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RESEARCH ARTICLE

Psychometric Validation of the Information Area of Digital Competence in High School Students in Perú

Teresa Fernández-Bringas · Francisco Sandoval-Arteta · Cristóbal Suárez-Guerrero · Giancarlo Ojeda Mercado

ABSTRACT

Background/purpose – Few psychometric tests have been identified in the literature that analyze digital competencies in school-aged children. The Evaluation Test of Digital Competencies in Compulsory Education Students (ECODIES, Casillas-Martín et al., 2020) is considered one of the most robust for its measurement. The aim of the study was to assess the psychometric validity of the "ECODIES – Area 1: Information" test with high school students from two Peruvian cities in 2021.

Materials/methods – The research was formed as a basic level, non-experimental, and cross-sectional study. Content validity was analyzed through expert judges ($n = 8$), while construct validity, factorial invariance, and reliability were tested with a sample of high school students from Lima and Cusco ($N = 201$).

Results – The content validity obtained satisfactory results (Aiken's $V = 0.952$, $p < .01$). Through construct validity, it was corroborated that the instrument measures the information competence (RMSEA = 0.052, CFI = 0.948, TLI = 0.928, PNFI = 0.67) and that this theoretical construct remains invariant between both of the groups studied. The instrument also demonstrates adequate internal consistency ($\alpha = 0.736$, $\omega = 0.751$, ordinal $\alpha = 0.869$).

Conclusion – "ECODIES - Area 1: Information" is a valid and reliable instrument for the assessment of the information digital competence, including cultural differences, in high school students.

Keywords – Psychometric instrument, validity, reliability, digital competence, high school.

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1. INTRODUCTION

Due to the social distancing introduced to contain the spread of the COVID-19 pandemic, digital competence became a priority in education, confirming its place as one of the six key transformations within the Sustainable Development Goals (Sachs et al., 2022). Many countries adopted this competence area as part of their educational policies to face the new digital era (United Nations Economic Commission for Latin America and the Caribbean, 2022) which was notably accelerated by the pandemic.

The European Union developed the Digital Competences Framework for Citizens (DigComp) in which digital competence is defined as the "safe, critical and responsible use of, and engagement with, digital technologies for learning, work and participation in society" (Vuorikari et al., 2022) and results from the combination of knowledge, skills, and attitudes (Ala-Mutka, 2011; European Union, 2019; Ferrari et al., 2013). This competence allows, through digital devices, the use, organization, and production of information found on the Internet (González, 2020). The DigComp proposes 21 digital competencies organized in five areas: 1) Information; 2) Communication and collaboration; 3) Digital content creation; 4) Security; and, 5) Problem solving (Vuorikari et al., 2022).

DigComp is one of the most prominent theoretical models developed for digital competence (Conde, 2017). Most models are based on a constructivist approach, which emphasizes interaction and cooperation for the construction of learning in students (Díaz-Barriga & Hernández, 2002, as cited in Tünnermann, 2011). Even though authors such as Siemens (2005) proposed the understanding of digital skills from a connectivist approach, as in away from the behaviorist, cognitivist, and constructivist positions, many authors understand this approach to be an evolution of constructivism (Anderson & Don, 2011, 2012, as cited in Mattar, 2018).

Within the five areas of the DigComp model, "Information and data literacy" is defined as the knowledge, skills and attitudes referred to the search, evaluation and storage of digital information (Vuorikari et al., 2016). Previous research evidences that high school students experience difficulties in searching for digital information according to their thought processes (Tu et al., 2007), teaching assistance, and the strategies employed (Colwell et al., 2013, as cited in Valverde-Crespo et al., 2020). A high percentage of students are unable to detect fake news or misleading webpages (Dimitru, 2020); failing to detect political bias, which generates distrust towards social networks in general (Johnston, 2020). Likewise, evidence shows that school-aged children use information and communication technologies (ICTs) for social purposes and less for learning, with low interest in actually searching for information (Basilotta et al., 2020).

The measurement of digital competencies, including "Information and data literacy," is a novel field in which instruments based on direct problem solving (Organisation for Economic Co-operation and Development, 2011), the behavioral observation of competencies (Sencia, 2018) and self-report (Mon & Cervera, 2013) have been proposed. This variety of instruments found in the literature is characterized by lacking comprehensive checks of their psychometric validity, with most presenting only content validity (Carrera et al., 2011) and few with construct validity (Colás-Bravo et al., 2017). Most questionnaires that measure such competencies are based on self-perceptions that do not guarantee to demonstrate the knowledge and skills of respondents (Garcia, Hernández, Basilotta, et al., 2019).

A recent proposal introduced to resolve this situation was the "Evaluation of Digital Competence for Compulsory Education Students" (ECODIES, García-Valcárcel, Hernández, Basilotta, et al., 2019) test, which was developed based on the DigComp model. This instrument measures activities reported by the subject under evaluation, surpassing the self-perception type of measurement (Casillas-Martín et al., 2020). It evaluates the five areas of the DigComp through subscales, one of which is the "ECODIES – Area 1: Information" subscale. The original psychometric study showed appropriate results of its validity (Casillas-Martín et al., 2020). This competence plays a crucial role in school-based student learning in the current education environment (Harju et al., 2019), and also in preventing the proliferation of fake news (Jones-Jang et al., 2019).

Validating an instrument aimed at measuring digital competence in information technology is considered very important in the Latin American context, where there is almost no standardization of psychometric instruments of this type, since each researcher creates instruments according to their own specific interest, therefore it is not possible to compare results. Henriquez-Coronel et al. (2018) evidenced that, out of 2,800 studies, only two employed standards such as DigComp. On the other hand, interest in digital competence has focused more on teachers, with little empirical literature on school-aged children (Morales, 2013) and undergraduate students (Henriquez-Coronel et al., 2018; Zhao et al., 2021).

On the other hand, differences exist in technology adoption according to culture (Lee et al., 2013); for example, among university instructors due to their culturally held values (Huang et al., 2019). Although no such studies have been conducted with school-aged students, the DigComp model is considered a robust theoretical framework that can be used for the design of new psychometric tests, such as the ECODIES. The interest in validating this instrument is of particular relevance in the wake of the COVID-19 pandemic, with its unforeseen and almost overnight transition to virtual education in schools worldwide (Pulido-Montes & Ancheta-Arrabal, 2021) was compounded by cultural and socioeconomic differences in access to ICT, the Internet, and digital devices. In Lima (the capital of Perú), 50.2% of households own a computer; however, this is in contrast to 38.1% for the urbanized areas of other provinces (Instituto Nacional de Estadística e Informática [National Institute of Statistics and Informatics, Perú], 2021). Under these conditions, the lack of research on digital information competencies in school-aged children becomes as important as the lack of access to digital technology (Loveless & Williamson, 2013).

Therefore, a clear need exists for duly validated instruments that account for digital information competence in the school context (van Lancker & Parolin, 2020) and that also address the variance of cultural differentiation. Therefore, the research question of the current study was: What is the validity of the "ECODIES – Area 1: Information" instrument when applied to high school students in the Peruvian cities of Lima and Cusco?

The general objective of the study was to validate the instrument for the evaluation of digital competencies in the area of Information, in high school students from two Peruvian cities with culturally different populations: Lima (the capital city) and Cusco (a city located in the southern highlands of the country). The specific objectives of the current study were: to identify the content validity of the "ECODIES – Area 1: Information" instrument; to identify its construct validity; to identify its factorial invariance; and to identify its reliability through internal consistency.

In this sense, the general hypothesis was: The "ECODIES – Area 1: Information" instrument is valid for the evaluation of digital competencies in the area of Information, in high school students from two cities in Perú with culturally different populations. This hypothesis is reached through the specific hypotheses that corroborate an adequate content validity (H1), construct validity (H2), is not modified by cultural differences (H3), and has reliability through internal consistency (H4).

2. METHODOLOGY

This article describes a quantitative, psychometric study that employs a cross-sectional design (Schweiger, 2012).

2.1. Participants

The sample was composed of 201 male and female students, aged between 15 and 17 years old, attending their last 2 years of secondary schooling in either public or private schools in the Peruvian cities of Lima or Cusco, formed according to a non-probabilistic convenience sampling method. This sample size exceeds the criterion of 10 subjects per item suggested in the literature for psychometric analyses (Nunnally, 2013) since the test to be validated ("ECODIES – Area 1: Information") consists of 18 items.

2.2. Instrument

The instrument subjected to psychometric validation was the subscale "ECODIES – Area 1: Information," part of the "Evaluation of Digital Competence for Compulsory Education Students" (ECODIES) test that aims to measure competencies related to information and data literacy (García-Valcárcel, Hernández, Basilotta, et al., 2019). The instrument consists of two dimensions. The "knowledge and skills" domain involves the digital competencies of "browsing, searching, and filtering digital information" (four items), "evaluation of information" (four items), and "managing, storage and retrieval of information" (four items). These items are each formed as multiple-choice questions with one correct answer (scored as "1") and three incorrect answers (scored as "0"). Therefore, original analysis procedures were followed (Casillas-Martín et al., 2020) considering the total score for each competency as a numerical variable from 0 to 4 points. The second domain, "attitude," consists of general affirmations regarding the digital information competence, with six items based on a 5-point, ordinal Likert-type scale (1 = *strongly disagree*, 2 = *disagree*, 3 = *indifferent*, 4 = *agree*, and 5 = *strongly agree*).

Table 1. Structure of the "ECODIES – Area 1: Information" test

Domain	Competence	Description	Items
Knowledge and skills	Browsing, searching and filtering digital information	Searching for and accessing digital information on the Internet, describing digital information needed for homework, finding relevant information, and the management of various sources of digital information.	1-4

Domain	Competence	Description	Items
	Evaluating digital information	Grouping, processing, understanding and evaluating digital information critically.	5-8
	Managing, storage and retrieval of information	Management and storage of digital information and digital content, strategies to organize and recover digital information.	9-12
Attitude	Attitudes related to digital information competencies	Values, aspirations and priorities that act as motivators of performance towards digital skills in the digital information area.	13-18

Adapted from García-Valcárcel, Hernández, Basilotta, et al. (2019) and García-Valcárcel, Hernández, Mena, et al. (2019)

2.3. Procedures

This research was conducted between August and October of 2021 with high school students in the cities of Lima and Cusco, Perú. The linguistic terms were adapted to the idiomatic use of Spanish in Perú with a preliminary semantic adaptation of the "ECODIES – Area 1: Information" instrument. This process was conducted with groups of students from both Lima (n = 5) and Cusco (n = 5), as well as a group of judges (n = 8) with expertise in education, linguistics, IT assistance, and psychology.

Content validation was performed by the same group of judges, using the criteria of clarity, coherence, and relevance, with the response template based on that used by Escobar-Pérez and Cuervo-Martínez (2008). The experts were selected considering their knowledge and experience in digital competencies, education and psychology. They were provided with response forms, with the definition of each criterion, dimensions, and the items of the instrument. The results were analyzed according to Aiken's V statistic (V ≥ 0.8).

Subsequently, to corroborate construct validity, factorial invariance and internal consistency reliability, the instrument was applied to a sample of high school students (N = 201). The application was conducted with the approval of the Ethics Committee of the Universidad Peruana Cayetano Heredia and with the permission of the authorities of the selected schools. To validate the "ECODIES – Area 1: Information" instrument, a self-administered virtual test was applied through Google Forms. The application was conducted during school hours with prior agreement obtained from both the school authorities and the participant students' parents. Different platforms were used according to the preferences of each school (i.e., Zoom, Google Meet, or WhatsApp), which allowed the delivery of the link to the instrument's webpage and the necessary explanation for the test. Administration of the test lasted 20 minutes on average.

2.4. Data Analysis

The descriptive analysis was based on calculating the mean, standard deviation, skewness and kurtosis for each item and each competency. The inferential analysis was based on

identifying the normal distribution of the sample through the univariate skewness/kurtosis test of D'agostino et al. (1990) and the multivariate normality test of Doornik-Hansen. The adequacy of the data to a factor structure was determined through the Kaiser-Meyer-Olkin test (expecting KMO scores above 0.7) and Bartlett's test of sphericity (expecting a significance level $p < .05$), according to the cut-off points recommended in the literature (López-Aguado & Gutiérrez-Provecho, 2019).

Exploratory factor analysis was performed with a principal component extraction method to assess eigenvalues, factor loadings and the explained variance. Subsequently, confirmatory factor analysis was performed to determine the final distribution of the factors with their indicators. Criteria were considered from both Hu and Bentler (1999) and also Schermelleh-Engel and Moosbrugger (2003) in order to interpret goodness-of-fit coefficients such as the ratio between χ^2 and the degrees of freedom ($\chi^2/df \leq 6$), the root mean square error of approximation (RMSEA ≤ 0.08), the standardized root mean square residual (SRMR ≤ 0.1), the comparative fit index (CFI ≥ 0.9), the Tucker Lewis index (TLI ≥ 0.9), the normed fit index (NFI ≥ 0.9), and the parsimony normed fit index (PNFI > 0.5). To assess the discriminant validity, we compared the square root of Average Variance Extracted (AVE) of each latent variable with the correlation between them, expecting the AVE to have a greater value.

For the assessment of model invariance due to the city of residence, differences between goodness-of-fit measures in configural, scalar, and strict measurement models were estimated. Cheung and Rensvold (2002) recommend rules of thumb related to the difference between Chi square tests ($\Delta\chi^2$, $p > .05$), comparative fit index (ΔCFI ≤ 0.01), and root mean square error of approximation (ΔRMSEA ≤ 0.015).

The internal consistency of the psychometric instrument was tested through Cronbach's alpha statistic (Bland & Altman, 1997) and McDonald's Omega (Viladrich et al., 2017), as well as the calculation of the ordinal alpha (Dominguez-Lara, 2018), with the expectation of values to exceed 0.7.

Microsoft Office Excel (version 16) was used for the creation and cleaning of the databases, as well as the analysis of content validity. Construct validity and internal consistency reliability were analyzed using StataCorp's STATA/SE statistical program (version 17). Factorial invariance was analyzed using IBM's SPSS AMOS statistical program (version 25).

3. RESULTS

The semantic validation resulted in the modification of words according to the Peruvian national context. Accordingly, the content validation by expert judgment had satisfactory results, as shown in Table 2.

Table 2. Content validity coefficients by expert judgment

Competencies	V				*p*
	Clarity	Coherence	Relevance	Total	
Browsing, searching, and filtering digital information	0.933	0.944	0.965	0.947	< .01
Evaluating digital information	0.931	0.921	0.965	0.939	< .01

Competencies	V				*p*
	Clarity	Coherence	Relevance	Total	
Managing, storage, and retrieval of information	0.973	0.952	0.977	0.967	< .01
Attitudes related to digital information	0.944	0.979	0.944	0.956	< .01
Total	0.945	0.949	0.963	0.952	< .01

Note: V = Aiken's (1985) validity coefficient

Table 3 presents the results of the descriptive analysis of the collected data, according to the scores for each competency and item. The asymmetry and kurtosis normality test (D'agostino et al., 1990) showed that the observations were not normally distributed ($p < .001$). Additionally, the absence of multivariate normality was determined by the Doornik-Hansen test ($\chi^2 = 13754.641$, $p < .001$).

Table 3. Descriptive analysis of the "ECODIES – Area 1: Information"

Domains	Min	Max	Mean	*SD*	Asymmetry	Kurtosis
Browsing, searching, and filtering digital information	0	4	1.303	0.966	0.465	2.836
Item 1	0	1	0.313	0.465	0.804	1.647
Item 2	0	1	0.308	0.463	0.829	1.688
Item 3	0	1	0.274	0.447	1.016	2.031
Item 4	0	1	0.408	0.493	0.375	1.140
Evaluating digital information	0	4	2.323	1.005	-0.325	2.538
Item 5	0	1	0.786	0.411	-1.395	2.947
Item 6	0	1	0.826	0.380	-1.719	3.954
Item 7	0	1	0.259	0.439	1.102	2.214
Item 8	0	1	0.453	0.499	0.190	1.036
Managing, storage, and retrieval of information	0	4	1.891	1.182	0.103	2.193
Item 9	0	1	0.438	0.497	0.251	1.063
Item 10	0	1	0.587	0.494	-0.354	1.125
Item 11	0	1	0.473	0.500	0.110	1.012
Item 12	0	1	0.393	0.490	0.438	1.192
Attitudes related to digital information	6	30	23.846	4.232	-1.384	6.346
Item 13 (Attitude 1)	1	5	3.891	1.232	-0.965	2.971
Item 14 (Attitude 2)	1	5	4.249	0.921	-1.629	6.031

Domains	Min	Max	Mean	*SD*	Asymmetry	Kurtosis
Item 15 (Attitude 3)	1	5	3.582	1.032	-0.495	2.845
Item 16 (Attitude 4)	1	5	4.139	0.980	-1.368	4.731
Item 17 (Attitude 5)	1	5	4.109	0.829	-1.207	5.460
Item 18 (Attitude 6)	1	5	3.876	1.072	-0.923	3.388
Total	10	41	29.363	5.345	-0.687	3.975

The average score of the knowledge and ability domains was 6.508, which was higher than the score obtained in the original Spanish validation (5.32). The average score of the attitude domain was 24.748, showing a marked negative asymmetry.

For the validity of structure, the adequacy of the factorial structure was verified, obtaining adequate scores in the Kaiser-Meyer-Olkin test (KMO = 0.811) and confirmed according to Bartlett's test of sphericity (χ^2 = 1387.964, *df* = 36, $p < .001$).

Exploratory factor analysis was performed by the principal components method, based on a matrix of polychoric correlations as a result of normal distribution. The existence of two factors with eigenvalues greater than 1 was identified, which explains 49.26% of the variance. The best factor loadings were found using a varimax rotation, with factor loadings greater than 0.3. The grouping of factors occurs in the domains assessed by the test, with knowledge and skills grouped under one factor and attitude under another (see Table 4).

Table 4. Principal component factor loadings

Variables	Factor loadings	
	Factor 1	Factor 2
Browsing, searching, and filtering digital information	**0.7794**	0.1509
Evaluating digital information	**0.6506**	0.3392
Managing, storage, and retrieval of information	**0.594**	-0.0853
Item 13 (Attitude 1)	0.2101	**0.8377**
Item 14 (Attitude 2)	0.2849	**0.7762**
Item 15 (Attitude 3)	0.0235	**0.7526**
Item 16 (Attitude 4)	-0.0884	**0.6885**
Item 17 (Attitude 5)	0.0642	**0.6317**
Item 18 (Attitude 6)	0.2533	**0.5976**

Subsequently, confirmatory factor analysis was performed using a maximum likelihood (ML) method with the Satorra-Bentler adjustment for coefficient estimations. This procedure is considered a robust method recommended when normality is not achieved. As shown in Figure 1, the structural coefficients have a moderate to high correlation on most items, except for the coefficient between factor 1 (knowledge and skills domain) and the "browsing,

searching, and filtering digital information" item, which is low. However, all correlations are significant ($p < .01$).

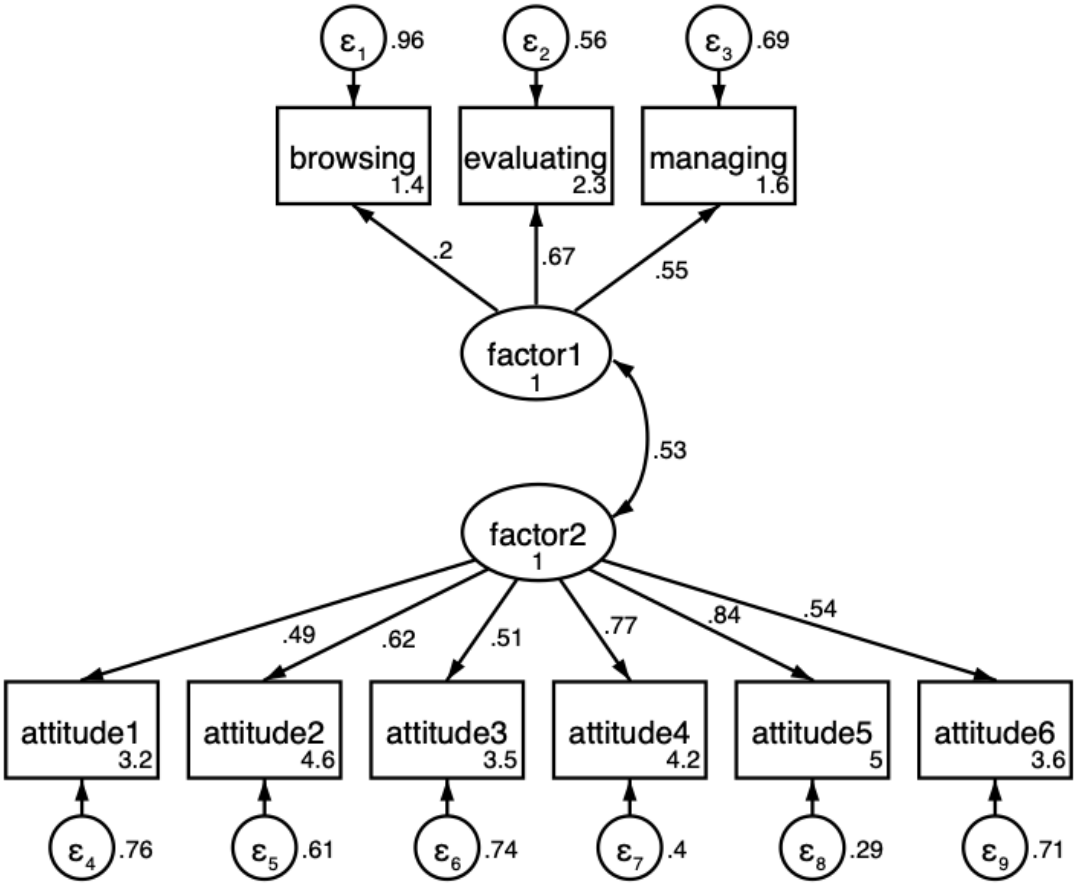

Figure 1. Structural equation model for the "ECODIES – Area 1: Information"
Note: standardized structural coefficients are displayed in the model

Through the structural model, error indices (RMSEA, SRMR) and goodness-of-fit indices (CFI, TLI, NFI) were obtained with a satisfactory level (see Table 5). These coefficients complement a lower degree of fit than expected in the χ^2 independence test ($p < .001$). Parsimony coefficient PNFI was also identified with a good value. Thus, a correct fit of the model to the sample was determined.

Table 5. Goodness-of-fit indices for the structural equation model

Values	χ^2/df*	RMSEA*	SRMR	CFI*	TLI*	NFI*	PNFI*
Obtained	1.37	0.043	0.047	0.973	0.963	0.910	0.657
Expected	≤ 6.0	< 0.08	< 0.1	> 0.9	> 0.9	> 0.9	> 0.5

* Estimated with the Satorra-Bentler adjustment

The square root of the extracted Mean Variances (√AVE) was obtained in the knowledge-ability dimension (√AVE = 0.513), which was slightly lower than the standardized covariance between both latent factors (β = 0.533). However, the attitude dimension (√AVE = 0.643) resulted lower, which is indicative of adequate discriminant validity in the model.

The invariance analysis was performed between student samples from Lima and Cusco. For the analysis, the baseline model (with no restrictions) was compared with the configural model; then the latter was compared with the scalar model and the strict model. Using the rules of thumb criteria ($\Delta\chi^2$, $p > .05$, $\Delta CFI \leq 0.01$, $\Delta RMSEA \leq 0.015$) introduced by Cheung and Rensvold (2002), the results showed that no significant differences exist between the models. Therefore, there was no significant difference between the two groups of high school students in the factorial structure.

Table 6. Invariance analysis by city of residence

Model	$\chi^2(df)$	χ^2/df	CFI	RMSEA	Model comparison	$\Delta\chi^2(df)$	ΔCFI	ΔRMSEA
Baseline	59.523(52)	1.145	0.981	0.027				
Metric	64.316(59)	1.09	0.986	0.021	Metric vs. Baseline	4.793(7) $p = .685$	0.005	-0.006
Scalar	77.562(68)	1.141	0.976	0.027	Scalar vs. Metric	13.246(9) $p = .152$	-0.01	0.006
Strict	88.228(80)	1.103	0.979	0.023	Strict vs. Scalar	10.667(12) $p = .558$	0.003	-0.004

Finally, the internal consistency reliability of the instrument was assessed, obtaining satisfactory scores through Cronbach's alpha coefficient ($\alpha = 0.748$), McDonald's omega ($\omega = 0.768$), and ordinal alpha ($\alpha_{ordinal} = 0.896$).

4. DISCUSSION

Since digital technology mediates the relationship with a world in which meaning is constructed (Floridi, 2015), the development of digital competence is intrinsically linked to the development of the knowledge, attitudes, and skills needed to be efficient and ethical with the use of digital technology (Loveless & Williamson, 2013). Therefore, the use of technology is not limited to the mere relationship between humankind and machines. Knowing when one is digitally competent and when one is not is part of the educational challenges and dilemmas that pedagogy must confront in the face of educational development based on technology (Suárez-Guerrero et al., 2020). This became significantly important during the COVID-19 pandemic, when technology usage was the only means through which students (at all levels) were able to continue their school education (van Lancker & Parolin, 2020).

The current study focused on the field of digital information, considered a fundamental digital competence since it establishes the knowledge, skills, and attitudes necessary to effectively navigate performing virtual searches, evaluation, and the management of information. In the case of high school students, especially in the context of remote education during the COVID-19 pandemic (Pulido-Montes & Ancheta-Arrabal, 2021), the need to quickly develop this area of competence is seen as crucial to the task of learning to appropriately use Internet resources. Accordingly, in order to achieve digital information literacy, students require appropriate guidance and teachers need the resources necessary to understand the status of their students' competencies.

The results of the current study determined that the "ECODIES – Area 1: Information" instrument is a valid and reliable psychometric test with an invariant theoretical construct as tested different cultural backgrounds of high school students (from Lima and Cuzco). This result demonstrates the acceptance of the general validity hypothesis of the ECODIES instrument, as well as the specific hypotheses referring to content validity (H1), construct validity (H2), its non-modification due to cultural aspects (H3), and its reliability according to internal consistency (H4). These findings contribute to overcoming the previous trend of digital competence tests based on self-perception towards an assessment of its level through more objective forms of measurement. Furthermore, this work provides a tool to promote the key digital learning necessary to mitigate the effects of unplanned school closure (Cifuentes-Faura, 2020), such as in the context seen with the COVID-19 pandemic. With this validated instrument, scientific knowledge can be generated to focus the development of digital information competencies, thus responding to the needs of today's knowledge society (García-Valcárcel et al., 2015).

The procedure of this validation was achieved despite the diverse conditions of application, conditioned by the context that the Peruvian educational system is currently going through, such as the use of a variety of study platforms (e.g., Zoom, Google Meet, WhatsApp). However, two conditions may be stated as having helped the application to be successful: 1) The flexibility of the test and that its online administration was applied based on its original design, and 2) the interest of the participant students and their teachers in wanting to know the position of their digital competency.

The aspects of semantic adequacy were deemed indispensable, just as it was highly appropriate to use focus group techniques with the students, since it allowed for knowing not only the language closest to the cultural characteristics of the students, but also to identify coincidences of unique linguistic use, valid for high school students from two very different populations such as the Peruvian cities of Lima and Cusco. These coincidences were confirmed by the opinions of expert judges who participated in the content validity process. In addition, the results of the invariance analysis showed that the instrument used has the ability to overcome cultural differences, thus ensuring the measurement of digital information competence beyond the cultural conditions of the context. This proves that the construct of digital competence can be used to assess different school populations. However, it is important to mention here that these samples were both from schools located in urban areas. Internal consistency was equally assured in both of the examined samples.

The structural validation process corroborated that the "ECODIES – Area 1: Information" instrument presents a factorial structure that agrees with the findings found in the original psychometric study. As for the evidence of convergent validity in the instrument, the Attitude dimension obtained satisfactory results, whilst the Knowledge-Ability dimension obtained a lower coefficient than expected, which may be due to the way in which this dimension was scored and corrected (through dichotomous hit/miss questions). Therefore, subsequent versions of the instrument may require a new way of developing the Knowledge-Ability dimension.

In terms of the results for the "browsing, searching, and filtering digital information" competence, which showed a low, but significant, correlation with the knowledge-ability variable, they were shown to coincide with the findings of the original authors (Casillas & Cabezas, 2020). However, their elimination in the statistical testing impacted on the degree of

explanation of the model; therefore, it was decided to keep it, with the suggestion of further research and evidence on their measurement.

The average score achieved by the participant students in the knowledge and skills area of digital information competency (browsing, evaluating and searching) was 5.52, which is a "negative performance" according to both Peruvian and European school marking systems. In the subareas, the score was lower in information search and storage, compared to information evaluation, which scored slightly better. This means that the participant students did not know how to search and store information on the web, nor did they know how to evaluate its reliability on the Internet. This result coincides with the findings of Martínez (2020, as cited in Díaz-Arce & Loyola-Illescas, 2021), who conducted a study with university students from Chile, Perú, Colombia, and Venezuela, and found that they basically used Google, Yahoo, and Wikipedia, and without evaluating the veracity of the information retrieved. This result is also similar to that found in a sample of Spanish schoolchildren, who identified a lower average score in the area of search, followed by saving, with the evaluation dimension being the highest scoring (Martín, 2020).

On the other hand, although it is a test that the authors consider more reliable because it evaluates the result of a task, application continues to be more cognitive than performance, surpassing tests that are entirely self-reporting, which are considered to be more subjective.

The usefulness of this test for the Peruvian context is that it can provide information of the utmost importance in terms of the current situation, both to gain an understanding of digital information competency development, and to develop training actions in both students and their teachers.

5. CONCLUSION

Due to the lack of valid and reliable psychometric tests to assess the digital competence related to information in Peruvian high school students, the "ECODIES – Area 1: Information" subscale developed by Casillas-Martín et al. (2020) may be said to be an adequate alternative based on the European Commission's DigComp framework.

Semantic validation was performed to the "ECODIES – Area 1: Information" items in order to ensure that cultural expressions and understanding at the item level in terms of Peruvian high school students. The test also showed good content validity related to clarity (V = 0.945), coherence (V = 0.949), and relevance (V = 0.963), according to assessment by expert judges.

Construct validation was assessed with through exploratory factor analysis, indicating the existence of two factors that explain 49.26% of the variance. The first factor grouped items related to "knowledge and skills" and the second factor grouped "attitude" items, each with adequate factor loadings. Confirmatory factor analysis indicated a significant relationship between the factors ($\beta = 0.66$, $p < .001$), as well as significant structural coefficients for all items with their respective factors. Goodness-of-fit indices (χ^2/df, RMSEA, SRMR, CFI, TLI, NFI, and PNFI) showed satisfactory coefficients.

The factorial invariance between the student sample from Lima and Cusco, using multiple-level restriction models (baseline, metric, scalar and strict), corroborated that no significant difference exists in the factorial structure of both groups.

Difficulties associated with access to the population due to distance education, as well as the scarcity of information on the subject in the national literature in Perú and in the Latin American region in general, reduced the possibilities for discussion of the results.

The findings allow for the proposal of pedagogical models for the development of digital information competence in secondary education, for public education police officers and for new ways of measuring student learning.

DECLARATIONS

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Data Availability Statement: The data is only available upon detailed and reasonable request to the principal author. It is not publicly available due to the ethical guidelines approved by the IRB.

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