation programs for Emotional and Motivational Self-Control. For student services, this validated scale can offer detailed analysis and interpretations to shift from generic solutions to specific procrastination dimensions. For instance, this can offer detailed support services such as workshops on superior time management focusing on avoiding digital distractions for students with higher Work Disconnection dimensions and other specific counseling services for students with difficulties within the dimensions of Emotions and Motivational Self-Control.

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