Research Article

Self-perceived information literacy skills in Peruvian university students: A metric and descriptive-comparative study

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ABSTRACT

Information literacy is a fundamental component in the academic development of future professionals. The aim of the study was to evaluate the metric properties of the 'questionnaire of self-perceived information competences', analyzing the factorial structure, internal consistency, convergent validity, factorial invariance according to gender and to propose cut-off points in Peruvian university students. The study followed an instrumental and descriptive design in which 30 items distributed in 4 factors were analyzed. The participants consisted of 1,173 university students from 12 Peruvian universities. The results show that the items show adequate values in the descriptive analysis; however, the analysis of the polychoric correlations determined the need to eliminate item 13. Confirmatory factor analysis was carried out with two models (with and without item 13), in which the second model showed better fit indices of χ^2/gl, CFI, TLI, RMSEA, and SRMR and factor loadings > 0.5. Convergent validity and internal consistency showed expected scores, and the instrument is shown to be gender invariant. Finally, it was established that there is not enough difference according to sociodemographic data to establish cut-off points based on sociodemographic variables, and the cut-offs for each factor were based on quartiles. In conclusion, the instrument is valid and reliable for measuring self-perceived information literacy in Peruvian university students.

Keywords: informational competence, validation, information literacy skills, reliability, invariance

INTRODUCTION

In contemporary society, information has established itself as an essential component for knowledge management and a fundamental resource for both individual and social progress. The growing demand for skilled human capital capable of effectively interacting with information is increasingly evident, particularly in the context of the use of digital technologies (De los Santos & Martínez Abad, 2021). This situation has generated the need to develop new informational competencies that enable individuals to manage the diversity of information present in both digital and physical media, as well as to confront the challenges posed by artificial intelligence. Such competencies encompass the ability to filter information, evaluate its quality, conduct efficient searches, communicate effectively, master technological tools, critically analyze data, collaborate in teams, and understand the fundamental principles of artificial intelligence (Moreira & Ribeiro, 2023). In this regard, education and access to information networks play a decisive role in the formation of competent citizens in a globalized world, prepared for continuous learning and equipped to face challenges that could lead to social exclusion. Consequently, the development of problem-solving and decision-making competencies has become an urgent necessity in the pursuit of lifelong learning (Martínez Santana & Pestana Morales, 2024).

In higher education, both at the undergraduate and postgraduate levels, continuous education is essential for addressing job market challenges and contributing to social advancement. It must constantly adapt to sociocultural, economic, and technological changes to enhance the quality of learning (Hernández Campillo et al., 2021). Information management skills are fundamental across all fields of knowledge, particularly in accessing academic literature, analyzing data, and the ability to discern between high-quality information and questionable sources (Moreira & Ribeiro, 2023). In this context, universities are reassessing their objectives and methods, focusing on the holistic development of future professionals in response to the internationalization of education and advancements in information and communication technologies (ICT) (Martínez Santana & Pestana Morales, 2024). In an increasingly interconnected landscape with social networks, behavior in cyberspace and the use of ICT to solve problems require a relevant development of informational competencies in future professionals (Zhu et al., 2021).

In this regard, various studies on university populations have examined information literacy, providing a fundamental basis for understanding the level of skills and abilities that students possess in searching for, evaluating, processing, and communicating information in digital and academic environments. At least 47% of incoming English university students have not had the opportunity to access a well-equipped library, which results in a limited development of information literacy skills (Dann et al., 2022). This difficulty is shared by Cuban students, who find it challenging to search for, evaluate, and manage digital information (Hernández Campillo et al., 2021). Although Dominican students demonstrated superior skills in locating information, they exhibited lower competence in evaluating its relevance, processing it appropriately, and communicating effectively, highlighting the importance of addressing information literacy in the university setting (Antonio Gutiérrez et al., 2023). Similarly, Panamanian (Castillo et al., 2021) and Ecuadorian students (Andrade Alvarado et al., 2023) struggle to manage, process, and communicate information, indicating a need for training in these areas. While the issue appears to be present at the university level, it is essential for professors and librarians to identify these challenges and propose relevant strategies for strengthening information literacy, library resource usage, plagiarism prevention, and proper citation (Álvarez et al., 2024).

In Peru, the reality is not dissimilar to the situation in Latin America, as there are also difficulties. The National Council of Education (2020), in its ninth strategic guideline, states that educational institutions must employ intensive use of digitalization at all levels of education, establishing within educational policies the need to promote research and the production of information and knowledge. Although students in nine Peruvian pedagogical specialties recognize the importance of acquiring information literacy skills, there is still a training deficit, particularly in the processing and evaluation of information (Turpo-Gebera et al., 2023). This competency is essential when transitioning to higher education, necessitating diagnosis and intervention (Stebbing et al., 2019).

The information problem in Peru is transversal and appears across various professional training disciplines. In the field of the arts, 100% of students demonstrated a regular level of information literacy, with greater difficulties reported by male students compared to their female counterparts (Espinoza Salazar &

Tamariz Nunjar, 2021). Meanwhile, among future optometry professionals, different levels of information literacy were identified: 29.8% low, 40.4% medium, and 29.8% high (Villanueva Cusihuallpa & Aliaga-Pacora, 2023). Regarding aspiring teachers, 67.05% showed a regular command of information literacy skills, while 32.95% demonstrated sufficient mastery (Ayala, 2020), indicating the need to strengthen these skills in most students. Research on information literacy among higher education students is crucial due to the increasing importance of information management skills, which are vital for academic and professional success in the digital age. A lack of ability to search for and manage information effectively can lead to superficial understanding and poor research; conversely, developing these skills provides more opportunities for professional growth, making it essential to cultivate them from early stages and refine them in university. However, obstacles persist in integrating information literacy into curricula, affecting many universities (Cedeño Espinoza et al., 2023).

The ability to search for, manage, evaluate, and communicate information effectively has gained greater relevance in an academic environment that demands access to and handling of vast amounts of digital and analogue information. To analyze such a construct, it is necessary to have valid and reliable instruments. The development of an instrument to assess information literacy skills was carried out by Contreras Cázarez and Campa Álvarez (2022a), who presented it within a Mexican population and focused on four key dimensions: searching, processing, evaluating, and communicating information. The results of the instrument's validation were promising, demonstrating high reliability as well as moderate to strong correlations between the dimensions. These findings indicate that the questionnaire is not only internally consistent in each of its dimensions but also in its overall structure, suggesting that the instrument could be an effective tool for assessing self-perceived information literacy skills in a university context. In line with this work, Contreras Cázarez (2022) conducted a detailed analysis of the metric properties of the same instrument among university students from both public and private Mexican institutions. The results of this study confirmed the relevance and consistency of the instrument (self-perceived information literacy). The subscales of the instrument also showed relevant reliability indices.

Psychometric studies aimed at assessing information literacy skills in other contexts have shown good fit measures. García Llorente et al. (2019) validated a self-perception questionnaire on information literacy in Spain, demonstrating high reliability, and exploratory factor analysis showed that all items adequately saturated on the factors, reflecting an acceptable intensity. Meanwhile, Reche et al. (2019) aimed to construct and validate a self-perception instrument regarding their level of information and communication skills for academic work among Spanish students, finding an excellent reliability index. Other studies, such as that by Franco Rico et al. (2024), developed and validated a Questionnaire for Information Access Competence among second-year pediatric residents. The reliability tests conducted showed that section 3 of the questionnaire, with a coefficient of 0.90, is suitable for measuring the frequency of activities related to information literacy among medical residents. However, although section 4, with a coefficient of 0.60, is effective for assessing information search situations, more cases are needed for its application in other groups. Girarte Guillén and del Valle López (2020) developed and validated an instrument to measure informational skills in a Mexican educational institution, which demonstrated very good internal structure validity. Similarly, Albornoz-Ocampo (2022) validated an instrument to measure the level of information literacy skills in an online class context at an educational institution in Chile, concluding that the instrument is valid and reliable for use with students with similar characteristics.

Several psychometric studies in the international arena have identified good fit indices in the North American context. For instance, a data literacy scale with 23 items was evaluated, demonstrating adequate evidence of validity from judges, construct validity, and reliability (Kim et al., 2023). Similarly, the self-directed information literacy scale for American engineering and technology students showed satisfactory fit measures, allowing for the assessment of recognition, search, evaluation, application, documentation, and reflection. This instrument also proved to be invariant across male and female scores (Douglas et al., 2020). Subsequently, an adaptation of the information literacy self-efficacy scale was conducted with university students (Sommer et al., 2021). Another scale measuring the perception of information literacy was validated with postgraduate students; this instrument consists of 36 items with adequate estimates of convergent and discriminant validity, as well as internal consistency (Doyle et al., 2019). In Latin America, media literacy was assessed among adolescents aged 13 to 15 in Colombia, Ecuador and Spain, focusing on evaluating access

and use of communication media, language and critical understanding, production and programming, and the transformation of situations through communication (Cuervo Sánchez et al., 2021). These various instruments have been tailored to the specific realities of the international landscape.

These studies provide a solid framework for evaluating self-perceived information competencies, validating the usefulness of the instrument in various educational contexts. They also highlight the need to continue exploring and refining measurement tools, especially in cultural and educational settings like Peru, which is characterized as an emerging context where basic education teachers (Vásquez-Pajuelo et al., 2024) and even university lecturers face challenges in managing information and participating in academic-digital contexts (Suyo-Vega et al., 2022). The proposed research, which analyses self-perceived information competencies in Peruvian university students, builds on these previous advances, employing a metric and descriptive-comparative approach to explore the instrument's relevance in a new and varied context.

Information Literacy

The term "competence" implies a person's responsibility and suitability to carry out specific tasks (Martínez Santana & Pestana Morales, 2024). It also refers to the ability to encapsulate the notion of mobilization, dynamism, integration, exchange, and construction of knowledge, skills, and resources (both informational and technological) related to the field of information. It focuses on promoting "learning to learn" and autonomy in learning to make decisions regarding the identification of information needs, its search, and critical and ethical use (Jacobsen et al., 2022). Therefore, the concept of information literacy is not only about knowing how to search for information but also about the ability to analyze information with appropriate criteria.

The concept of information literacy most commonly used in the field of information sciences refers to an individual's set of skills to use, evaluate, and communicate information (Machin-Mastromatteo, 2021). From an ethical standpoint, these are indispensable skills, considering that in this society, value lies in information; thus, an individual who recognizes its importance and can manage it effectively can advance in both personal and professional growth (Antonio Gutiérrez et al., 2023). In higher education, it constitutes the combination of various aspects: knowledge, which involves having a specific understanding of information management; skill, which requires possessing specific techniques and the ability to update them; and disposition, which is reflected in an attitude of ethical and professional commitment towards the regulations associated with the creation of a particular document (Mendoza et al., 2023).

Dimensions of Information Literacy

Regarding the dimensions of information literacy, according to the proposal by Contreras Cázarez and Campa Álvarez (2022b), these can be:

a. Information search: A crucial aspect of information literacy related to how individuals search for, access, and select the most relevant information (Alonso Varela & Saraiva Cruz, 2020).

b. Information management: Encompasses the knowledge and use of tools such as applications, systems for processing academic texts, spreadsheets, databases, and information storage (Conde et al., 2022).

c. Information evaluation: Involves a critical analysis of sources, selecting those that are reliable and well-founded, while considering ethical considerations for their proper and legal use. This process requires cognitive and motivational effort, where students must conduct a complex analysis to collect, understand, process, and evaluate information (De los Santos & Martínez Abad, 2021).

d. Information communication: Refers to appropriate participation in virtual environments, using the tools provided by the Internet to disseminate and communicate information, and contributing to both academic and extracurricular networks or groups (López-Gil et al., 2020).

This study aims to analyze the metric properties of the 'Questionnaire to assess self-perceived informational competence' (Contreras Cázarez & Campa Álvarez, 2022a) in the Peruvian context, because the theoretical structure proposed by the authors follows the same line proposed by the Ministry of Education (2016) through the ability to 'manage information in the virtual environment' that Peruvian students developed during their basic training and continue to strengthen in higher education. Both Mexican and Peruvian university students have similar basic training, and education in both countries faces challenges to

promote educational equity and quality (Chuquilin Cubas & Zagaceta, 2017). Based on the above, the aim of the research is to analyze the metric properties of the Self-perceived information competences questionnaire, analyzing the factorial structure, internal consistency, factorial invariance according to gender and the comparison between the factors in order to propose cut-off points for Peruvian university students.

METHOD

The research is instrumental and descriptive-comparative in nature, aiming to verify the metric evidence of the instrument adapted to a new setting, such as the Peruvian context (Ato et al., 2013). Additionally, it seeks to make descriptive comparisons based on gender, type of university management, year of study, and field of knowledge (Aggarwal & Ranganathan, 2019).

Participants

The study involved 1173 university students from 12 Peruvian universities, exceeding the minimum requirement of 300 subjects for studies of metric evidence (Kline, 2014). Participants were aged between 18 and 65 years (mean [M] = 21.947, standard deviation [SD] = 5.803), with 679 (57.89%) being women and 494 (42.11%) men. Of these students, 662 (56.44%) were enrolled in a private university and 511 (43.56%) in a public one. Additionally, 566 (48.25%) were in their first year of study; 154 (13.13%) in the second; 244 (20.80%) in the third; 83 (7.08%) in the fourth, and 126 (10.74%) in the fifth year, respectively. The students were pursuing programs in fields established by the Organisation for Economic Co-operation and Development (OECD, 2015), such as agricultural sciences (4.86%), medical or health sciences (9.46%), natural sciences (6.14%), social sciences (48.58%), humanities (15.26%), and engineering and technology (15.60%).

Instrument

The instrument is "cuestionario para valorar la competencia informacional autopercibida" and was developed by Contreras Cázarez and Campa Álvarez (2022a), who designed it in Spanish and was validated with the participation of Mexican university students (Contreras Cázarez, 2022). Therefore, in order to apply it to the Peruvian setting, no translation was necessary because both Peru and Mexico are two countries that share the same language (Spanish); however, the instrument was revised by two Peruvian linguists, who carried out a linguistic revision (syntactic, lexical and semantic) for its applicability to Peruvian university students. The instrument is divided into two sections, the first consists of sociodemographic data, requesting information on gender, age, year of study, field of knowledge based on the OECD (2015), and type of university management. The second section contains 30 items of the questionnaire with a scale from 1 = never, 2 = rarely, 3 = sometimes, 4 = almost always, to 5 = always, distributed across 4 dimensions:

(1) "information search" (7 items), which evaluates how students locate information in different academic settings,

(2) "information management" (6 items), focusing on how information is processed in texts, databases, or stored,

(3) "information evaluation" (8 items), involving critical analysis for selecting information, and

(4) "information communication" (9 items), based on participation in virtual spaces by sharing resources or materials with the academic community, groups, or networks.

Procedures

The data collection process had four stages. First, permission was requested from public and private universities in the country. Second, the instrument was designed in digital format using the Google Form tool, containing the research objective, informed consent, socio-demographic data and the questionnaire. Third, the instrument was shared through email channels and WhatsApp groups disseminated by teachers and program directors to students. Fourth, before filling out the instrument, each student gave their consent to participate voluntarily, anonymously and informed of the objectives and aims of the study.

Data Analysis

The data analysis was conducted using the R 4.3.3 program and R Studio 2024.04.1. Additionally, packages such as "corrplot", "ggplot2", and "polycor" were used to verify polychoric relationships. "Lavaan", "semPlot", and "semTools" were also employed for confirmatory factor analysis (CFA), factorial invariance, and to estimate the reliability of latent variables.

First, the behavior of the items was initially examined based on the responses provided by participants. The mean, standard deviation, corrected item-total correlation, communalities, aspects of skewness and kurtosis, as well as the potential for improving reliability by removing an item, were analyzed.

Second, the internal structure of the instrument was verified through CFA, as the aim was to confirm a previously established theoretical proposal (Cattell, 1966). This means the process did not start from scratch but was intended to verify the model within the Peruvian context. Due to the nature of the items, the weighted least squares mean and variance adjusted method was used. Fit measures were assumed based on recommendations by Hu and Bentler (1999): Chi-square, comparative fit index (CFI ≥ 0.95), Tucker Lewis index (TLI ≥ 0.95), root mean square error of approximation (RMSEA ≤ 0.08), standardized root mean square residual (SRMR < 0.06).

Third, convergent validity was assessed using the average variance extracted (AVE > 0.5) according to criteria established by Hair et al. (2010). Subsequently, correlations between latent variables were estimated, and internal consistency was calculated using Cronbach's alpha (α > 0.7) and omega (ω > 0.7) coefficients (Ventura-León, 2017). The stability and consistency of the model were then verified across groups using factorial invariance techniques based on gender. A progressive evaluation of the items was conducted, considering the following models: configural (without constraints), metric (based on factor loadings), scalar (factor loadings and intercepts or tau), and strict (factor loadings, intercepts, and residuals) (Dimitrov, 2010). At each stage, fit indices such as χ^2, degrees of freedom, RMSEA (≤ 0.08), CFI, and TLI (≥ 0.95) were evaluated (Barrera-Barrera et al., 2015).

Finally, comparisons were made between sociodemographic variables such as gender (female or male), management (private or public), year of study (first, second, third, fourth, or fifth), and field of knowledge (agricultural sciences, medical or health sciences, natural sciences, social sciences, humanities, or engineering and technology). These comparisons aimed to determine the need for establishing cut-off points for each case, considering the significance level ($p < 0.05$) of non-parametric tests like Mann-Whitney U and Kruskal-Wallis H, as well as the effect size with biserial rank ($r_{bis} > 0.10$ = minimum required) for comparisons between two groups or epsilon ($\varepsilon > 0.04$ = minimum necessary) for three or more groups (Dominguez-Lara, 2018). Based on this, cut-off points were established using quartiles (25%, 50%, and 75%) considering the item scores partitioned by factors.

RESULTS

Table 1 presents the descriptive analysis of the items with 4 factors. The mean of the items ranges from 2.82 to 3.86, while the variability around the mean lies between 0.79 and 1.154. The skewness of the items is negative, with a left tail (except for item 13) and shows a platykurtic distribution in most items (except for 1, 2, and 12) with scores within the ±1 range. The corrected item-total correlation scores are above 0.3 for all items (except for item 13).

Table 1. Statistical analysis of the items from the information literacy questionnaire

Item	ME	DE	CHI	H^2	If the item is discarded		g^1	g^2
					α	ω		
BUI1	3.83	0.846	0.590	0.416	0.830	0.836	−0.396	0.136
BUI2	3.78	0.925	0.590	0.997	0.830	0.837	−0.500	0.059
BUI3	2.87	1.127	0.530	0.325	0.843	0.845	−0.023	−0.694
BUI4	3.54	0.921	0.670	0.553	0.819	0.825	−0.309	−0.007
BUI5	3.51	0.875	0.680	0.615	0.817	0.822	−0.163	−0.121
BUI6	3.28	0.970	0.600	0.452	0.829	0.836	−0.195	−0.259
BUI7	3.45	0.900	0.620	0.477	0.826	0.832	−0.223	−0.014
GEI8	3.69	0.836	0.565	0.710	0.617	0.759	−0.283	−0.059

Table 1 (Continued).

Item	ME	DE	CHI	H²	If the item is discarded		g¹	g²
					α	ω		
GEI9	3.67	0.910	0.629	0.740	0.590	0.728	–0.371	–0.086
GEI10	3.67	0.900	0.614	0.640	0.596	0.738	–0.339	–0.050
GEI11	3.60	0.858	0.648	0.670	0.589	0.742	–0.234	–0.145
GEI12	3.71	0.818	0.626	0.530	0.600	0.747	–0.276	0.030
GEI13	3.36	1.154	0.156	0.120	0.862	0.862	0.160	–0.867
EVI14	3.61	0.854	0.623	0.496	0.868	0.869	–0.217	–0.206
EVI15	3.71	0.896	0.667	0.654	0.863	0.865	–0.352	–0.109
EVI16	3.74	0.931	0.667	0.525	0.863	0.865	–0.474	–0.035
EVI17	3.66	0.833	0.717	0.587	0.858	0.859	–0.181	–0.169
EVI18	3.42	0.864	0.625	0.443	0.868	0.869	–0.115	–0.063
EVI19	3.76	0.875	0.565	0.463	0.874	0.874	–0.247	–0.396
EVI20	3.86	0.790	0.642	0.535	0.866	0.867	–0.351	0.067
EVI21	3.74	0.875	0.656	0.531	0.864	0.866	–0.329	–0.223
COI22	3.61	1.009	0.477	0.357	0.859	0.861	–0.411	–0.257
COI23	3.83	0.890	0.534	0.645	0.854	0.855	–0.458	–0.008
COI24	3.60	0.876	0.647	0.648	0.845	0.846	–0.223	–0.173
COI25	3.16	1.090	0.631	0.625	0.845	0.848	–0.174	–0.551
COI26	2.82	1.118	0.619	0.587	0.846	0.849	0.159	–0.626
COI27	3.09	1.125	0.615	0.684	0.847	0.850	–0.158	–0.658
COI28	3.51	1.044	0.634	0.544	0.845	0.847	–0.335	–0.389
COI29	3.48	1.036	0.598	0.638	0.848	0.851	–0.370	–0.265
COI30	3.39	1.040	0.588	0.547	0.849	0.851	–0.325	–0.291

Note. CHI: Corrected homogeneity index; H^2: Communalities; g^1: Skewness; g^2: Kurtosis
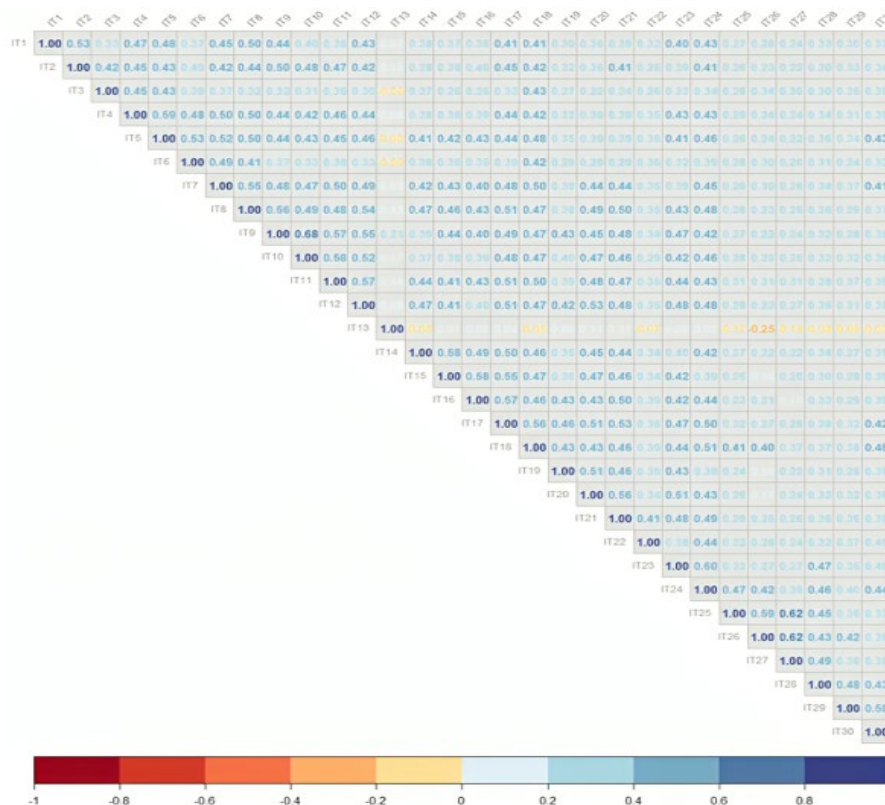

Figure 1. Polychoric relationships between items (Source: Authors)

Additionally, communalities are above 0.4 (except for items 3, 13, and 22). Regarding reliability, only the removal of item 13 could improve the internal consistency of the second construct (α and ω = 0.862).

Figure 1 presents the polychoric correlations between the items of the instrument. It is evident that item 13 shows the lowest correlation with the others, with scores ranging from –0.25 to 0.21. The other items show positive correlations ranging from 0.16 to 0.68. Thus, the evidence accumulates for the removal of this item.

Table 2. Comparison of the original model and the model without item 13

Model	χ^2	df	P	SRMR	RMSEA	RMSEA 90 [I-S]	TLI	CFI	GFI
Original	3,676.74	399	0.000	0.062	0.084	[0.081–0.086]	0.981	0.982	0.984
Without item 13	3,126.66	371	0.000	0.057	0.08	[0.077–0.082]	0.984	0.985	0.987
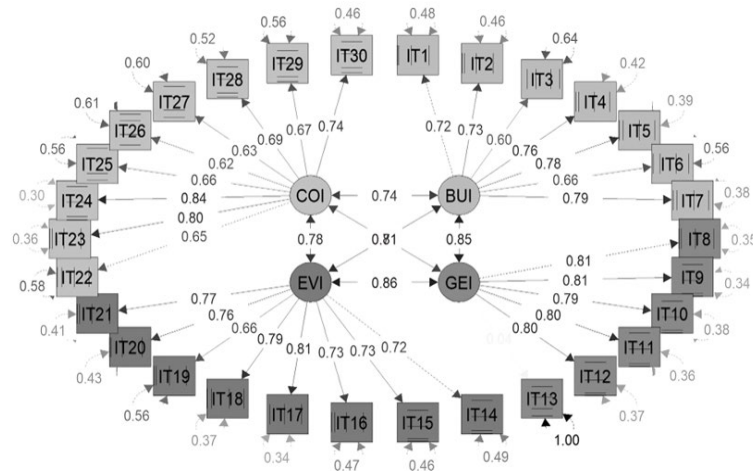
Figure 2. Path diagram based on the original model (BUI: Búsqueda de información/Information seeking; GEI: Gestión de la información/Information management; EVI: Evaluación de la información/Information evaluation; COI: Comunicación de la información/Information communication) (Source: Authors)
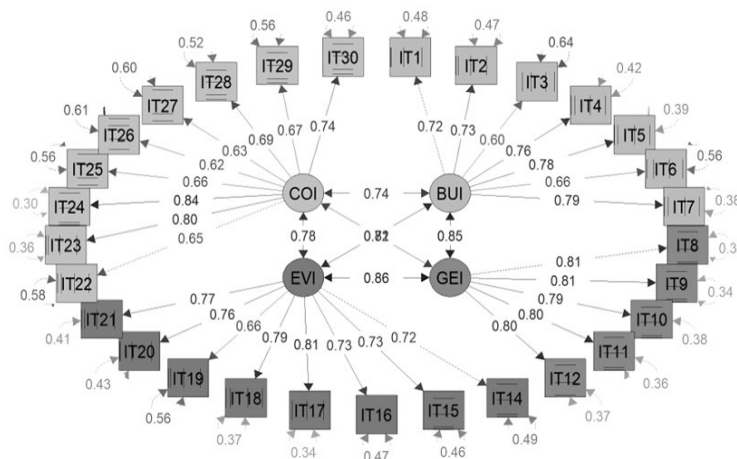
Figure 3. Path diagram based on the corrected model (Source: Authors)

Subsequently, after conducting the CFA, it is evident that, according to the original model, the fit measures of χ^2/df = 9.214 were above the expected value (> 5); meanwhile, the p-value was significant (< 0.05), and TLI, CFI, and GFI (> 0.95) indicated a good fit when compared to a null or independent model, and the proportion of variance explained by the model was adequate. However, the SRMR (> 0.06) and RMSEA (> 0.08) measures presented values not in line with expectations (**Table 2**).

This is more evident in the path diagram, where the factor loading of item 13 is 0.04, indicating that the latent factor (information management) explains only a small percentage (4%) of the variability in the observed variable (**Figure 2**).

Based on the statistical evidence from the item analysis, polychoric correlations, and the CFA, a new model was developed excluding item 13. The new model shows relevant values χ^2/df = 8.427, p < 0.05, SRMR < 0.06, RMSEA ≤ 0.08, TLI, CFI, and GFI > 0.95. Additionally, it has a better fit than the original model. Regarding the factor loadings of the latent variables BUI (0.66 and 0.79), GEI (0.79 and 0.81), COI (0.66 and 0.81), and EVI (0.66 and 0.81), they were all above 0.5, indicating that they adequately contribute to the construct they measure (**Figure 3**).

Table 3. Convergent validity and reliability of the instrument

Construct	BUI	GEI	EVI	$\alpha_{Cronbach}$	Ω	AVE
BUI				0.849	0.854	0.52
GEI	0.85			0.862	0.862	0.64
EVI	0.81	0.86		0.880	0.881	0.56
COI	0.74	0.72	0.78	0.863	0.865	0.50

Note. $\alpha_{Cronbach}$: Cronbach's alpha; Ω: McDonald's omega

Table 4. Factorial invariance by sex

Models	χ^2 (df)	p	RMSEA (90% CI)	SRMR	TLI	CFI	ΔCFI	ΔRMSEA
M1	3,399.604 (742)	< 0.001	0.078 (0.076–0.088)	0.06	0.985	0.986		
M2	3,728.296 (850)	< 0.001	0.076 (0.074–0.079)	0.06	0.986	0.985	0.001	0.002
M3	3,728.296 (850)	< 0.001	0.076 (0.074–0.079)	0.06	0.986	0.985	0.000	0.000
M4	3,728.296 (850)	< 0.001	0.076 (0.074–0.079)	0.06	0.986	0.985	0.000	0.000

Note. ΔRMSEA: Difference in RMSEA value; ΔCFI: Difference in CFI value; CI: Confidence interval

Convergent validity showed adequate scores for the factors BUI (AVE = 0.52), indicating that the items have a strong relationship with the constructs. Additionally, the scores of the internal consistency indices $\alpha_{Cronbach}$ and Ω showed values greater than 0.7 for each of the latent variables (**Table 3**).

The determination of factorial invariance by sex was evaluated progressively based on configurational invariance (M1), metric invariance (M2), strong invariance (M3), and strict invariance (M4) using a four-factor model. Firstly, the structure of the information competency questionnaire in M1 shows adequate fit results with RMSEA = 0.078 (90% CI 0.076–0.088), SRMR = 0.06, CFI = 0.986, TLI = 0.985. Secondly, referencing M1, M2 was tested, which showed adequate fit indices with RMSEA = 0.076 (90% CI 0.074–0.079), SRMR = 0.06, CFI = 0.985, TLI = 0.986. The comparison indicates that the changes are not significant, suggesting that there is invariance between the groups of men and women (ΔCFI = 0.001, ΔRMSEA = 0.002). Thirdly, M3 was analyzed, which expressed relevant fit indices with RMSEA = 0.076 (90% CI 0.074–0.079), SRMR = 0.06, CFI = 0.985, TLI = 0.986. When comparing M2 and M3, no significant differences were observed (ΔCFI = 0.000, ΔRMSEA = 0.000), indicating that the intercepts are invariant between the groups of men and women. Lastly, M4 was evaluated, where the scores were RMSEA = 0.076 (90% CI 0.074–0.079), SRMR = 0.06, CFI = 0.985, TLI = 0.986, emphasizing that the factor loadings, intercepts, and residuals show invariability in both groups (ΔCFI = 0.000, ΔRMSEA = 0.000). The results indicate that the factorial invariance of the information competency questionnaire is maintained with respect to the variable sex (**Table 4**).

Comparisons between the factors of information seeking (BUI), information management (GEI), information evaluation (EVI), and information communication (COI) were made according to sociodemographic data such as sex, study cycle, year of study, type of university management, and area of knowledge (**Table 5**). The results indicate that, by sex, although scores are slightly higher in males, the differences are not significant in any case (p > 0.05, rbis < 0.10). Regarding university management, scores in the private sector exceed those in the public sector, but only in BUI (p = 0.040) and EVI (p = 0.019) did significant differences in scores emerge; however, the size of the difference does not meet the desired minimum (rbis < 0.10), so there is insufficient evidence. The year of study also does not condition differences in the scores of the BUI, GEI, and EVI factors (p > 0.05). Although a significant difference was observed in COI (p = 0.037), the differential size is minimal (ɛ̂ < 0.04), rendering it insubstantial. Finally, according to the area of knowledge, similar scores were found in EVI and COI (p > 0.05), while in BUI (p = 0.046) and GEI (p = 0.042) significant differences were identified; nonetheless, these are not relevant (ɛ̂ < 0.04).

Based on the quartiles identified for the factors BUI, GEI, EVI, and COI, cut-off points have been established to categorize levels of self-perception of information competencies into

(1) inefficient: the student has a negative assessment and recognizes that their competencies are well below the standard,

(2) insufficient: the student is aware of their limitations and evaluates their performance as below the standard, but not severely,

(3) sufficient: the student feels capable of meeting basic and improvable standards, and

Table 5. Comparison of information competencies by socio-demographic data

V	BUI			GEI			EVI			COI		
	ME (SD)	Z/H (p)	r_{bis}/ê	ME (SD)	Z/H (p)	r_{bis}/ê	ME (SD)	Z/H (p)	r_{bis}/ê	ME (SD)	Z/H (p)	r_{bis}/ê
Sex												
F	23.82 (4.93)	0.554	0.016	18.07 (3.64)	1.444	0.042	29.01 (5.34)	1.229	0.003	22.78 (5.55)	0.305	0.009
M	24.11 (4.73)	(0.580)		18.47 (3.58)	(0.149)		29.53 (5.10)	(0.219)		23.02 (5.48)	(0.760)	
University management												
PR	24.36 (4.77)	2.051	0.059	18.52 (3.55)	1.935	0.056	29.71 (5.23)	2.345	0.068	23.05 (5.66)	0.884	0.026
PU	23.63 (4.88)	(0.040)		18.03 (3.67)	(0.053)		28.88 (5.23)	(0.019)		22.75 (5.41)	(0.377)	
Year of study												
1st	24.30 (4.58)	3.925	0.003	18.61 (3.49)	5.572	0.005	29.53 (5.11)	5.596	0.005	23.30 (5.16)	10.228	0.009
2nd	23.78 (5.10)	(0.416)		18.00 (3.49)	(0.233)		28.84 (5.14)	(0.231)		22.77 (5.20)	(0.037)	
3rd	23.69 (4.73)			18.00 (3.56)			28.65 (4.98)			21.79 (6.12)		
4th	22.78 (5.22)			17.86 (4.06)			29.19 (6.13)			21.86 (5.56)		
5th	23.99 (5.26)			17.78 (3.89)			29.33 (5.45)			23.54 (6.10)		
Field of knowledge												
AS	24.70 (4.40)	11.301	0.01	19.10 (4.38)	11.508	0.01	29.03 (5.38)	5.649	0.005	24.37 (5.08)	5.959	0.005
MHS	23.51 (4.53)	(0.046)		17.94 (3.36)	(0.042)		29.10 (5.18)	(0.342)		22.46 (5.34)	(0.310)	
NS	24.42 (4.74)			18.08 (3.54)			29.57 (4.91)			23.07 (5.13)		
SC	23.79 (4.84)			18.06 (3.64)			29.17 (5.28)			22.68 (5.47)		
H	23.29 (5.20)			18.00 (3.78)			28.62 (5.55)			22.61 (5.69)		
ET	24.99 (4.70)			19.10 (3.33)			30.10 (4.94)			23.55 (5.86)		

Note. V: Variable; F: Female; M: Male; PR: Private; PU: Public, AS: Agricultural sciences; MHS: Medical and health sciences; NS: Natural sciences; SC: Social sciences; H: Humanities; ET: Engineering and technology; r_{bis}: Biserial rank effect size; ê: Epsilon effect size

Table 6. Cut-off points for information competencies of Peruvian students

Percentile	BUI	GEI	EVI	COI	Level
25	≤ 21	≤ 16	≤ 25	≤ 20	Inefficient self-perception
50	22–24	17–18	26–29	21–23	Insufficient self-perception
75	25–27	19–21	30–32	24–27	Sufficient self-perception
99	28 ≤	≥ 22	33 ≤	28 ≤	Efficient self-perception

(4) efficient: the student has a high perception of their competence and considers themselves to have a high standard (**Table 6**).

DISCUSSION AND CONCLUSION

The purpose of the study was to examine the metric properties of the "self-perceived information competencies questionnaire" in Peruvian university students. The results indicate a version with 29 items grouped into 4 factors. Empirical evidence shows that the instrument exhibits relevant metric properties, displaying appropriate fit indices and factorial loadings as expected. Additionally, it demonstrates adequate internal consistency and a strong relationship between the constructs. Finally, the instrument shows strict measurement invariance by sex, and cut-off points are presented based on the quartiles.

The four-factor structure (information searching, information management, information evaluation, and information communication) obtained through the CFA shows similarities to those found in other studies such as Contreras Cázarez and Campa Álvarez (2022a), Albornoz-Ocampo (2022), García Llorente et al. (2019), García-Llorente et al. (2020), and Bielba Calvo et al. (2016). Therefore, these factors reflect components consistently supported in empirical studies, reinforcing their construct validity and allowing for a convergent interpretation of information competency in different contexts.

The internal consistency of the scores obtained through the alpha and omega coefficients were relevant for each factor. Compared to other studies like that of Contreras Cázarez (2022), it was found that the reliability coefficients of the scale (0.89) and subscales (mostly indices above 0.82) are more than acceptable according to specialized literature. Similarly, Contreras Cázarez and Campa Álvarez (2022a) found internal consistency in each of the dimensions and the overall instrument, indicating a high degree of validity and reliability, with a total alpha of 0.86; while each of the analyzed dimensions obtained a coefficient above 0.60. García Llorente et al. (2019) demonstrated that both in the four dimensions and in the complete scale,

adequate internal consistency is achieved, with values exceeding 0.7. This indicates that the items are precise in their measurement and consistently measure the constructs. Additionally, Pinto Molina and Puertas Valdeiglesias (2012) concluded that the instrument demonstrates high reliability, as the indices for each factor are elevated and all are significant. Regarding the information competencies questionnaire, the analysis indicates a Cronbach's alpha ranging from 0.729 for factor 4 to 0.806 for the information searching factor, while the total scale presents an alpha of 0.903, which is adequate (Albornoz-Ocampo, 2022).

The removal of item 13, "copy and paste useful information for academic work without mentioning the author," was justified by its low scores in item correlations and factorial loadings below the required threshold. This item belonged to the factor "information management," which focuses on how information is treated. In addition to statistical evidence, the reason for its elimination is that its wording reflects a negative situation (academic plagiarism) that is not addressed in the original instrument.

This study is one of the first to demonstrate factorial invariance between both sexes among university students. The university community consists of both female and male students enrolled in various study programs. Thus, achieving invariance indicates a uniform perception of information competencies in the professional training process. Other studies, such as Rodríguez et al. (2013), observed similar patterns in the distributions of variables between male and female groups. In the specific case of the information selection variable, differences were noted between men and women concerning the narrowing of the curve: women tend to perceive their information selection competencies within a narrower range of scores. When examining differences between men and women, slight variations were found, consistently favoring men.

The study did not find significant differences in the factors based on statistical significance or differentiating effects according to sociodemographic data, leading to the implementation of homogeneous cut-off points for all items. Regarding sex, while findings showed higher scores in all information competencies for males, except in information communication, this differentiation is not significant. This contrasts with some research in the literature that reported significant differences favoring male students (Bussell, 2021; Nierenberg & Dahl, 2023; Singh & Kumar, 2020). Like in this study, scores were mathematically higher for males in all information competencies except in communication.

Regarding academic training, there seems to be no significant difference between academic cycles; however, literature indicates that graduate students have greater information management skills than undergraduates (Allari et al., 2022; Nierenberg & Dahl, 2023; Soltani & Nikou, 2020). It is possible that the experiences and information-seeking needs in undergraduate studies do not constitute a differentiating factor across different cycles, whereas graduate students face greater demands due to doctoral program requirements and the ongoing obligation to publish scientific articles or participate in academic events.

The implementation of cut-off points provides a robust tool for accurately segmenting and evaluating the self-perceived capabilities of university students. This approach not only allows for the categorization of the variable but also facilitates the identification of data patterns and trends. This aspect is essential for designing educational interventions tailored to the identified needs and skills. It is worth noting that there are few studies that have explored these aspects, making this research a valuable opportunity to delve deeper into how these factors can influence students' perceptions of their capabilities.

The study has theoretical implications as it contributes to the debate surrounding the informational competencies of future professionals in the fields of social sciences, health, engineering, humanities, and natural sciences. This adaptation may lead to more accurate assessments in the empirical field; furthermore, it strengthens the theory of critical information literacy, which encourages active participation from students in their learning processes (Schachter, 2020). Additionally, the field of information literacy has been enriched by integrating contemporary definitions and a multidimensional approach that addresses the complexities of the current information environment. In terms of practical contributions, the instrument can be used by instructors in courses such as study techniques, study methodology, communication, or research, among others, as a resource for diagnosing students' proficiency in information management. Methodologically, rigorous validation procedures were applied, including statistical analyses and tests of internal consistency, which not only ensured the instrument's reliability but also established a replicable model for future research in the realms of education and literacy. These contributions are essential for training future professionals with critical capacity and autonomy in managing digital information.

Although the research presents relevant evidence to consider, it is not without limitations. Firstly, while the relationship between the factors has been established through the AVE, it is pertinent to conduct this process considering the correlation with other constructs such as written communication competencies, research skills, or attitudes towards information, in order to obtain more relevant evidence of convergent validity. Secondly, discriminant validity was not assessed, which could be a reason to initiate future research efforts. Thirdly, due to the limited variability of responses provided by participants, factorial invariance according to other sociodemographic variables, such as management type or professional discipline, was not performed.

It is recommended that future researchers adapt this instrument in other settings (countries or regions) and compare the findings obtained. Furthermore, since the instrument is based on students' self-perception, a second recommendation is to construct instruments (analytical rubrics) aimed at heterogeneous evaluation (teacher to student) or peer assessment (among students) of informational competencies in higher education.

In conclusion, the self-perceived digital competencies questionnaire is a valid and applicable tool for Peruvian university students. Its evaluation does not differ from the original instrument in terms of the number of factors, but it does reduce the number of items to 29 for the context of Peru. The reliability of the instrument is appropriate for each factor, and it shows invariance concerning the students' gender. Therefore, it is urged to continue with further metric analyses of the instrument.

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