

Evidence of Validity of the Perceived Self-Efficacy for Academic Situations Scale: A Psychometric Network Analysis

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Abstract

Introduction: Related to psychological well-being and resilience, self-efficacy is a key determinant of academic performance. **Objective:** To assess the validity and reliability of the Perceived Self-Efficacy for Academic Situations Scale in a Peruvian university sample using psychometric network models. **Method:** A total of 600 participants took part, with a mean age of 25.49 years (SD = 7.82), 67.3% of whom were women. Dimensionality, structural consistency, and network loadings were evaluated using Exploratory Graph Analysis (EGA). In addition, the relationship between academic satisfaction and self-efficacy was examined. **Results:** The scale showed a uni-dimensional structure with ideal structural consistency (SC = 1.00). Network loadings ranged from moderate to high (0.26 to 0.39), and invariance between sexes was found. Academic self-efficacy and satisfaction had a moderate correlation ($r = .50$). **Discussion and Conclusions:** The results support the scale's validity and reliability, highlighting its usefulness in educational settings. Further research with diverse samples is encouraged. **Keywords:** Academic self-efficacy; psychometric networks; psychometric validity; academic satisfaction; structural consistency.

Evidencia de Validez de la Escala de Autoeficacia Percibida Para Situaciones Académicas: Un Análisis de Red Psicométrica

Resumen

Introducción: Relacionada con el bienestar psicológico y la resiliencia, la autoeficacia es un determinante del rendimiento académico. **Objetivo:** Evaluar la validez y fiabilidad de la Escala de Autoeficacia Percibida para Situaciones Académicas en una muestra universitaria peruana mediante modelos psicométricos en red. **Método:** Participaron 600 personas, con una edad media de 25.49 años (DE = 7.82), 67.3% mujeres. Se evaluaron la dimensionalidad, consistencia estructural y cargas de red mediante el Análisis Exploratorio de Grafos (EGA). También se analizaron las relaciones entre satisfacción y autoeficacia

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académicas. **Resultados:** La escala presentó una estructura unidimensional y una consistencia estructural ideal ($SC = 1.00$). Las cargas de red fueron moderadas a altas (0.26 a 0.39), y se observó invarianza entre sexos. La correlación entre autoeficacia y satisfacción fue moderada ($r = .50$). **Discusión y conclusiones:** Se confirma la validez y fiabilidad de la escala, recomendando su uso en contextos educativos y más investigaciones futuras.

Palabras clave: Autoeficacia académica; redes psicométricas; validez psicométrica; satisfacción académica; consistencia estructural.

Introduction

Self-efficacy is a key predictor of academic success (Gamarra et al., 2024; Gao, 2023; González-Cantero et al., 2020). However, research indicates that low self-efficacy limits students' ability to self-regulate learning (Widowati et al., 2023) and apply appropriate study strategies (Kuznetcova et al., 2023; Yip, 2021) or one's ability to mentally manipulate spatial information about objects, are critical to STEM enrollment, retention, and achievement. Low level of VS skills may deter some people from joining the STEM workforce or complicate their learning experience. While there is plenty of evidence suggesting that VS skills can be improved through training, few accessible training programs exist as of now, particularly for younger students. The current study proposes a new direction of VS training focusing on the development of visuospatial self-efficacy (VSSE making it difficult for them to adapt to academic demands (García-Álvarez et al., 2021). Consequently, insufficient academic self-efficacy constitutes a relevant problem in higher education, affecting both academic performance and emotional well-being.

Rooted in classical psychology, perceived self-efficacy, defined by Bandura (1997) as a person's view of their capacity to do an activity successfully has origins in Though conceptualizations of academic self-efficacy have changed, this variable is still regarded as the evaluation each person makes of his or her capacity to plan and execute the required actions to face educational situations; thus, greater self-efficacy is associated with greater expectations, ambitions, and effort (Huertas, 1997). Recent research in this past decade indeed correlate self-efficacy with well-being, academic achievement,

and satisfaction (Delgado Domenech et al., 2019; González-Cantero et al., 2020; Phuoc-Thien et al., 2024a; Veliz & Apodaca-Urquijo, 2012).

The study of self-efficacy becomes relevant because of its implication in the teaching-learning processes, both for students and teachers (Gordon et al., 2023; Schunk & DiBenedetto, 2022) and because it is a good predictor of academic success. Similar findings indicate that self-efficacy increases psychological resilience and predicts posttraumatic growth (Zeng et al., 2021). In the university context, self-efficacy has proven to be a key factor in students' persistence, academic performance, and emotional regulation (Honicke & Broadbent, 2016).

According to Social Cognitive Theory, satisfaction with one's academic experience constitutes a source of self-efficacy information via enactive mastery and affective states (Bandura, 1997). In particular, Lent et al. (2007) outcome expectations, environmental supports, and perceived goal progress have demonstrated that students who report higher levels of academic satisfaction are more likely to interpret their past successes as evidence of competence, thereby bolstering their self-efficacy beliefs in subsequent learning tasks. Empirical studies corroborate this: Delgado-Domenech et al. (2019) found that satisfaction with coursework significantly predicted academic self-efficacy, even after controlling for prior achievement. Thus, conceiving academic satisfaction not merely as an outcome but as an antecedent of self-efficacy provides a theoretical foundation for the joint analysis of these constructs in the present network framework.

The Academic Satisfaction Scale is an instrument designed to gauge students' perceived satisfaction and wellbeing across dimensions such as academic progress, quality of instruction,

and the institutional environment ([Lent et al., 2007](#); [Sisto et al., 2008](#)) outcome expectations, environmental supports, and perceived goal progress. In the present study, it is employed to assess the impact of psychoeducational interventions on motivation and engagement, to monitor satisfaction throughout the training cycle, and to detect early those groups at risk of dropout. It also enables an examination of the relationships among academic satisfaction, achievement, self-efficacy, and emotional wellbeing. The following validity hypotheses were prespecified: (a) a unidimensional structure with factor loadings ≥ 0.50 in Confirmatory Factor Analysis; (b) positive correlations ($r \geq 0.40$) with the Perceived Self-Efficacy for Academic Situations Scale; and (c) configural and metric factorial invariance across sexes in culturally similar contexts ([Delgado-Domenech et al., 2019](#); [Medrano & Pérez, 2010](#)).

A recent literature review confirmed a positive association between academic self-efficacy and academic satisfaction. In Vietnam, [Hò \(2024\)](#) found a moderate correlation between the two variables in university students ($r = .26$, $p < .001$). In China, [Tian et al. \(2024\)](#) observed a stronger link ($r = .59$, $p < .01$), and their SEM indicated that a one-unit increase in self-efficacy predicted a 1.64-unit rise in satisfaction ($\beta = 1.64$, $p < .01$). In Ghana, a PLSSEM showed a small but significant direct effect of self-efficacy on programme satisfaction ($\beta = .22$, $p = .007$), explaining 28% of the variance ($R^2 = .28$; [AzilaGbetor et al., 2022](#)). Among nursing students in Jordan, hierarchical regression revealed that self-efficacy emerged as the sole positive predictor ($\beta = .95$, $p = .001$), raising the explained variance to 37% ($R^2 = .37$; [Shehadeh et al., 2020](#)). Finally, [Pham et al. \(2024\)](#) demonstrated that self-efficacy is related to satisfaction ($r = .29$) and that self-efficacy amplifies the motivation \rightarrow satisfaction pathway, the coefficient increased from $\beta = .037$ under low self-efficacy to $\beta = .050$ under high self-efficacy, with a significant moderation effect ($\beta = -.002$, 95% CI [.0001, .0005]). Together, these studies corroborate that higher academic self-efficacy is systematically associated with and indeed magnify levels of academic satisfaction.

Regarding gender differences in academic self-efficacy, multiple studies have found mixed

patterns: In Pakistan, female high school students scored higher than their male counterparts with a moderate effect size ($d = 0.99$; [Hasan & Parvez, 2019](#)), while in Uganda, male university students showed a large advantage ($d = 1.46$; [Musa, 2020](#)). In contrast, in Malaysia, female university students outperformed males by a medium magnitude ($d = 1.17$; [Ibrahim & Wah, 2020](#)), and in Morocco, the differences were small in favor of women ([Mamnoun et al., 2023](#)). A systematic review of 53 studies confirms that gender significantly moderates the relationship between self-concept and self-efficacy, especially in STEM disciplines ([Wang & Yu, 2023](#)). These results underscore the need to assess measurement invariance before comparing self-efficacy means between men and women.

Therefore, it is necessary to measure self-efficacy with valid and reliable tools that allow us to study and better understand this phenomenon so that we can promote better psychological well-being in people since self-efficacy is also related to a better profile of use of coping strategies ([Freire et al., 2020](#)), which would reduce the probability of developing psychological distress ([Zhou et al., 2021](#)).

One of the first studies on perceived self-efficacy in academic contexts was carried out by [Palenzuela \(1983\)](#). To measure the expectation of academic efficacy, he designed a 10-item questionnaire applied to the Spanish population, obtaining a Tucker reliability coefficient of .92. [García-Fernández et al. \(2010\)](#) assessed a sample of Spanish teenagers later and reported a Cronbach's Alpha of .89 and a test-retest reliability of .87. Another research by [García-Fernández et al. \(2016\)](#) examined Chilean teenagers and found a Cronbach's Alpha of .88. The scale was revised by [Dominguez and Villegas \(2012\)](#) and [Dominguez \(2016\)](#) in a sample of Peruvian university students, showing a good fit in a 9-item model (RMSEA = .054; CFI = .99).

Initially, it was [Palenzuela \(1983\)](#) who developed the *Perceived Self-Efficacy for Academic Situations Scale* (EPESA) as part of a research program carried out in Spain, based on a social cognitive motivation model. This instrument was designed in a unidimensional form and was aimed at adolescents and university students; the scale was useful both for research and for the diagnosis

and treatment of problems in school and academic contexts. In addition, it was applied in cases of school failure, where students with good potential or intellectual capacity tended to underestimate their academic abilities (Palenzuela, 2012). Regarding the evidence of validity, the author used factor analysis by the maximum likelihood method, where he evidenced the one-dimensionality of the test. Finally, the reliability by internal consistency was reported with a Cronbach's alpha of .91, likewise; the scale was subjected to test-retest reliability reporting a value of .92.

Previous validations of the Perceived Self-Efficacy for Academic Situations Scale in Latin American contexts, (Alfaro et al., 2022; Buenaño & Flores, 2023; Carranza-Esteban et al., 2022) have primarily used classical psychometric approaches, including exploratory and confirmatory factor analysis. However, these studies did not assess item-level dynamics or structural indices from a network perspective, which limits the depth of their psychometric evidence. The present study addresses this gap by applying psychometric network analysis to examine the internal structure of the scale in greater detail.

Therefore, having an instrument with suitable evidence of validity and reliability allows a more accurate measurement when studying self-efficacy, which provides a basis for studies that implement novel and relevant methodologies to explore factors associated with self-efficacy, so that the dynamics and interaction with them can be understood. This would allow researchers and mental health professionals to propose and design evidence-based interventions to improve self-efficacy and thus reduce the risk of mental illness in the population (Freire et al., 2020; Zhou et al., 2021).

Network analysis has gained popularity as a method for studying the interconnections of mental health variables across disciplines (Rogers et al., 2019). This approach visualizes symptoms as interrelated nodes that reinforce each other, estimating the interaction between factors to be analyzed (Borsboom & Cramer, 2013). Initially used in psychopathology, it has expanded to areas such as intelligence, personality (Di Fabio et al., 2022), emotional intelligence (Di Fabio et al., 2023), academic self-efficacy (Hu et al., 2023) and romantic

relationships (Ventura-León & Lino-Cruz, 2023).

From an a priori perspective, network psychometrics constitutes a methodological complement to classic validations of self-efficacy, because it allows (i) estimating and testing the replicability of the dimensional structure through Exploratory Graph Analysis (EGA) and its bootstrap version (bootEGA), attenuating the dependence on a single sample (Christensen & Golino, 2021a; Golino & Epskamp, 2017); (ii) quantifying the contribution of each item with network loadings, which have shown functional equivalence with factor loadings for the purposes of item selection and invariance (Christensen & Golino, 2021); (iii) evaluating the redundancy or local dependence between items with Unique Variable Analysis (UVA), providing objective criteria to refine or abbreviate scales (Christensen et al., 2023); (iv) testing for invariance across groups (e.g., sex) using permutations in the network framework (Jamison et al., 2024); and (v) comparing structures with entropy-based fit indices (TEFI; Golino et al., 2020). Furthermore, comparative evidence indicates that Louvain, Fast greedy, and Walktrap are suitable community detection algorithms for recovering dimensionality in psychometric networks, reinforcing the technical relevance of the approach (Blondel et al., 2008; Christensen et al., 2023; Clauset et al., 2004; Pons & Latapy, 2005). Together, these properties justify a priori its use to corroborate structural robustness, audit item-item overlaps and guarantee comparability between subgroups, expanding the validity base of self-efficacy instruments beyond traditional factorial adjustment (Christensen et al., 2020; Golino, Shi et al., 2020).

The main objective of this study is to analyze the psychometric properties of the Perceived Self-Efficacy for Academic Situations Scale, using metrics based on network models. Following international regulations (Association et al., 2014; International Test Commission, 2018), the validity of the internal structure and its relationship with other variables will be assessed, in addition to reliability through structural consistency. Additionally, the configurational and metric invariance across gender groups will be explored to determine whether the network structure and item associations remain stable

across subpopulations. Although self-efficacy has been widely studied, the use of network analysis in its assessment is scarce, which makes this study a valuable contribution to improving its understanding and application in educational and psychological contexts.

Method

Research Design

The present study adopted an instrumental design, as outlined by [Ato et al. \(2013\)](#) and [Montero and León \(2002\)](#), as it focused on the validation of a psychometric instrument.

Participants

Examining the age distribution among the 600 participants revealed that the majority were young adults, with a mean age of 25.49 years ($SD = 7.82$). Regarding gender distribution, males accounted for 32.7% of the sample, while females constituted the majority with 67.3%. About academic performance, 44.8% of the participants reported high performance, followed by 39.5% with medium performance, while only a small proportion indicated having low performance. When considering the academic cycles of the participants, the majority were between the seventh and tenth cycles (41.5%), followed by those in the fourth to sixth cycles (40%), and only a small fraction (16%) were in the first cycles. As for employment, 41.7% of the participants focused exclusively on their studies, while 58.3% combined work and studies. Undergraduate university students enrolled between the first and tenth academic cycles who were available to participate were included. Individuals who were not university students, fell outside the specified academic range, or had incomplete data were excluded. To calculate the sample size, a post hoc analysis of power and replicability was performed using the 'netSimulator' function of the bootnet package ([Epskamp & Fried, 2018](#)). With 600 participants, both the power for connection detection and the replicability of force centrality exceeded the recommended thresholds (> 0.80 and > 0.70 , respectively), supporting the suitability of the sample for an accurate and stable

network estimation. Finally, it should be noted that a non-probability convenience sampling technique was used, an appropriate decision for an exploratory investigation, since data collection depends largely on the accessibility and ease of selection of the participants ([Maxwell, 2012](#)).

Measures

Sociodemographic card. In the present study, a specialized card was prepared to collect detailed information on the personal characteristics of the participants. It included variables such as age, sex, academic performance, academic cycle and occupation.

Perceived Self-Efficacy for Academic Situations Scale (EAPESA, Palenzuela, 1983). In the Peruvian context, [Dominguez-Lara \(2014\)](#) used the nine-item version with a four-point Likert format (1 = *Never* to 4 = *Always*). A confirmatory factor analysis with maximum-likelihood estimation tested the hypothesized one-factor model and showed good fit: $\chi^2(27) = 64.69, p < .001, CFI = .978, GFI = .969, AGFI = .949, RMR = .029, RMSEA = .056$, supporting one-dimensionality; internal consistency was $\alpha = .881$ (95% CI [.864, .897]). Notably, the earlier preliminary study (exploratory factor analysis) reported that the single factor accounted for 55.261% of the total variance with $\alpha \approx .89$, providing convergent evidence for a robust one-dimension structure across studies.

The Academic Satisfaction Scale (Sisto et al., 2008). Adapted for Argentine university students ([Medrano & Pérez, 2010](#)), the Academic Satisfaction subscale consists of eight items with four-point Likert-type responses (0 = *never* to 3 = *always*). An example item is: "I am interested in classes." Prior to analysis, sampling adequacy (KMO = .817) and sphericity (Bartlett $\chi^2 = 1058.13, df = 55, p < .001$) were verified. An exploratory factor analysis was performed using principal components extraction with Varimax rotation, guided by the Kaiser criterion and the scree plot. Although an initial two-factor solution explained -55% of the variance, the second factor was weak and difficult to interpret; After item refinement and reanalysis, the final solution maintained acceptable adequacy indices (KMO = .828; Bartlett $\chi^2 = 808.72, df = 36, p < .001$) and

retained a unidimensional structure that explained 49% of the variance, with all loadings $> .35$. Internal consistency was $\alpha = .84$.

Procedure

In line with the ethical guidelines for human research stated in the Declaration of Helsinki ([World Medical Association, 1964](#)), the project got ethical clearance from the committee of the university to which the researchers are associated. Before being included in the study, each subject gave informed consent. Also, the questions were administered digitally in keeping with [Hoerger and Currell \(2012\)](#) recommendations for internet research. Popular social networking sites like WhatsApp and Facebook were used in the approaches applied to distribute and share the evaluation procedure. Although the completion of the surveys was not specifically timed, participants typically took eighteen minutes to finish them. Data gathering ran from September to December 2023; the results were stored in the OSF public repository: <https://osf.io/8c6j7/>

Data analysis

The statistical analysis was performed utilizing the R programming language in the RStudio environment ([RStudio Team, 2022](#)). Useful tools were available, such as 'EGAnet' ([Golino & Christensen, 2024](#)) and 'psychometrics' ([Epskamp, 2024](#)). Supporting libraries such as 'tidyverse' ([Wickham, 2023](#)) and gridExtra ([Auguie & Antonov, 2017](#)) were also used. The initial analysis of the descriptive statistics was evaluating the response rates or percentages corresponding to each response option. This was done to reflect the ordinal nature of the variables.

Subsequently, an exploratory phase was carried out using an Exploratory Graph Analysis (EGA) applied with the EGAnet library, due to its efficiency in unidimensional and multidimensional structures ([Golino & Christensen, 2024](#)). A GLASSO Gaussian model combined with the louvain algorithm was used to verify the dimensionality of the data. This procedure is more accurate than other exploratory methodologies for determining the number of communities using a visual representation of regularized partial correlations

([Christensen, 2020](#)). In addition, network loadings were calculated; 0.15 denotes small magnitude, 0.25 moderate, 0.35 is large ([Christensen & Golino, 2021](#)). Using 1000 replicates and the bootEGA function of EGAnet, structural consistency and item stability were assessed by dimension and item replication analysis under the LE algorithm ([Golino & Christensen, 2024](#)). A minimum of 75% replications was considered sufficient for structural consistency and item stability ([Golino et al., 2020](#)).

Structural consistency in a psychometric model differs from measures such as Cronbach's alpha or McDonald's omega, as it focuses on the evaluation of the unity and logical coherence of the variables ([Christensen et al., 2020](#)). In that sense, structural consistency analyzes the relationship between items within each dimension and their replication in different samples, as opposed to internal consistency. Therefore, this metric is fundamental to ensure the stability and accuracy of the model in a variety of application contexts. For its interpretation, the criterion used was that a dimension should maintain the same composition of items in at least 75% of the bootstrap samples, and that each item should be located in its original dimension in at least 75% of cases ([Christensen & Golino, 2021](#)).

The study of latent networks investigates the relationship between latent variables within a network, employing a latent network model ([Epskamp et al., 2017](#)). This approach integrates elements of latent variable models and network analysis to analyze complex relationship between variables that are not directly observable. In the study, the relationship between the academic self-efficacy scale and academic satisfaction is analyzed to verify convergence and assess model performance. To interpret the correlations, the following cut-off points are used: ($r > .10$) small correlations, ($r > .20$) moderate correlations and ($r > .30$) large correlations ([Gignac & Szodorai, 2016](#)).

Regarding invariance in this network approach, the assessment of the configurational invariance of each group by EGA was carried out independently, classifying participants according to their gender, thus ensuring whether nodes clustered in the same communities in each group. Next, across the entire sample, a bootEGA study was conducted to

assess any structural and numerical changes in the organization of nodes into communities, as well as to investigate consistency. Configural invariance was considered acceptable when at least 75% of nodes were assigned to the same communities across groups. To confirm the equality of network loadings between the different groups, metric invariance was finally checked by permutation tests. Non-significant p-values ($p > .05$) indicate invariance in the strength of the item-community associations (Jamison et al., 2024).

Results

Preliminary item analysis

Figure 1 presents a detailed distribution of response percentages for the nine items labeled EAPESA1 to EAPESA9, categorized into four frequency levels: "Never," "In some cases," "Many times," and "Always." Overall, there is a tendency towards the higher categories, particularly in items EAPESA7, EAPESA4, and EAPESA6, where 66.33%, 53.33%, and 57.50% of participants, respectively, selected the highest categories ("Many times" and "Always"). On the other hand, the lower categories ("Never" and "In some cases") are less represented,

as in item EAPESA7, with only 4% of respondents selecting those categories. This distribution indicates a tendency among participants to report more frequent and positive behaviors or attitudes related to the evaluated items, suggesting a high prevalence of the behaviors or attitudes associated with these items.

Dimensionality and stability

Figure 2 provides a detailed view of the dimensionality and item stability in the psychometric model evaluated (M1). It displays a network composed of nine items (EAPESA1 to EAPESA9) interconnected, representing a single community, which suggests a high level of cohesion among the items in the model. The strongest connections are visualized through thicker links between several of these items, indicating significant interrelations in their responses. On the right-hand side, the item stability is shown, where all items achieve a replication value of 1, indicating that the items were consistently identified within this single dimension in 100% of the replicated samples. This result suggests a high level of consistency in the model's dimensional structure, with all items remaining stable and robust within this configuration.

Figure 1. Response rates for each of the items of the academic self-efficacy scale.

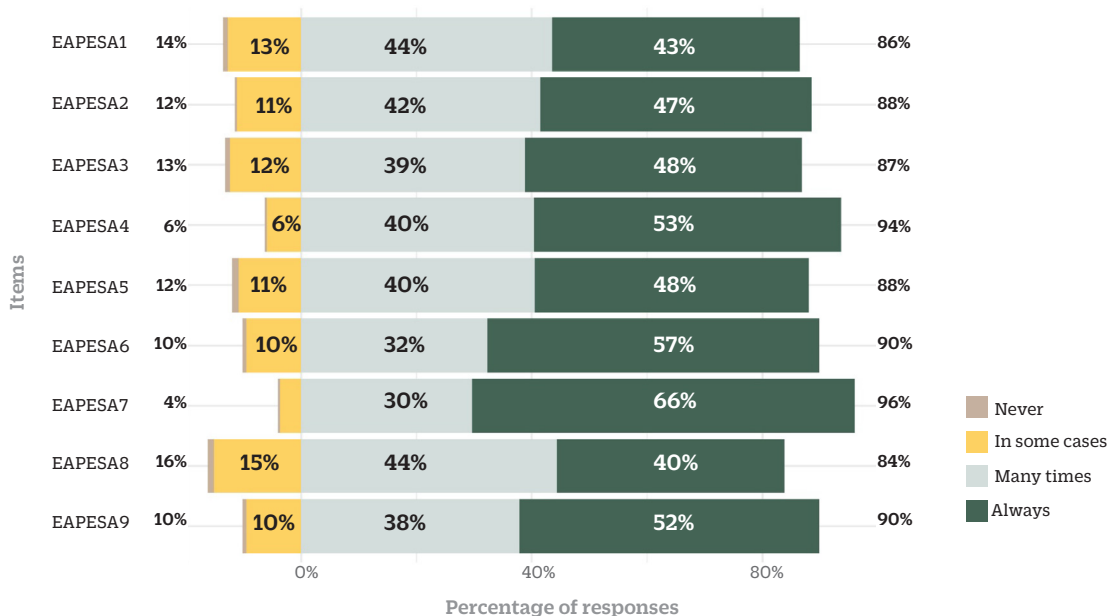
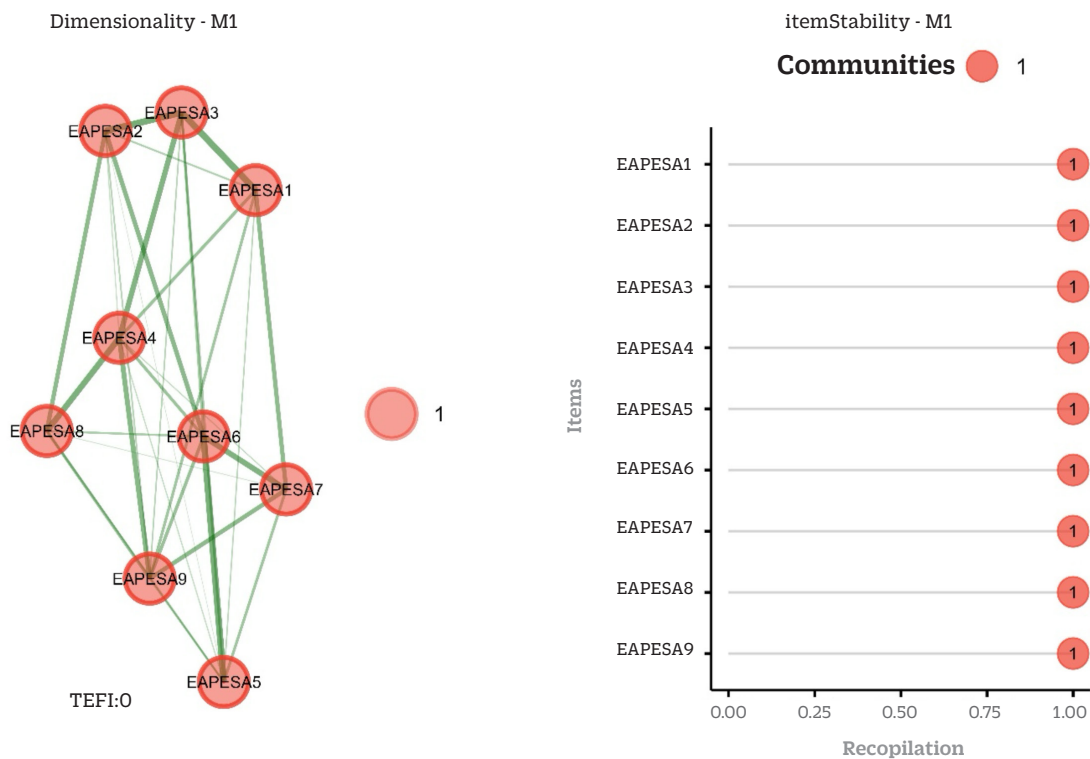


Figure 2.
Dimensionality and stability of items



Network Loads

In Table 1, which presents the analysis of the psychometric model M1, variations in the magnitude of network loadings among the evaluated items can be observed. In this model, high loadings (≥ 0.35), indicating a strong association, are found in items EAPESA6, EAPESA4, and EAPESA3. These high loadings suggest a significant connection within the evaluated community. Additionally, moderate loadings (≥ 0.25 and < 0.35) are observed in items EAPESA9, EAPESA2, EAPESA1, EAPESA7, EAPESA5, and EAPESA8, indicating important but less intense relationships among these items. This pattern of loadings demonstrates the structural consistency of the model, with a total SC value of 1, suggesting a robust and well-defined structure in model M1.

Structural consistency

Based on the structural consistency results for the unidimensional model M1, a perfect structural

consistency is observed. In Table 1, it is reported that the single dimension evaluated in M1 reached a structural consistency value of 1, indicating complete stability in the model's structure. This value suggests that the items associated with this dimension are fully aligned with the underlying structure of the model, demonstrating high reliability and robustness in the assessment of the analyzed construct.

Latent network analysis (relationship with other variables)

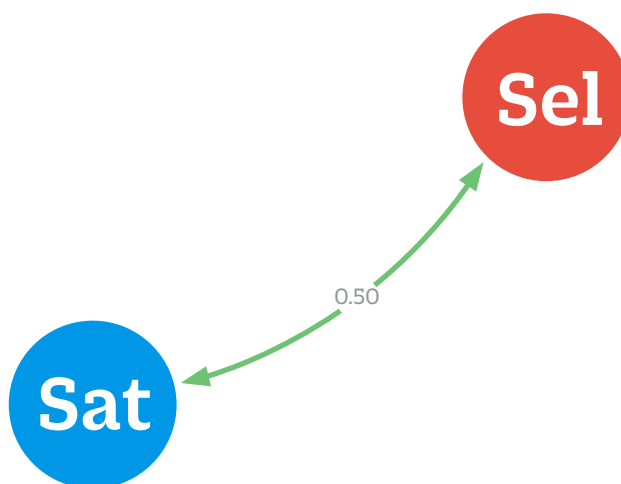
In Figure 3, a latent network model is presented, illustrating the relationship between Academic Self-Efficacy (Sel) and Academic Satisfaction (Sat), along with their respective observable items. In the model, the correlation between Sel and Satisfaction is 0.50, indicating a moderate relationship between these two latent variables. Each latent variable is associated with several observable items

Table 1.
Network Loads of the Analyzed Model

	Items	M1
EAPESA1	I consider myself capable enough to cope successfully with any academic task.	.29
EAPESA2	I think I have the ability to understand a subject well and quickly.	.29
EAPESA3	I feel confident to approach situations that test my academic ability.	.35
EAPESA4	I have the conviction that I can do well in the exams.	.37
EAPESA5	I don't mind that teachers are demanding and harsh, as I am confident in my own academic ability.	.27
EAPESA6	I believe that I am a skilled and competent person in my academic life.	.39
EAPESA7	If I put my mind to it, I believe I have the ability to achieve a good academic record.	.27
EAPESA8	I think I can pass the courses quite easily and even get good grades.	.26
EAPESA9	I believe I am ready and able to achieve many academic successes.	.34
SC		1.00

Note. Network loadings reflect the association of each item with the single dimension evaluated in the model. SC represents the structural consistency of the model.

Figure 3.
Latent network analysis between academic self-efficacy and academic satisfaction.

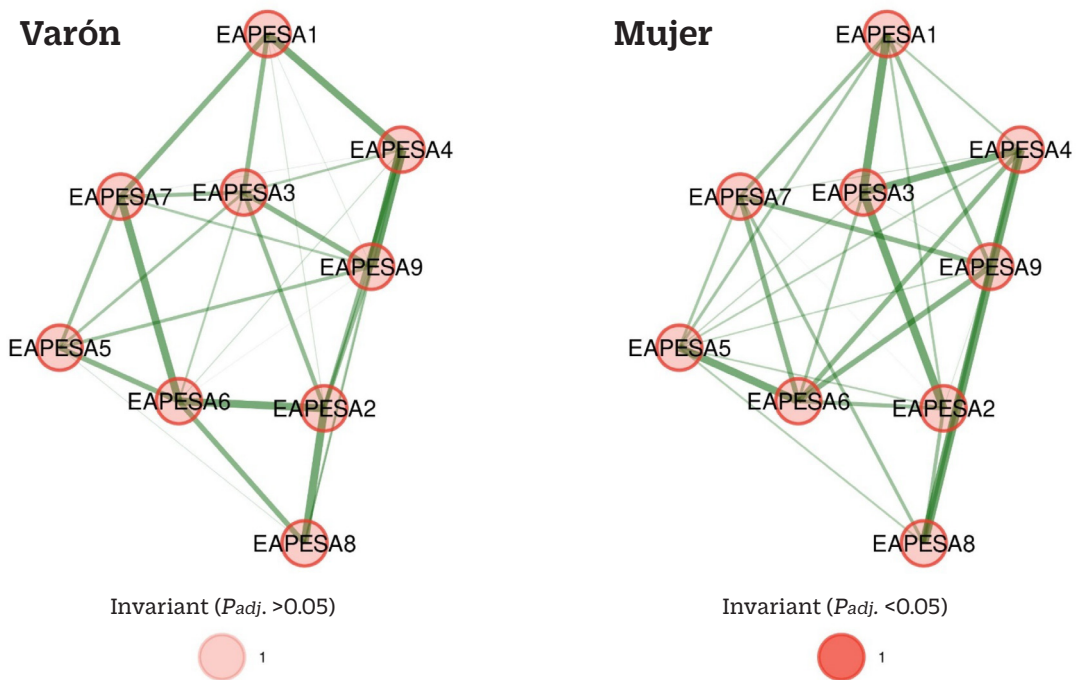


that measure it. For Sel, the items show loadings ranging from 0.69 (EAPESA8) to 0.85 (EAPESA6), suggesting that these items have a strong relationship with the academic self-efficacy construct. On the other hand, the items related to Satisfaction present loadings between 0.68 (ESA3) and 0.87 (ESA6), demonstrating a significant connection between the items and academic satisfaction.

Network invariance

Figure 4 indicates that male and female nodes show clustering within the same community according to the EGA. Furthermore, the bootEGA internal study on the combined sample confirmed this result by demonstrating a consistent clustering of nodes within the same community. These results support configurational invariance. A metric invariance analysis was then performed;

Figure 4.
Configuration and metric invariance



thus, Figure 4 visually indicates metric invariance by showing that each node is colored in a regular way. This implies that the instrument performs the same regardless of the group, as the loadings and network structure of the male and female groups are the same.

Discussion

Under this perspective, self-efficacy research highlights its role in enhancing academic performance through commitment to learning (Gordon et al., 2023; Meng & Zhang, 2023; Rosales-Ronquillo & Hernández-Jáquez, 2020). In this study we adopt network analysis as a complementary psychometric approach, which has gained notoriety for revealing dynamic inter-relationships among multiple mental health variables and providing valuable empirical evidence for the development

of effective psychological interventions (Liu et al., 2022). Within this framework, network analysis allows us to estimate aspects of validity that are seldom addressed in traditional validations: (a) structural validity via dimensional recovery and item stability under bootstrap; (b) replicability and structural uncertainty (e.g., TEFI) at the model level; and (c) reliability through structural consistency, evidence that extends beyond internal consistency coefficients. Therefore, it is crucial to have an accurate and reliable instrument to measure behaviors where students indicate how often they feel capable of coping with adverse situations; a network-based evaluation of its structure provides a priori justification for the instrument's robustness and facilitate its use in future research in the Peruvian context.

In parallel, we incorporated the Academic Satisfaction Scale, an instrument that gauge's students' satisfaction with academic

progress, instructional quality, and the institutional environment (Lent et al., 2007; Sisto et al., 2008). In our design, this measure additionally serves to test convergent validity for the self-efficacy construct within a latent-network modeling perspective, with three practical objectives: (a) monitoring the impact of psychoeducational interventions on motivation and engagement; (b) tracking satisfaction across the training cycle to identify students at risk of dropout; and (c) examining links among satisfaction, achievement, self efficacy, and emotional well being. Accordingly, we posited a unidimensional factor/network structure, positive correlations ($r \geq .40$) with the Perceived Academic Self-Efficacy Scale, and measurement invariance across sexes. (Delgado Domenech et al., 2019; Medrano & Pérez, 2010).

The descriptive analysis shows a clear tendency among participants to select higher scoring options, particularly in items 7, 4, and 6, reflecting strong confidence in their academic abilities. This trend indicates a positive self-perception, which is essential for motivation and academic success. For instance, these items assess students' perceived efficacy in organizing academic tasks, maintaining focus, and fulfilling responsibilities in the university setting. This pattern can be understood within the framework of individuals' perceptions of their ability to successfully carry out specific behaviors (Rosales-Ronquillo & Hernández-Jáquez, 2020), as well as in students' ability to self-regulate their learning and apply effective study strategies (Zheng et al., 2021), which are crucial elements in university life.

Regarding the internal structure, the results of the analyses showed a unidimensional structure, i.e., the items were grouped in a single community, which was stable across bootstrap replications, as were the items that make up the network (Christensen & Golino, 2021). Such findings coincide with the original model (Palenzuela, 1983) and with the Peruvian adaptation (Dominguez Lara, 2014). At the level of network loadings, moderate to high saturations were found in all items, which implies a good interconnection among them. Furthermore, this was supported by a total entropy fit index (TEFI) of 0, indicating minimal structural

uncertainty and suggesting that the identified dimensional structure represents an orderly and coherent organization of the variables (Golino, Moulder, et al., 2020).

Taken together, these indicators provide multi-layered validity evidence not previously reported for EAPESA: structural validity via dimensional recovery (Golino & Epskamp, 2017) and item-dimension stability under bootstrap (Christensen & Golino, 2021), low structural uncertainty (TEFI; Golino, Moulder, et al., 2020), and network loadings with functional equivalence to factor loadings (Christensen & Golino, 2021). In addition, we contribute group comparability through permutation-based invariance in the EGA framework (Jamison et al., 2024) and convergent validity with academic satisfaction using a latent-network model. This evidence package complements and EAPESA's validation record from the original Spanish development (Palenzuela, 1983), Peruvian EFA/CFA confirmation (Dominguez Lara, 2014), and recent Rasch/IRT and invariance studies in Spain, Chile, and Ecuador (García-Fernández et al., 2016; Garzón et al., 2021; Moreta-Herrera et al., 2021; Regatto-Bonifaz et al., 2023) confirming one-dimensionality and internal consistency while adding replicability, parsimony, and interpretability from a network-psychometrics perspective. Practically, these results justify using EAPESA for longitudinal monitoring, item refinement, and fair sex comparisons in Peruvian university settings.

These structural and invariance results gain additional relevance considering international evidence for gender gaps in self efficacy: Malaysian undergraduates display a medium female advantage (Ibrahim & Wah, 2020); whereas Ugandan students show a large male advantage (Musa, 2020). Demonstrating configural and metric equivalence therefore ensures that any observed mean differences reflect true variation rather than measurement artefacts. Indeed, a broader synthesis shows mixed patterns higher female scores in Pakistan and Malaysia but higher male scores in Uganda and domain specific differences in Morocco and a meta analytic review confirms that gender moderates'

self concept/self efficacy links, particularly in STEM fields ([Hasan & Parvez, 2019](#); [Mamnoun et al., 2023](#); [Wang & Yu, 2023](#)). Such conflicting evidence underscores the necessity of confirming measurement invariance before making substantive gender comparisons.

Latent network analysis confirmed a substantive link between the EAPESA and academic satisfaction, supporting theoretical coherence with related constructs ([Delgado-Domenech et al., 2019](#); [González-Cantero et al., 2020](#); [Phuoc-Thien et al., 2024](#); [Veliz & Apodaca-Urquijo, 2012](#)). Within the network-analysis paradigm, each scale item functions as a node whose dynamic interconnections define academic self-efficacy. The single cohesive community indicates that efficacy beliefs form a unified, self-reinforcing system confidence in exams or assignments bolsters other competence perceptions. Edge weights of 0.26–0.39 denote each node's relative influence, highlighting EAPESA3, EAPESA4, and EAPESA6 as central hubs. From [Bandura's \(1997\)](#) social-cognitive standpoint, this structure shows that success expectations arise from interlinked beliefs. A moderate correlation with academic satisfaction further implies that self-efficacy coevolves with subjective well-being, sustaining coping strategies and intrinsic motivation. This finding is consistent with recent international evidence: studies from Vietnam, China, Ghana, Jordan and Vietnam again ([Pham et al., 2024](#)) all converge on the conclusion that higher self-efficacy aligns with (and can magnify) academic satisfaction.

As for reliability, it was demonstrated through structural consistency ([Christensen et al., 2020](#); [Christensen & Golino, 2021](#)), which showed satisfactory results. That is, all items obtained a stability value of 1, indicating perfect replication in their corresponding dimension across all bootstrap samples. Although previous studies did not apply this specific procedure, they did report adequate internal consistency in both the original version ([Palenzuela, 1983](#)) and the Peruvian adaptation ([Dominguez Lara, 2014](#)). Unlike traditional measures of internal consistency based on CTT, structural consistency assesses “the extent to which a dimension is in-terrelated

(internal consistency) and homogeneous (test homogeneity) in the presence of other related dimensions” ([Christensen & Golino, 2021a, p. 482](#)). These findings reinforce that the structure is robust and stable, ensuring the accuracy of the model.

Configural and metric invariance analyses confirm that the network structure of the Perceived Academic Self Efficacy Scale is equivalent for male and female students. Over 75 % of items cluster identically in both groups, demonstrating shared dimensionality, while non significant permutation tests indicate equivalent item-community associations, thus permitting unbiased score comparisons. Given the mixed gender patterns reported in prior research, ranging from female advantages in Pakistani high school samples to male advantages in Ugandan undergraduates and domain specific differences in Morocco ([Hasan & Parvez, 2019](#); [Ibrahim & Wah, 2020](#); [Mamnoun et al., 2023](#); [Musa, 2020](#)); this invariance evidence assures that any sex differences observed in the present study reflect genuine variation rather than measurement bias. Consequently, self efficacy interventions can be implemented across sexes in Peruvian higher education with psychometric confidence ([Wang & Yu, 2023](#)). Replication in larger, culturally diverse samples is recommended to establish broader generalizability.

This study presents relevant findings in two main areas. First, it highlights the need for valid and reliable psychometric instruments to assess general self-efficacy, which allows a more accurate measurement of this variable in the academic setting. The validation of the scale proposed in this research constitutes a fundamental tool to analyze its influence on academic performance ([Pichen-Fernandez & Chaparro, 2022](#)), self-regulation of learning ([Gordon et al., 2023](#); [Schunk & DiBenedetto, 2022](#); [Widowati et al., 2023](#); [Zheng et al., 2021](#)) and academic success ([Gamarra et al., 2024](#); [Gao, 2023](#); [González-Cantero et al., 2020](#); [Rosales-Ronquillo & Hernández-Jáquez, 2020](#)). Furthermore, it strengthens the theoretical framework by providing a solid foundation for future research on the relationship between self-efficacy and factors such as psychological

well-being (Bani et al., 2022; Zhou et al., 2021), resilience (Zeng et al., 2021), coping strategies (Freire et al., 2020; Kuznetcova et al., 2023; Yip, 2021), life satisfaction (Döş, 2023; Macakova & Wood, 2022) and mental health (Zhou et al., 2021).

In applied contexts, this scale may be useful for teachers and mental health professionals working with university students (Carranza-Esteban et al., 2022), as it allows for the identification of academic self-efficacy levels a construct closely related to academic performance, motivation, and psychological well-being (Avellán-Pérez et al., 2022; Viteri & Regatto, 2023; Yip, 2021). Although the predictive capacity of academic self-efficacy was not assessed in this study, previous research has documented its associations with academic and emotional adjustment (Buenaño & Flores Hernández, 2023; Manobanda & Vásquez de la Bandera, 2022). Future work should examine predictive validity in longitudinal designs and evaluate whether changes in the network structure (e.g., hub items) mediate intervention effects.

Methodological limitations include the use of non-probability sampling, which limits generalizability and emphasizes the need for random sampling in future research. Additionally, virtual data collection restricts verifying inclusion criteria compliance, so face-to-face methods are recommended. Finally, although the sample size was adequate, larger samples are suggested to ensure more consistent conclusions. Replications in culturally diverse contexts will be essential to examine the transportability of the network structure and the stability of invariance results.

The present study confirms the relevance of academic self-efficacy as a key factor in the performance and adaptation of university students. The Perceived Self-Efficacy for Academic Situations Scale (EAPESA) demonstrated a unidimensional structure, convergent validity and adequate reliability, consolidating itself as a useful tool to measure the perception of competence in academic contexts (Christensen & Golino, 2021; Dominguez Lara, 2014). The results highlight that students with high self-efficacy tend to employ effective metacognitive strategies, improving their motivation and academic performance (González et al., 2021;

Rosales-Ronquillo & Hernández-Jáquez, 2020). In addition, its potential to guide interventions that favor self-regulation and psychological well-being in higher education is highlighted (Yip, 2021; Zhou et al., 2021). By incorporating network-specific indicators (structural consistency, TEFI, permutation-based invariance, and network loadings), this study expands the validity portfolio of the EAPESA beyond traditional analyses, providing a solid basis for research and strategies in the Peruvian educational setting.

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