Psychology, Society & Education (2025) 17(2), 66-75

Psychology, Society & Education

www.uco.es/ucopress/ojs/index.php/psye

Cross-national measurement equivalence of the *Self-Regulation Learning Processes Inventory* in university students from Ecuador, Peru, and Venezuela

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Keywords

Self-regulation
Learning
Equivalence of measurement
Cross-cultural
Validity

Abstract

Self-regulation of learning comprises a multifactorial process in which students achieve specific educational goals. This work aims to determine the cross-national measurement equivalence of the *Self-Regulation of Learning Processes Inventory* in university students in South America. It is a descriptive, quantitative, psychometric, and cross-sectional study, with 762 students from public universities in Ecuador (n = 370), Peru (n = 202), and Venezuela (n = 190), selected through an intentional non-probabilistic sampling. The factor analysis of the inventory confirmed a hierarchical factor structure with three first-order factors and one general second-order factor. It should be noted that the inventory is invariant based on the country of origin of the participants, in addition, it converges with a measure of academic self-efficacy and adequate internal consistency between its items. Additionally, it is positioned as a valid and reliable instrument for the evaluation and measurement of academic self-regulation processes for samples of university students from the participating countries.

Equivalencia de medida transnacional del *Inventario de Procesos de Autorregulación del Aprendizaje* en universitarios de Ecuador, Perú y Venezuela

Palabras clave

Autorregulación
Aprendizaje
Equivalencia de medida
Transcultural
Validez

Resumen

La autorregulación del aprendizaje comprende un proceso de orden multifactorial en el que los estudiantes alcanzan metas educativas específicas. Este trabajo tiene por objetivo determinar la equivalencia de medida transnacional del *Inventario de Procesos de Autorregulación del Aprendizaje* en universitarios de América del Sur. Es un estudio descriptivo, cuantitativo, psicométrico y transversal, que contó con 762 estudiantes de universidades públicas de Ecuador (n = 370), Perú (n = 202) y Venezuela (n = 190), seleccionados por medio de un muestreo de tipo no probabilístico intencional. El análisis factorial del inventario confirmó una estructura factorial jerárquica con tres factores de primer orden y uno general de segundo orden. Cabe indicar que el inventario es invariante basado en el país de origen de los participantes, además, converge con una medida de autoeficacia académica y adecuada consistencia interna entre sus ítems. Adicionalmente, se posiciona como un instrumento válido y confiable para la evaluación y medición de los procesos de autorregulación académica para muestras en estudiantes universitarios de los países participantes.

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Cite this article as: Regatto-Bonifaz, J., Viteri-Miranda, V., & Moreta-Herrera, R. (2025). Cross-national measurement equivalence of the *Self-Regulation Learning Processes Inventory* in university students from Ecuador, Peru, and Venezuela. *Psychology, Society & Education, 17*(2), 66-75. https://doi.org/10.21071/psye.v17i2.17442
Received: 9 September 2024. *First review*: 4 December 2024. *Accepted:* 1 March 2025.

ISSN 1989-709X

Within the university academic context, self-regulated learning (SRL) constitutes a cognitive mechanism through which students consciously engage with their own educational processes, encompassing a multifactorial array of cognitive, affective, and motivational strategies aimed at achieving academic goals (Panadero & Alonso, 2014; Regatto- Bonifaz et al., 2023; Viteri-Miranda et al., 2024; Zimmerman, 2013), thereby enabling a commitment to their own formation (Koivuniemi et al., 2017).

Despite its recognized significance, SRL encounters considerable challenges in the contemporary university landscape, including the educational realities of the Latin American region. The transition to higher education often exposes students to heightened levels of independence, leading to difficulties for those who lack robust self-regulatory skills (Mascia et al., 2023*;* Regatto-Bonifaz et al., 2023). Furthermore, the proliferation of digital technologies and online learning environments has profoundly transformed educational dynamics, presenting new obstacles to self-regulation and academic self-efficacy (Regatto-Bonifaz & Viteri-Miranda, 2023; Tamannaeifar & Arbabi Ghohroudi, 2023), necessitating adaptations within the educational system to cultivate more autonomous and flexible learning environments that simultaneously enhance student interest, satisfaction, and overall well-being (Santillán-García et al., 2025).

Rooted in the socio-cognitive model (Barboza & Miranda, 2017), SRL is underpinned by a) the tenets that students are active agents in constructing their objectives and meanings, influenced by their internal cognitive systems and the external environment; b) that individuals actively monitor and regulate the cognitive, motivational, and behavioral facets of their learning; c) that student actions are shaped by both individual factors (biological, emotional, and cognitive) and contextual elements; and d) that students evaluate their learning objectives, monitor their behaviors and cognitive processes, and leverage these evaluations to regulate their learning (Zimmerman, 2002), underscoring the importance of not only instructional strategies focused on knowledge dissemination but also student agency in acquiring that knowledge (Berrío-Quispe et al., 2023).

Furthermore, SRL represents a process for developing cognitive, attitudinal, and procedural competencies essential for achieving academic objectives (Fernández et al., 2024). This process follows a cyclical sequence involving planning (objective setting), execution (self-control and self-observation processes), and evaluation (self-reflection). Within this framework, a salient issue is the scarcity of research on SRL within the university student population in Latin America. While certain studies address the relationship between SRL and academic self-efficacy (Araya et al., 2022; Regatto-Bonifaz et al., 2023), feedback and formative assessment (Fraile et al., 2020; Hernández Rivero et al., 2021), and academic performance (Valiente-Barroso et al., 2020), a critical challenge remains the limited availability of measurement instruments that are adequately calibrated and adapted to the specific populations of interest, accounting for potential sources of variation, particularly cultural factors, place of origin or residence, and other relevant contextual influences that may affect the interpretation of results derived from these measures.

Inventory of Learning Self-Regulation Processes assessment and psychometric limitations

Within the regional context, the scarcity of available measures to assess SRL, encompassing both the limited catalog of instruments and their adaptation and validation, presents a significant challenge to evaluating this phenomenon. Despite these limitations, the *Inventory of Learning Self-Regulation Processes* (ILSRP) stands out as one instrument utilized in this setting. Initially developed in Barcelona, Spain, among university students (Rosario et al., 2014), the ILSRP employs a 12-item questionnaire across three factors: (a) planning, involving the establishment of strategic goals; (b) execution, encompassing the implementation of these strategies and the monitoring of progress; and (c) evaluation, entailing the review of performance and adjustment of methods to enhance learning. Several studies in the region have incorporated the ILSRP in assessments of SRL and its interaction with other academic attributes, such as general self-efficacy (Covarrubias-Apablaza et al., 2019), attitudes towards statistics (Regatto-Bonifaz & Viteri-Miranda, 2024), and overall self-regulation of learning (Luna Vargas & Álvarez Becerra, 2020), highlighting its frequent use and indicating its value in analyzing other processes and attributes within the field of education.

However, the ILSPR faces limitations in the exploration of its psychometric properties, hindering the advancement of future empirical research. A primary challenge lies in identifying the optimal model fit for evaluating university student populations. For instance, the original report of the measure (Rosario et al., 2014) presented a three-dimensional correlated or oblique factor structure; however, this proposition is largely conjectural, as it did not undergo an internal validity analysis for confirmation. Subsequently, a bifactor model with a general factor (GF) and three specific factors (SF) was proposed among Chilean university students (Bruna et al., 2017), incorporating confirmatory factor analysis (CFA) with findings of acceptable fit, as well as internal consistency. More recently, a hierarchical structure with the original three first-order factors and a global second-order factor was proposed. This model exhibited improved evidence of fit, as similar results were corroborated in university students from Mexico (González Franco, et al., 2023) with adequate internal consistency values, as well as from Ecuador (Viteri-Miranda et al., 2024), which also included an adequate report of internal consistency and a slight and moderate convergence with measures of academic self-efficacy, being this one of the most complete studies in the psychometric analysis of the ILSRP.

Based on this evidence, it is observed that the diversity of factorial models suggests that the diversity between countries (whether origin, residence, others) of the university population may be a source of variability that affects the measure. It is generally known that the culture associated with instruction processes between nations affects the variability of SRL (Manchado Porras & Hervías Ortega, 2021), but not specifically at the level of measures. Based on this, the analysis of the impact of residence needs to be analyzed, given that this criterion is

widely collected in transcultural validity studies as an element to overcome in psychometric studies (Jonason et al., 2020; Moreta-Herrera et al., 2024; Żemojtel-Piotrowska et al., 2018). In this sense, to consider a more general adjustment model of the ILSRP, it is necessary to carry out multi-country order studies in which the measurement equivalence (ME) is analyzed.

Establishing ME as a psychometric property is critical to ascertaining whether nationality (residence or birth) influences the formation of a consistent measurement model across different groups. This is particularly relevant in South American countries like Ecuador, Peru, and Venezuela, given their extensive commercial and social ties, shared language, and cultural proximity. Considering the historical and ongoing connections between these nations, including Venezuela's previous membership in the Andean Community of Nations (CAN), and their geographical proximity within the continent's northwestern region, ME testing becomes essential. Furthermore, these countries share a significant population of university students and a notable prevalence of learning-related challenges (Dávila Morán et al., 2022; Guerrero & Espejo, 2024; Verdezoto et al., 2018).

Without ME assessment, comparing student groups from these nations becomes problematic due to the absence of a common measurement standard, potentially leading to inaccurate interpretations stemming from model misfit rather than actual group differences (Asparouhov & Muthén, 2014; Moreno-Montero et al., 2023), thereby introducing structural bias (Van de Vijver & Tanzer, 2004). Therefore, testing for ME would facilitate the establishment of a specific multi-country fit model for the ILSRP, determining if the country of residence is a factor of variability in the measure. This, in turn, would enable comparative research between national groups within the SRL context, fostering a shared and reliable measurement instrument for this student segment.

The current study

The ILSRP is a widely used instrument for assessing acculturation internationally. However, its model fit remains a subject of scholarly debate, with no clear consensus on the optimal representation. Various models proposed and tested in different countries require further validation. Therefore, examining internal validity through cross-national comparative studies, employing ME, is crucial to determine whether country of residence influences structural configurations. It is hypothesized that residency does not alter the underlying structure, and any observed differences are external, related to the unique characteristics of the respective groups.

The objectives are: (a) to confirm the internal structure of the ILSRP within university student samples from Ecuador, Peru, and Venezuela; (b) to determine the extent of measurement equivalence (ME) of the ILSRP across the national groups; (c) to evaluate the validity of the ILSRP based on its relationship with academic self-efficacy; and (d) to ascertain the reliability of the ILSRP within each national group. Correspondingly, it is hypothesized that the ILSRP will demonstrate a hierarchical factor structure in the samples from Ecuador, Peru, and Venezuela (H1), exhibit invariant measurement properties across the national study groups (H2), display convergent validity with measures of academic self-efficacy (H3), and possess adequate reliability both overall and within each national group (H4).

Method

Design

The study is descriptive, psychometric, and cross-sectional (Ato et al., 2013), analyzing ME based on the country concerning the ILSRP among university students in Ecuador, Peru, and Venezuela.

Participants

The research consisted of 762 students from public universities in Ecuador (n = 370; 76% women) with an average age of M = 25.9 years (SD = 7.1), enrolled at the State University of Milagro and the University of Guayaquil, Peru (n = 202; 45% women) with an average age of M = 21.7 years (SD = 5.7), enrolled at the National University of the Center of Peru; and Venezuela (n = 190; 63% women) with an average age of M = 32.7 years (SD = 14.7), enrolled at the Central University of Venezuela. In the Ecuador group, 66% belong to the urban sector and 34% to the rural sector. In the Peru group, 72% live in the urban sector and the remaining 28% in the rural sector. In the Venezuela group, 94% reside in the urban sector and the remaining 6% in the rural sector.

For the selection of the target group for the study, a non-probabilistic intentional sampling method with inclusion criteria was applied. In this regard, the following was considered: a) being of legal age; b) being enrolled in the year the study was conducted (2023); c) regularly attending classes; and d) voluntarily participating in the study.

Instruments

Inventory of Learning Self-Regulation Processes (ILSRP; Rosario et al., 2014) using the adapted Chilean version (Bruna et al., 2017). This instrument comprises 12 items distributed across three dimensions: planning (items 1-3), execution (items 4-7), and evaluation (items 8-12), with responses recorded on a five-point Likert scale ranging from 1 = *Strongly Disagree* to 5 = *Strongly Agree*. The adapted Chilean version demonstrated adequate internal consistency with a Cronbach' alpha of .87 (Bruna et al., 2017), while the Ecuadorian validation revealed a hierarchical factor structure with three first-order factors and a second-order general factor, exhibiting robust fit indices (χ^2 = 116.4; $p < .001$; df = 53; χ^2/df = 2.2; CFI = .999; TLI = .999; SRMR = .022; RMSEA = .046 [.035 - .057]) and high internal consistency (α = .94; Viteri-Miranda et al., 2024).

The Scale of Specific Perceived Self-Efficacy for Academic Situations (EAPESA; Palenzuela, 1983) adapted to Spanish by Domínguez-Lara (2014) and García-Fernández et al. (2010), and further adapted for the Ecuadorian context by Moreta-Herrera

et al. (2021). The EAPESA consists of nine items assessing perceived academic self-efficacy, utilizing a four-point Likert scale (1 = *Never* to 4 = *Always*). Although normative values are not available for specific countries, higher scores are indicative of greater perceived academic self-efficacy (Palenzuela, 1983).

The Ecuadorian adaptation demonstrated high internal consistency with α = .89 and temporal stability also r = .87, with confirmatory factor analysis supporting a unifactorial model with adequate fit indices (χ^2 = 107.6; p < .001; df = 27; χ^2/df = 3.99; CFI = .999; TLI = .999; SRMR = .039; RMSEA = .073 [.058 - .087]) and strong internal consistency (α = .91; Moreta-Herrera et al., 2021).

Procedure

This research endeavor involved the participation of 762 students drawn from three South American universities located in Ecuador, Peru, and Venezuela, representing the academic disciplines of Psychology, Education, and Social Work. The instrument was sent to an average of 400 students per country participating in the study, of which a total of 762 cases were answered globally and after 34 were excluded. Prior to data collection, authorization was secured from the academic coordinators of the aforementioned disciplines within the respective institutions, granting the research team access to classrooms for the purpose of inviting student participation in the study. Potential collaborators were comprehensively briefed regarding the project's aims, objectives, and their designated responsibilities within the research framework.

Data acquisition was conducted entirely online via Google Forms during the period spanning May to December 2023. Prior to engaging with the survey, all participants were required to complete an informed consent form, affirming their voluntary agreement to participate. Subsequent to this initial phase, data underwent a rigorous cleaning process, involving the removal of 34 cases that failed to meet pre-established inclusion criteria or exhibited incomplete assessment responses. It is pertinent to emphasize that all research activities adhered strictly to the established research protocols, ethical codes stipulated by the participating universities, and the tenets of the Declaration of Helsinki concerning research involving human subjects. Following data collection and refinement, statistical analyses were performed in accordance with the research objectives, hypotheses were tested, and comprehensive research reports were prepared. The complete dataset utilized in this research is publicly accessible for further analysis and utilization via the Open Science Framework repository at the following URL: https://osf.io/rx3ba

Data analysis

The statistical analysis was conducted following a structured, multi-stage approach. Initially, a preliminary item analysis of the ILSRP was performed to elucidate the individual behavior of each item, employing descriptive statistics including the arithmetic mean (M), standard deviation (SD), skewness ($g1$), and kurtosis ($g2$). The assumption of univariate normality was assessed based on $g1$ and $g2$ values, with compliance determined when values did not exceed a threshold of approximately ~1.5 (Ferrando y Anguiano-Carrasco, 2010). Furthermore, multivariate normality was evaluated using Mardia's test (1970), where non-significant results (p > .05) for skewness and kurtosis were indicative of meeting the assumption. Depending on the fulfillment of these normality assumptions, robust estimators were considered for subsequent factor analyses.

The second phase involved a CFA of the ILSRP, utilizing a polychoric correlation matrix and a weighted least squares mean and variance adjusted (WLSMV) estimator. This estimation method was selected due to the categorical or ordinal nature of the items and the observed lack of multivariate normality (Li, 2016). Model fit was evaluated based on a range of indices including the chi-square (χ^2), normed chi-square (χ^2/df), standardized root mean square residual (SRMR), Tucker-Lewis index (TLI), comparative fit index (CFI), and root mean square error of approximation (RMSEA). Item loadings (λ) were also examined to assess the consistency of items within the fitted model. Acceptable model fit was determined by a non-significant χ^2 (p > .05) or a χ^2/df ratio less than 4, CFI and TLI values exceeding .95, SRMR and RMSEA values below .08, and factor loadings greater than .4 (Byrne, 2008; Brown, 2015; Moreno-Montero et al., 2023; Wolf et al., 2013; Yang-Wallentin et al., 2010).

Subsequently, ME across countries of residence was investigated through a multigroup CFA (MG-CFA) employing the WLSMV estimator. Initially, CFAs were conducted independently for each country (baseline model), and differences in χ^2 ($\Delta\chi^2$) were compared to establish similarity across groups via ANOVA, expecting non-significance (p > .05). Subsequently, the model was subjected to progressively restrictive constraints on factor loadings (weak invariance), intercepts (strong invariance), and residuals (strict invariance), while assessing the variability (Δ) of fit indices (χ^2, CFI, and RMSEA) at each stage to determine the level of ME (Asparouhov & Muthén, 2014; Brown, 2015; Jonason et al., 2020; Moreta-Herrera et al., 2022). Acceptable tolerance for ME was defined as non-significant changes in χ^2 and minimal variation in fit indices (ΔCFI > -.01; ΔRMSEA ≤ .01 (Chen, 2007).

The third component focused on validity based on relationships with other variables. Specifically, the relationship with academic self-efficacy (EAPESA) was examined, given the previously reported associations (Regatto-Bonifaz et al., 2023). Pearson's correlation coefficients (r) were calculated for each group, with values exceeding .2 (r > .2) considered indicative of relevant convergent validity (Ferguson, 2016).

Finally, the fourth component involved calculating reliability based on the internal consistency of the scores using the Omega coefficient (ω; McDonald, 1999) and its 95% confidence intervals. This analysis was conducted for the overall sample, as well as for each factor within the measure and stratified by participants' countries. Values of ω exceeding .7 (ω > .7) were considered indicative of adequate reliability.

All analyses were performed using the R programming language, version 4.1.1 (R Core Team, 2022) and relevant packages like foreign, MVN, lavaan, MBESS and semTools.

Results

Preliminary analysis of the items

Table 1 presents the performance of the items from the ILSRP classified by countries. In general, it is observed across the groups that the reported means of each item are homogeneous, ranging from *M*(item 6) = 3.66, *SD* = 1.27, and *M*(item 2) = 3.98, *SD* = 1.33 for participants from Ecuador; *M*(item 7) = 3.38, *SD* = 1.04, and *M*(item 4) = 3.77, *SD* = 1.11 for Peru; and *M*(item 7) = 3.31, *SD* = 1.26, and *M*(item 2) = 3.88, *SD* = 1.33 for participants from Venezuela. Regarding the distribution and the assumption of univariate normality of the items, it is observed that in all cases across all groups, none of the results for *g*1 and *g*2 exceed the ranges of ~ 1.5. Thus, it can be inferred that the distribution at the univariate level is normal; however, when contrasting multivariate normality, it is observed that all products resulting from Mardia's test show statistical significance ($p < .05$), indicating that the distribution at the multivariate level is not normal.

The reported evidence underscores the necessity of employing robust estimation methods when conducting latent variable analyses such as CFA, given the ordinal nature of the items and the absence of multivariate normality.

Confirmatory factor analysis

As depicted in Figure 1, the factorial structure of the ILSRP was examined through a hierarchical factor model, comprising three first-order factors –planning, execution, and evaluation– and a general second-order factor encompassing both the factors and the measure's items. Furthermore, the fit indices demonstrate acceptable levels of model fit ($\chi^2/df < 4$; CFI and TLI > .95; SRMR and RMSEA < .08). Observed factor loadings for both the items and first-order factors, segmented by group (Ecuador, Peru, and Venezuela), exhibit satisfactory values, indicating their contribution to the explanation of variance; overall, the fit indices for the ILSRP factorial model demonstrate adequate scores for the samples under investigation.

Measurement equivalence analysis

Table 2 presents the ILSRP's ME, considering participant country of residence. Baseline group data generally indicate adequate fit for each hierarchical model. Observed changes (Δ) in absolute fit indices (χ^2) are not statistically significant ($p > .05$) across models, suggesting group similarity. Regarding invariance, increasing model complexity (loadings, intercepts, residuals) results in changes (Δ) to χ^2, CFI, and RMSEA that remain within acceptable tolerance thresholds (excluding χ^2). Therefore, the ILSRP is deemed strictly invariant (CFI and RMSEA < .01 variability across nesting levels).

Analysis of convergent validity or validity based on the relationship with other variables

Table 3 presents the validity analysis of the ILSRP, based on its correspondence with related constructs, specifically academic self-efficacy as measured by the EAPESA. The correlations between the ILSRP components and the EAPESA are displayed, categorized by the participants' countries of origin. In all instances, positive correlations were observed between the variables of interest. The Peruvian cohort exhibited moderate correlations (r > .4) between factors and the global scale, while the Ecuadorian and Venezuelan groups showed weak correlations (r > .2). These findings suggest convergent validity between the ILSRP and the EAPESA among university students from Ecuador, Peru, and Venezuela.

Table 1

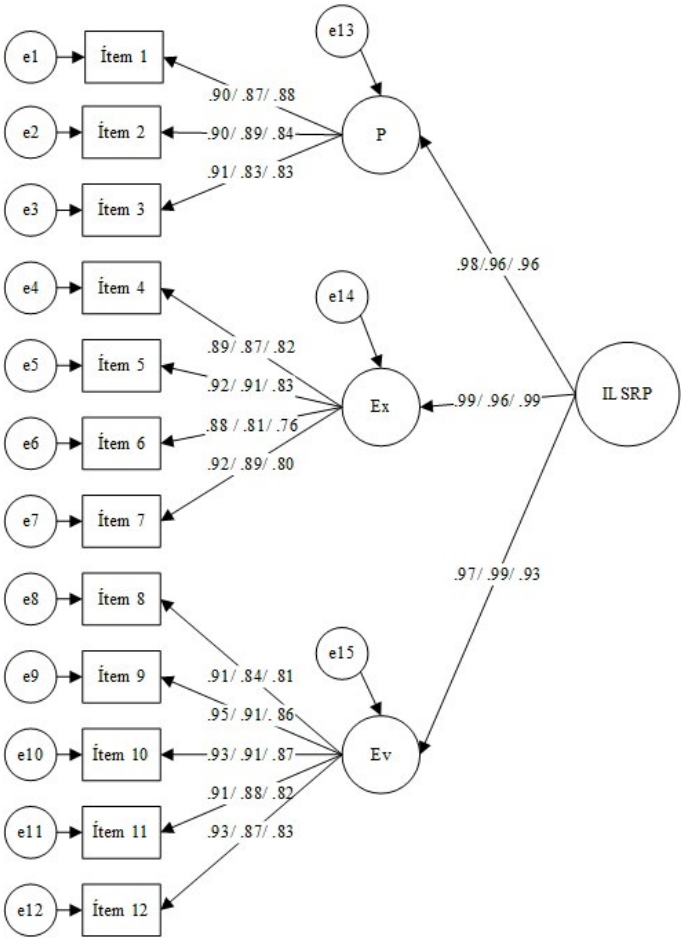
Descriptive analysis of ILSRP items classified by country

Items	*Ecuador*				*Peru*				*Venezuela*			
	M	*SD*	g^1	g^2	*M*	*SD*	g^1	g^2	*M*	*SD*	g^1	g^2
Item 1	3.83	1.31	-1.18	0.25	3.58	1.11	-0.99	0.18	3.74	1.4	-0.89	-0.56
Item 2	3.98	1.33	-1.35	0.6	3.74	1.19	-0.99	0.19	3.88	1.33	-1.15	0.12
Item 3	3.9	1.31	-1.2	0.28	3.57	1.13	-0.74	-0.17	3.59	1.29	-0.73	-0.57
Item 4	3.92	1.27	-1.31	0.68	3.77	1.11	-1.15	0.75	3.76	1.32	-1.03	-0.1
Item 5	3.79	1.25	-1.15	0.37	3.65	1.09	-1.07	0.6	3.68	1.2	-0.74	-0.31
Item 6	3.66	1.27	-0.91	-0.19	3.59	1.04	-0.86	0.28	3.62	1.21	-0.89	-0.13
Item 7	3.78	1.22	-1.13	0.39	3.38	1.04	-0.62	-0.15	3.31	1.26	-0.32	-1.01
Item 8	3.91	1.31	-1.21	0.29	3.58	1.11	-0.7	-0.19	3.59	1.33	-0.71	-0.71
Item 9	3.94	1.29	-1.34	0.66	3.75	1.11	-1.11	0.68	3.69	1.24	-0.84	-0.32
Item 10	3.88	1.31	-1.25	0.41	3.58	1.1	-0.93	0.22	3.69	1.29	-0.91	-0.28
Item 11	3.77	1.25	-1.03	0.09	3.54	1.06	-0.75	0.01	3.42	1.27	-0.47	-0.85
Item 12	3.78	1.29	-1.08	0.11	3.5	1.12	-0.75	-0.21	3.43	1.29	-0.52	-0.87
Mardia			3541.44^{***}	89.4^{***}			1289.14^{***}	30.83^{***}			1139.81^{***}	28.14^{***}

Note. *M* = arithmetic mean; *SD* = standard deviation; *g1* = skewness; *g2* = kurtosis.

Figure 1

Confirmatory factor analysis of the ILSRP



χ^2 = 433.94; p < .001; df = 159; χ^2/df = 2.73; *CFI* = .991; *TLI* = .988; *SRMR* = .029; *RMSEA* = .08 IC95% [.073 - .092]

Note. χ^2: Chi square, χ^2/df: Normed chi square; SRMR; Standardized root mean square residual; CFI: Comparative fit index; TLI: Tucker-Lewis index; RMSEA: Root mean square error of approximation; *r*: Pearson correlation coefficient; P: planning; Ex.: execution; Ev.: evaluation; IL-SRP: *Inventory of Learning Self-Regulation Processes.* The reported values of the factorial loadings represent, from left to right, the samples from Ecuador, Peru, and Venezuela.

Table 2

Measurement equivalence analysis of the ILSRP

Restrictions	χ^2	*CFI*	*RMSEA*	$\Delta\chi^2$	*ΔCFI*	*ΔRMSEA*
Base Line - Ecuador	(53) 131.99	.997	.996	-	-	-
Base Line - Perú	(53) 197.01	.981	.976	-	-	-
Base Line - Venezuela	(53) 125.94	.984	.981	-	-	-
Configural	(159) 56.64	.991	.083	-	-	-
Metric	(177) 74.71	.992	.074	23.99	.001	.008
Scalar	(241) 297.58	.989	.073	122.11***	.003	.001
Strict	(249) 949.03	.985	.083	17.65*	.004	.01

Note. χ^2: Chi-square; CFI: Comparative fit index; RMSEA: Root means square error of approximation; Δ: change.
* p < .05, *** p < .001.

Table 3

Validity analysis of the IPAA based on the relationship with academic self-efficacy

Factors	*Ecuador*	*Peru*	*Venezuela*
Planning	.36*	.43*	.28*
Execution	.4*	.46*	.36*
Evaluation	.39*	.45*	.38*
ILSRP	.39*	.47*	.37*

* $p < .01$.

Table 4

Internal consistency analysis of the ILSRP classified by country

Factors	*Ecuador* (ω; IC95%)	*Peru* (ω; IC95%)	*Venezuela* (ω; IC95%)
Planning	.94 [.91 - .95]	.89 [.85 - .92]	.88 [.84 - .92]
Execution	.94 [.93 - .96]	.92 [.89 - .94]	.87 [.82 - .91]
Evaluation	.94 [.93 - .96]	.94 [.91 - .95]	.92 [.89 - .94]
ILSRP	.98 [.97 - .99]	.97 [.96 - .98]	.96 [.94 - .97]

Note. ω: McDonald coefficient; 95%; CI: 95% confidence intervals.

Internal consistency analysis

Table 4 presents the internal consistency of the ILSRP items among students from Ecuador, Peru, and Venezuela, classified by country. It is observed that in all three countries, both the constitutive factors and the overall scale of the ILSRP have reliability exceeding ω > .8, which is considered adequate internal consistency for the items, providing evidence of their independent use and relevance in these three countries.

Discussion

The present investigation sought to validate the internal factorial structure and overall validity of the ILSRP among university students from Ecuador, Peru, and Venezuela, employing EM techniques, and further examining the internal consistency of its constituent items.

The results robustly confirmed the hypothesized hierarchical factorial model, comprising three first-order factors subsumed under a single, overarching second-order general factor, within the student populations of all three nations. This suggests that the ILSRP, as administered, retains its original structural characteristics and, moreover, encompasses a global scale as previously postulated. Noteworthy is the divergence of these findings from earlier studies conducted with Spanish and Chilean students (Bruna et al., 2017; Rosario et al., 2014), which favored models with correlated factors, whereas the current research lends support to a more recent proposition advocating the aforementioned hierarchical model in university students from Mexico and Ecuador (González Franco et al., 2023; Viteri-Miranda et al., 2024), positioning it as a more representative model within the broader university student demographic, even accommodating a global assessment scale.

Furthermore, the ME, trough the AFC-MG, revealed strict factorial invariance, indicating that the factorial configuration of the ILSRP is equivalent or invariant across the student populations of the three countries, implying that national differences do not systematically affect item interpretation and therefore do not appear to constitute a significant source of measurement variability. Consequently, the ILSRP exhibits potential utility in cross-national comparative studies, suggesting that observed variations in the assessed attribute are likely attributable to genuine group characteristics rather than discrepancies in item comprehension (Asparouhov & Muthén, 2014; Jonason et al., 2020; Moreno-Montero et al., 2023; Moreta-Herrera et al., 2024; Żemojtel-Piotrowska et al., 2018). While these findings represent a significant advancement in the psychometric evaluation of the instrument and pioneering the application of ME for assessing its psychometric properties, they warrant cautious interpretation due to the absence of directly comparable prior research. Nevertheless, the evidence strengthens the case for the hierarchical model as the optimal fit for the ILSRP within the university student population of the region.

The observed positive correlation between SRL and academic self-efficacy, assessed via the EAPESA, while moderate in Peru and slight in Ecuador and Venezuela, initially supports the convergent validity of the SRL measurement, corroborating the interrelation of these constructs across nationalities, contrary to findings in Flores Araya et al. (2022) and Regatto-Bonifaz et al. (2023). However, the variation in correlation strength across the three countries suggests a contextual influence on the relationship between SRL and self-efficacy, lending credence to the potential impact of cultural factors on SRL (Manchado Porras & Hervías Ortega, 2021), which acts as a modulating variable requiring further investigation.

Furthermore, the ILSRP exhibited satisfactory internal consistency across factors and countries, affirming its reliability as a measurement instrument and replicating findings from prior instrumental studies (Bruna et al., 2017; González Franco et al., 2023; Viteri-Miranda et al., 2024). The consistency ensures the

dependable and reliable scoring of the ILSRP, bolstering its utility in identifying and evaluating SRL processes. Practically, the validated and reliable instrument will contribute to future research by solidifying the construct of SRL and identifying the optimal method to assess it in diverse student populations. The tool can then be used to identify, assess, and target SRL in university students across diverse cultural backgrounds, promoting the incorporation of this perspective into future educational interventions.

Limitations

This study's conclusions regarding the factor structure of the ILSRP are limited by its exclusive focus on university students from three South American countries. Therefore, findings may not be generalizable to other educational demographics, such as adolescents, or to populations in countries not included in the research. Future instrumental studies of the ILSRP should consider these limitations to broaden the scope and applicability of the findings.

Conclusions

This study provides evidence supporting the validity and reliability of the ILSRP within university settings in Ecuador, Peru, and Venezuela. The demonstration of cross-national measurement invariance confirms the ILSRP as a suitable instrument for international comparative research involving university student populations, enabling more precise and reliable cross-cultural comparisons. Furthermore, the apparent absence of cultural variability within the measure's factorial structure suggests internal stability. The positive interaction between academic achievement and academic self-efficacy underscores the instrument's relevance in educational contexts and its potential to inform improved teaching and learning strategies. Future research can leverage these findings to further explore learning self-regulation and its determinants across diverse educational landscapes.

Author contributions

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Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of interests

The authors declare that there is no conflict of interest.

Data availability statement

The data supporting the findings of this study are available upon request from the corresponding author.

References

Álvarez García, J. J., Quinayas, M. B., Salazar Cárdenas, Y., & Fernández Guayana, T. G. (2024). Impacto de los fenómenos sociales en la autorregulación del aprendizaje en instituciones educativas de Colombia. *Mikarimin. Revista Científica Multidisciplinaria*, *10*(1), 64-80. https://doi.org/10.61154/mrcm.v10i1.3293

Asparouhov, T., & Muthén, B. (2014). Multiple-group factor analysis alignment. *Structural Equation Modeling: A Multidisciplinary Journal*, *21*(4), 495-508. https://doi.org/10.1080/10705511.2014.919210

Ato, M., López, J., & Benavente, A. (2013). Un sistema de clasificación de los diseños de investigación en psicología. *Anales de Psicología*, *29*(3), 1038-1059. https://doi.org/10.6018/analesps.29.3.178511

Barboza, E., & Miranda, L. (2017). Aprendizaje autorregulado en la teoría sociocognitiva: Marco conceptual y posibles líneas de investigación. *Ensayos Pedagógicos*, *12*(2), 47-71. https://doi.org/10.15359/rep.12-2.3

Berrío-Quispe, M., Chávez-Bellido, D., Gutiérrez-Avellaneda, M., & Gonzales-Sánchez, A. (2023). Práctica pedagógica afectiva en el proceso de aprendizaje de estudiantes universitarios. Encuentros. *Revista de Ciencias Humanas, Teoría Social y Pensamiento Crítico*, *17*, 217-227. https://doi.org/10.5281/zenodo.7527645

Brown, T. A. (2015). *Confirmatory factor analysis for applied research* (Vol. 2nd). Guilford Publications.

Bruna, D., Pérez, M., Bustos, C., & Núñez, J. (2017). Propiedades psicométricas del inventario de procesos de autorregulación del aprendizaje en estudiantes universitarios chilenos. *Revista Iberoamericana de Diagnóstico y Evaluación Psicológica*, *2*(44), 77-91. https://doi.org/10.21865/RIDEP71.1.09

Byrne, B. (2008). Testing for multigroup equivalence of a measuring instrument: A walk through the process. *Psicothema*, *20*(4), 872-882.

Camere, J., & Javier, J. (2021). *Propiedades psicométricas del Inventario de Procesos de Autorregulación del Aprendizaje (IPAA) en universitarios de Lima Metropolitana*. [Third Level Thesis]. Universidad César Vallejo.

Chen, F. F. (2007). Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural Equation Modeling: A Multidisciplinary Journal*, *14*(3), 464-504. https://doi.org/10.1080/10705510701301834

Covarrubias-Apablaza, C. G., Acosta-Antognoni, H., & Mendoza-Lira, M. (2019). Relación de autorregulación del aprendizaje y autoeficacia general con las metas académicas de estudiantes universitarios. *Formación Universitaria*, *12*(6), 103-114. http://dx.doi.org/10.4067/S0718-50062019000600103

Dávila Morán, R. C., Agüero Corzo, E. D. C., Portillo Rios, H., & Quimbita Chiluisa, O. R. (2022). Deserción universitaria de los estudiantes de una universidad peruana. *Revista Universidad y Sociedad*, *14*(2), 421-427.

Domínguez-Lara, S. (2014). Autoeficacia para situaciones académicas en estudiantes universitarios peruanos: Un enfoque de ecuaciones estructurales. *Revista de Psicología-Universidad Católica San Pablo*, *4*(4), 45-53.

Ferguson, C. (2016). An effect size primer: A guide for clinicians and researchers. En A. Kazdin (Ed.), *Methodological issues and strategies in clinical research* (pp. 301-310). American Psychological Association. https://doi.org/10.1037/14805-020

Ferrando, P. J., & Anguiano-Carrasco, C. (2010). El análisis factorial como técnica de investigación en psicología. *Papeles del Psicólogo*, *31*(1), 18-33.

Flores Araya, E., Romo López, E., & Godoy Guevara, R. (2022). Autorregulación del aprendizaje y autoeficacia académica: Correlación con el rendimiento académico en estudiantes de ingeniería. *Revista Electrónica de Investigación en Docencia Universitaria*, *4*(1), 67-98. https://doi.org/10.54802/r.v4.n1.2022.99

Fraile, J., Gil-Izquierdo, M., Zamorano-Sande, D., & Sánchez-Iglesias, I. (2020). Autorregulación del aprendizaje y procesos de evaluación formativa en los trabajos en grupo. *RELIEVE - Revista Electrónica de Investigación y Evaluación Educativa, 26*(1). http://doi.org/10.7203/relieve.26.1.17402

García-Fernández, J., Díaz-Herrero, Á., Pérez-Fernández, E., & Martínez-Monteagudo, M. (2010). Propiedades psicométricas de la Escala de Autoeficacia Percibida Específica de Situaciones Académicas en una muestra de estudiantes españoles de Educación Secundaria Obligatoria. *European Journal of Education and Psychology*, *3*(1), 61-73. https://doi.org/10.1989/ejep.v3i1.46

González Franco, V., González Lomelí, D., Fuentes Vega, M., & Maytorena Noriega, M. (2023). Estructura factorial de autorregulación del aprendizaje en estudiantes universitarios mexicanos. *Revista de Psicología de la Universidad Autónoma del Estado de México*, *12*(32), 86-112.

Guerrero, S. C., & Espejo, R. L. (2024). Deserción universitaria: Estudio comparativo entre Colombia y España desde la perspectiva de género. *Formación Universitaria*, *17(*2), 101-112. http://dx.doi.org/10.4067/s0718-50062024000200101

Hernández Rivero, V., Santana Bonilla, P., & Sosa Alonso, J. (2021). Feedback y autorregulación del aprendizaje en educación superior. *Revista de Investigación Educativa*, *39*(1), 227-248. https://doi.org/10.6018/rie.423341

Jonason, P., Zemojtel-Piotrowska, M., Piotrowski, J., Sedikides, C., Campbell, W. K., Gebauer, J. E., Maltby, J., Adamovic, M., Adams, B. G., Lestari Kadiyono, A., Atitsogbe, K. A., Bundhoo, H. Y., Bălţătescu, S., Bilić, S., Gruneau Brulin, J., Chobthamkit, P., Del Carmen Domínguez, A., Dragova-Koleva, S., El-Astal, S., … Yahiiaev, I. (2020). Country-level correlates of the Dark Triad traits in 49 Countries. *Journal of Personality*, *88*(6), 1252-1267. https://doi.org/10.1111/jopy.12569

Koivuniemi, M., Panadero, E., Malmberg, J., & Järvelä, S. (2017). Higher education students' learning challenges and regulatory skills in different learning situations. *Journal for the Study of Education and Development: Infancia y Aprendizaje*, *40*(1), 19-55. https://doi.org/10.1080/02103702.2016.1272874

Li, C. H. (2016). Confirmatory factor analysis with ordinal data: Comparing robust maximum likelihood and diagonally weighted least squares. *Behavior Research Methods*, *48*(3), 936-949. https://doi.org/10.3758/s13428-015-0619-7

López-Angulo, E. (2020). Revisión sistemática sobre instrumentos de autorregulación del aprendizaje en estudiantes de educación secundaria. *Información Tecnológica*, *31*(4), 85-98. https://doi.org/10.4067/S0718-076420

Luna Vargas, S. A., & Alvarez Becerra, R. M. (2020). Relación entre autoeficacia académica y autorregulación del aprendizaje en estudiantes de la carrera de tecnología médica. REVISTA *VERITAS ET SCIENTIA - UPT*, *9*(2), 170-181. https://doi.org/10.47796/ves.v9i2.392

Manchado Porras, M., & Hervías Ortega, F. (2021). Procrastinación, ansiedad ante los exámenes y rendimiento académico en estudiantes universitarios. *Interdisciplinaria. Revista de Psicología y Ciencias Afines*, *38*(2), 242-258. https://doi.org/10.16888/interd.2021.38.2.16

Mardia, K. (1970). Measures of multivariate skewness and kurtosis with applications. *Biometrika*, *57*(3), 519-530. https://doi.org/10.2307/2334770

Mascia, M., Agus, M., Cabras, C., Bellini, D., Renati, R., & Penna, M. (2023). Present and future undergraduate students' well-being: Role of time perspective, self-efficacy, self-regulation and intention to drop-out. *Education Sciences*, *13*(2), Article 202. https://doi.org/10.3390/educsci13020202

McDonald, R. (1999). *Test theory: A unified treatment*. Lawrence Erlbaum Associates, Inc.

Moreno-Montero, E., Moreta-Herrera, R., Jiménez-Borja, M., Jiménez-Mosquera, C., & Vaca-Quintana, D. (2023). The measure equivalence across gender of the Cognitive Fusion Questionnaire (CFQ) for Ecuadorian college students. *Mediterranean Journal of Clinical Psychology*, *11*(2). https://doi.org/10.13129/2282-1619/mjcp-3712

Moreta-Herrera, R., Dominguez-Lara, S., Rodas, J., Sánchez-Guevara, S., Montes-De-Oca, C., Rojeab-Bravo, B., & Salinas, A. (2022). Examining psychometric properties and measurement invariance of the Emotion Regulation Questionnaire in an Ecuadorian Sample. *Psychological Thought*, *15*(2), 57-74. https://doi.org/10.37708/psyct.v15i2.634

Moreta-Herrera, R., Montes de Oca, C., Navarro Cuellar, L., & Villegas Villacrés, N. (2021). Validez factorial con estimación robusta de la Escala de Autoeficacia Percibida Específica de Situaciones Académicas (Eapesa) en universitarios ecuatorianos. *Ciencias Psicológicas*, *15*(1), Article e2153. https://doi.org/10.22235/cp.v15i1.2153

Moreta-Herrera, R., Perdomo-Pérez, M., Reyes-Valenzuela, C., Gavilanes-Gómez, D., Rodas, J., & Rodríguez-Lorenzana, A. (2024). Analysis from the classical test theory and item response theory of the Satisfaction with Life Scale (SWLS) in an Ecuadorian and Colombian sample. *Journal of Human Behavior in the Social Environment*, *34*(5), 739-751. https://doi.org/10.1080/10911359.2023.2187915

Palenzuela, D. (1983). Construcción y validación de una escala de autoeficacia percibida específica de situaciones académicas. *Análisis y Modificación de Conducta*, *9*(21), 185-219.

Panadero, E., & Alonso, J. (2014). ¿Cómo autorregulan nuestros alumnos? Revisión del modelo cíclico de Zimmerman sobre autorregulación del aprendizaje. *Anales de Psicología*, *30*(2), 450-462. https://doi.org/10.6018/analesps.30.2.167221

R Core Team. (2022). *R: A language and environment for statistical computing*. R Foundation for Statistical.

Regatto-Bonifaz, J., & Viteri-Miranda, V. (2023). Attitude towards technology and its relationship with Academic self-efficacy in Ecuadorian university students. *Journal of Namibian Studies: History Politics Culture*, *33*, 3216-3233.

Regatto-Bonifaz, J., Viteri-Miranda, V., & Moreta-Herrera, C. (2023). Autorregulación del aprendizaje como predictor de la autoeficacia académica en universitarios del Ecuador. *Ciencias Psicológicas*, *17*(2), Article e3254.

Regatto Bonifaz, J., & Viteri Miranda, V. (2024). Actitudes hacia la estadística y su relación con la autorregulación del aprendizaje en universitarios del Ecuador. *Revista Alpha & Omega*, *1*(02), Article 17. https://doi.org/10.24133/alphaomega.vol01.02.2024.art01

Rosario, P., Pereira, A., Högemann, J., Nunes, A., Figueiredo, M., Nuñez, J., & Gaeta, M. (2014). Self-regulation of learning: A systematic review in journals from the SciELO database. *Universitas Psychologica*, *13*(2), 781-797. https://doi.org/10.11144/Javeriana.UPSY12-2.aars

Santillán-García, N., Rueda-Espinoza, K., Orozco-Moreno, Z., Moreta-Herrera, R., & Rodas, J. A. (2025). The mediating role of satisfaction with life in the relationship between hope and academic satisfaction among Ecuadorian university students. *Revista de Psicodidáctica (English ed.)*, *30*(1), Artículo 500154. https://doi.org/10.1016/j.psicoe.2024.500154

Tamannaeifar, M., & Arbabi Ghohroudi, F. (2023). Relationship between selfregulation and self-efficacy with students' academic buoyancy: Mediating of academic resiliency. *Journal of Educational Psychology Studies*, *19*(48), 39-61. https://doi.org/10.22111/JEPS.2022.7168

Valiente-Barroso, C., Suárez-Riveiro, J., & Martínez-Vicente, M. (2020). Autorregulación del aprendizaje, estrés escolar y rendimiento académico. *European Journal of Education and Psychology*, *13*(2), 161-176. https://doi.org/10.30552/ejep.v13i2.358

Van de Vijver, F., & Tanzer, N. (2004). Bias and equivalence in cross-cultural assessment: An overview. *European Review of Applied Psychology*, *54*(2), 119-135. https://doi.org/10.1016/j.erap.2003.12.004

Verdesoto, G. J. Z., Mora, K. G. R., & Torres, L. H. G. (2018). Análisis de la deserción estudiantil en las universidades del Ecuador y América Latina. *Revista Pertinencia Académica*, *8*, 1-28.

Viteri-Miranda, V., Regatto-Bonifaz, J., & Moreta-Herrera, R. (2024). Propiedades psicométricas del Inventario de Procesos de Autorregulación del Aprendizaje (IPAA) en universitarios del Ecuador. *Revista Iberoamericana de Diagnóstico y Evaluación – e Avaliação Psicológica. RIDEP*, *71*(1), 119-130. https://doi.org/10.21865/RIDEP71.1.09

Wolf, E. J., Harrington, K. M., Clark, S. L., & Miller, M. W. (2013). Sample size requirements for structural equation models: An evaluation of power, bias, and solution propriety. *Educational and Psychological Measurement*, *73*(6), 913-934. https://doi.org/10.1177/0013164413495237

Yang-Wallentin, F., Jöreskog, K. G., & Luo, H. (2010). Confirmatory factor analysis of ordinal variables with misspecified models. *Structural Equation Modeling*, *17*(3), 392-423. https://doi.org/10.1080/10705511.2010.489003

Żemojtel-Piotrowska, M., Piotrowski, J. P., Osin, E. N., Cieciuch, J., Adams, B. G., Ardi, R., Bălţătescu, S., Bogomaz, S., Bhomi, A. L., Clinton, A., De Clunie, G. T., Czarna, A. C., Esteves, C., Gouveia, V., Halik, M. H. J., Hosseini, A., Khachatryan, N., Kamble, S. V., Kawula, A., … Maltby, J. (2018). The mental health continuum-short form: The structure and application for cross-cultural studies – A 38 nation study. *Journal of Clinical Psychology*, *74*(6), 1034-1052. https://doi.org/10.1002/jclp.22570

Zimmerman, B. (2002). Becoming a self-regulated learner: An overview. *Theory into Practice*, *41*(2), 64-70. https://doi.org/10.1207/s15430421tip4102_2

Zimmerman, B. (2013). From cognitive modeling to self-regulation: A social cognitive career path. *Educational Psychologist*, *48*(3), 135-147. https://doi.org/10.1080/00461520.2013.794676