



Measuring Digital Media Literacy in Adolescents: Evidence for a Multidimensional Structure Through ESEM

Lisbeth Farfán-Chávez*¹  and Tomás Atarama-Rojas¹ 

¹ Universidad de Piura, Piura, Peru

lisbeth.farfán.ch@udep.edu.pe*, tomas.atarama@udep.edu.pe

Abstract. This study examines the multidimensional internal structure of a measure of digital media literacy in adolescents, considering their dual role as consumers and creators of social media content. In an increasingly dynamic digital environment, the study integrates critical, ethical, emotional, and self-regulatory competencies to address the complexity of contemporary digital practices. A quantitative cross-sectional design was employed with a sample of 1,026 Peruvian adolescents aged 11 to 17 years. The analysis followed an exploratory–confirmatory strategy that included exploratory factor analysis based on polychoric correlations, a CFA model, and ESEM modeling. The analyzed version consisted of 50 items organized into eight dimensions: content publication involvement, critical thinking, emotional impact, parental mediation, awareness of digital use, identity and privacy management, self-regulation, and propensity to digital engagement. The results provide initial validity evidence based on internal structure, together with adequate internal consistency estimates ($\alpha = .678-.900$; $\omega = .727-.916$). The ESEM model showed a better fit than the CFA model, supporting an interrelated representation of the construct within the analyzed sample. This study provides empirical evidence on the multidimensional internal organization of digital media literacy and offers a conceptual and analytical basis for future longitudinal and comparative research.

Keywords: Digital Media Literacy; Adolescents; Social Media; Internal Structure; ESEM Modeling.

1 Introduction and Literature Review

The contemporary digital ecosystem has transformed the ways in which content is accessed, produced, and circulated, shaping an environment in which users not only consume content but also actively participate in its creation and dissemination [1, 2]. In this context, social media platforms have become central spaces of interaction, particularly among adolescents, who engage in intensive communicative practices mediated by digital technologies. This transformation poses new challenges for understanding the competencies required to navigate these environments in a critical, ethical, and responsible manner.

Media literacy has been defined as the set of skills that enables individuals to access, analyze, evaluate, and create messages across different formats [3]. However, the expansion of social media has driven a reconceptualization toward more complex approaches that incorporate the participatory and relational dimensions of digital environments. In this sense, digital media literacy involves not only interpreting content, but also managing one's online presence, regulating digital behavior, and understanding the algorithmic dynamics that shape information visibility [4].

A persistent limitation in the literature is the tendency to approach digital media literacy from a consumption-centered perspective. Nevertheless, several studies have shown that adolescents simultaneously act as consumers and creators of content, positioning themselves as prosumers on social media [5–7]. This dual role introduces additional dimensions related to responsibility in content publication, digital identity management, and exposure to social validation dynamics, all of which are key to understanding adolescents' digital experiences.

Likewise, social media use has been associated with effects that go beyond cognitive dimensions, incorporating emotional and behavioral components. Previous research has highlighted the relevance of emotional impact, propensity to digital engagement, and self-regulation mechanisms as fundamental elements for analyzing adolescents' relationships with digital environments [8, 9]. These dimensions are also connected to contextual factors such as parental mediation, which continues to play a relevant role in guiding and regulating digital use [10].

Within this framework, digital media literacy emerges as a multidimensional construct that integrates critical, ethical, emotional, and self-regulatory competencies. However, despite theoretical advances, a gap remains in the development of instruments capable of empirically measuring this complexity. This challenge becomes even more relevant when considering the interrelated nature of digital competencies. Unlike more delimited constructs, media literacy in social media environments involves overlapping processes, such as critical content evaluation, time-use regulation, and social interaction management [11]. Consequently, traditional factorial approaches based on strict structures without cross-loadings may be insufficient to adequately represent this complexity.

In response to this limitation, recent methodological developments have highlighted the potential of Exploratory Structural Equation Modeling (ESEM), which allows the simultaneous estimation of primary and secondary loadings, providing a more realistic representation of complex latent structures [12]. This approach is particularly suitable for the study of digital competencies, where dimensions do not operate independently but are configured through dynamic and contextual relationships.

In Latin America, and specifically in the Peruvian context, empirical evidence on digital media literacy among adolescents remains limited. Although relevant contributions have addressed the integration of digital competencies in educational settings [13] and advertising literacy in digital environments [14], there is still a lack of studies that jointly examine content consumption and creation on social media, as well as validated instruments capable of rigorously assessing these competencies.

Given these limitations, this study aims to examine the multidimensional internal structure of digital media literacy in adolescents and to provide initial validity evi-

dence based on the relationships among the items and their underlying dimensions, considering their dual role as consumers and creators of social media content. Through an exploratory–confirmatory approach, the study seeks to identify a factorial organization composed of eight interrelated dimensions: content publication involvement, critical thinking, emotional impact, parental mediation, awareness of digital use, identity and privacy management, self-regulation, and propensity to digital engagement.

Beyond the examination of a specific measure, this study provides evidence on how different dimensions of digital media literacy interact within contemporary digital environments. The proposed structure offers a conceptual and empirical basis for future longitudinal and comparative research, as well as for the design of educational strategies and policies aimed at promoting a critical, ethical, and responsible use of digital technologies among adolescents.

2 Material and Methodology

A quantitative, cross-sectional, and non-experimental study was conducted to evaluate the multidimensional structure of digital media literacy in social media environments through a questionnaire administered to Peruvian adolescents in their dual role as consumers and creators of content. The methodological objective was to identify and describe a set of latent dimensions that would allow the understanding of critical, ethical, emotional, and self-regulatory competencies in the use of digital platforms.

The sample consisted of Peruvian adolescents aged 11 to 17, selected using a random sampling design stratified by sex and age, with nationwide coverage. The design achieved a 95% confidence level, a margin of error of $\pm 3.06\%$, and a representativeness of 95.09% for the defined strata. The study was approved by the Institutional Research Ethics Committee of the University of Piura (No. CIEI.0047.01), ensuring compliance with ethical principles for research involving minors. Participation was voluntary and required the informed consent of parents or legal guardians and the assent of the adolescents. Furthermore, anonymity, data confidentiality, and the exclusive use of the information for research purposes were ensured.

A total of 1,026 responses from Peruvian adolescents were analyzed. This sample size constitutes a methodological strength, as it provides stability for the estimation of polychoric correlation matrices and is suitable for factorial models involving multiple dimensions and ordinal variables. The cross-sectional design allows the structure of the instrument to be evaluated at a specific moment in time, without aiming to establish causal relationships or developmental dynamics.

The questionnaire consisted of Likert-type items with five response categories: “Strongly disagree,” “Disagree,” “Neither agree nor disagree,” “Agree,” and “Strongly agree.” Initially, 83 Likert-type items were identified through an automated detection criterion ($\geq 80\%$ non-empty responses across predefined categories). All items were recoded on a 1-to-5 scale while explicitly preserving their ordinal nature. As an additional verification step, the distribution of response categories was examined for

each item, confirming the absence of empty categories, a condition that favors the stability of polychoric correlations and the convergence of factorial models.

The questionnaire was designed based on the conceptual framework of digital media literacy and initially consisted of 83 Likert-type items. Before its final administration, the instrument was pilot-tested with 174 adolescents to assess item clarity, language comprehension, and estimated response time. The complete version was subsequently administered to the final sample of 1,026 adolescents. The refinement process was conducted in two stages. First, the item wording was theoretically reviewed to preserve the conceptual representativeness of the proposed dimensions and reduce thematic redundancy. Second, the resulting item set was empirically examined through the exploratory and model-based analyses described below. The combined consideration of conceptual coherence and empirical performance resulted in a final 50-item version organized into eight dimensions (Table 1).

Table 1. Dimensions of the instrument and number of items

Dimension	Number of items
Content publication involvement	12
Critical thinking and media interaction	10
Emotional impact of social media use	6
Parental mediation of digital use	6
Awareness of digital use	4
Identity and digital privacy management	3
Self-regulation of digital use	5
Propensity to digital engagement	4

Note: The instrument comprises 50 Likert-type items distributed across eight dimensions.

The analysis followed a sequential exploratory–confirmatory strategy, widely recommended for the development and structural validation of instruments in applied social sciences, particularly when addressing complex digital competencies that combine practices, attitudes, and self-regulatory processes [15].

In the first stage, an exploratory factor analysis (EFA) was conducted on a polychoric correlation matrix, which is appropriate for ordinal variables. The minimum residuals (minres) extraction method and an oblique rotation (oblimin), which allows factor correlations, were employed. Matrix adequacy was assessed using the Kaiser–Meyer–Olkin (KMO) index and Bartlett’s test of sphericity. Overall model fit was evaluated through error and residual indices, including RMSEA with a 90% confidence interval and RMSR, together with internal structure indicators such as communalities, mean item complexity, and interfactor correlations.

Internal consistency indices were estimated for each dimension using Cronbach’s alpha, with key corrections when necessary, and total omega calculated from polychoric correlation matrices. The use of polychoric omega represents a methodological strength, as it aligns with the ordinal nature of the data and overcomes limitations associated with alpha in scales with non-tau-equivalent loadings [16].

In the second stage, a confirmatory factor analysis (CFA) model with a simple structure was estimated, in which each item was specified within its corresponding

theoretical dimension. The model was estimated using the WLSMV estimator, recommended for ordinal variables [17], and evaluated through standard and scaled fit indices: CFI, TLI, RMSEA, and SRMR [18]. Since digital media literacy involves interrelated competencies that are unlikely to operate independently, an additional ESEM (Exploratory Structural Equation Modeling) model was estimated using the EFA-within-CFA approach. This model allows the simultaneous estimation of primary and secondary loadings under oblique rotation, providing a more realistic representation of complex latent structures [12, 19].

A detailed item-level diagnostic was also conducted within the ESEM framework, considering primary factor loadings, the presence of relevant cross-loadings ($\geq .30$), and the margin between primary and secondary loadings. Additionally, an exploratory low-margin criterion ($< .20$) was used to identify potential factorial ambiguities. This criterion was employed for interpretative purposes rather than as an automatic item removal rule, acknowledging the interrelated nature of digital competencies.

Overall, the adopted methodological strategy captures the empirical complexity of digital media literacy in adolescents by recognizing its multidimensional nature. The combination of EFA, CFA, and ESEM provides a robust analytical framework that balances empirical exploration with theory-informed evaluation of the construct while maintaining coherence between the nature of the data and the analytical methods employed.

3 Results Analysis

The polychoric correlation matrix showed excellent adequacy for factorial analysis. The KMO index reached a value of 0.886, indicating a high degree of intercorrelation among items and supporting the suitability of the data for identifying latent dimensions. Bartlett's test of sphericity was statistically significant ($\chi^2 = 28,784.60$; $df = 1,225$; $p < .001$), rejecting the identity matrix hypothesis and supporting the existence of an underlying factorial structure.

The exploratory factor analysis conducted on the polychoric matrix identified an eight-factor solution consistent with the proposed theoretical structure. These factors explained approximately 52% of the total variance, an adequate value for multidimensional instruments in applied social sciences. The exploratory model fit indices showed acceptable performance (RMSEA = .071; RMSR = .032), while the TLI presented moderate values, which can be interpreted considering the complexity of the model and the correlations among factors.

As shown in Table 2, factor loadings exhibited clear and conceptually interpretable patterns. Most items presented moderate to high primary loadings, with adequate communalities and a mean item complexity of 1.5, suggesting a globally coherent structure, although with some overlap between dimensions, which is characteristic of complex constructs such as digital media literacy.

Table 2. Factor structure and reliability of the instrument

Factor	Dimension	Items	n	Factor loadings (range)	α	ω
MR1	Content publication involvement	I21, I22, I23, I24, I25, I26, I28, I29, I30, I34, I56, I76	12	0.415–0.743	0.871	0.905
MR2	Critical thinking and media interaction	I36, I37, I38, I39, I40, I42, I51, I52, I53, I54	10	0.309–0.808	0.900	0.916
MR3	Emotional impact	I78, I79, I80, I81, I82, I83	6	0.549–0.843	0.849	0.873
MR4	Parental mediation	I46, I49, I50, I61, I64, I65	6	0.373–0.753	0.774	0.805
MR5	Awareness of digital use	I04, I05, I19, I73	4	0.434–0.774	0.678	0.727
MR6	Identity and privacy management	I47, I48, I63	3	0.472–0.815	0.721	0.781
MR7	Self-regulation	I17, I18, I20, I32, I33	5	0.533–0.624	0.766	0.793
MR8	Digital engagement propensity	I07, I08, I09, I10	4	0.418–0.602	0.714	0.773

The eight identified dimensions showed adequate levels of internal consistency. Cronbach’s alpha values ranged from .678 to .900, while total omega values based on polychoric correlations ranged from .727 to .916. The dimensions of content publication involvement, critical thinking, and emotional impact presented the highest reliability levels, indicating consistent measurement of these constructs. Although most dimensions showed satisfactory internal consistency, awareness of digital use presented more modest coefficients ($\alpha = .678$; $\omega = .727$), suggesting that its item coverage and formulation should be further examined in future studies.

To empirically contextualize the identified factorial structure, descriptive statistics were calculated for each dimension, providing an initial characterization of the sample’s digital media literacy profile (Table 3).

Table 3. Descriptive statistics by dimension

Dimension	Mean	Interpretation
Content publication involvement	2.21	Low level of active content creation, suggesting predominance of consumption practices
Critical thinking and media interaction	3.44	Moderate–high levels, indicating positive self-perception of critical engagement
Emotional impact	2.79	Moderate emotional experience, reflecting both positive and negative responses
Parental mediation	3.09	Moderate levels, showing variability in adult guidance and regulation
Awareness of digital use	3.06	Moderate awareness, not necessarily associated with behavioral control

Identity and privacy management	2.44	Low levels, suggesting potential exposure to digital risks
Self-regulation	3.65	High levels, indicating a key role in adaptive digital behavior
Digital engagement propensity	2.47	Moderate–low levels, suggesting usage intensity alone does not explain problematic outcomes

Note: Values range from 1 to 5. Interpretations are indicative.

The results reveal differentiated patterns across dimensions. Content publication involvement presented low levels, suggesting a predominance of consumption-oriented practices over content production. In contrast, critical thinking and self-regulation showed moderate to high values, indicating a positive self-perception of these competencies.

The emotional impact of social media use was situated at a moderate level, reflecting a diverse emotional experience rather than exclusively negative effects. Parental mediation showed intermediate levels, evidencing heterogeneity in adult guidance and regulation. Awareness of digital use also presented moderate levels, whereas identity and privacy management showed low levels, suggesting the need to strengthen competencies related both to reflection on digital use and online identity protection. Propensity to digital engagement was situated at a moderate–low level, indicating that usage intensity alone does not explain potentially problematic outcomes.

In a second stage, a confirmatory factor analysis (CFA) model with a simple structure was estimated, showing moderate performance. Although the non-scaled indices reached acceptable values, the scaled indices, which are more demanding for ordinal variables, revealed limitations in the model's ability to capture the empirical complexity of the construct.

These results suggest that a strict factorial structure without cross-loadings is insufficient to adequately represent the nature of digital media literacy competencies in adolescents. Based on these findings, an ESEM (Exploratory Structural Equation Modeling) model was estimated, showing a clearly superior fit. The non-scaled indices indicated excellent fit (CFI = .992; TLI = .988; RMSEA = .037; SRMR = .034), while the scaled indices also showed acceptable fit (Table 4).

Table 4. Fit indices of factorial models

Model	CFI	TLI	RMSEA	SRMR	Scaled CFI	Scaled TLI	Scaled RMSEA
CFA	0.932	0.927	0.090	0.081	0.832	0.820	0.073
ESEM	0.992	0.988	0.037	0.034	0.926	0.894	0.056

Within the analyzed sample, ESEM provided a clearly better-fitting and theoretically coherent representation of the interrelations among digital media literacy competencies than the simple-structure CFA model. Latent factor correlations were generally low to moderate, revealing a structure in which the dimensions are empirically differentiated yet conceptually interconnected.

Table 5. Latent factor correlations (ESEM model)

	MR1	MR2	MR3	MR4	MR5	MR6	MR7	MR8
MR1	1							
MR2	0.136	1						
MR3	0.190	-0.093	1					
MR4	0.130	-0.047	0.428	1				
MR5	0.188	0.287	-0.024	-0.072	1			
MR6	0.060	0.064	0.094	0.088	0.054	1		
MR7	-0.049	0.122	0.130	0.354	0.011	0.030	1	
MR8	0.288	0.303	0.156	0.098	0.303	0.120	0.078	1

The strongest associations were observed between conceptually related dimensions, such as emotional impact and parental mediation ($r = .428$), parental mediation and self-regulation ($r = .354$), and propensity to digital engagement and awareness of digital use ($r = .303$), which is consistent with theoretical frameworks on adolescent digital socialization.

Overall, the results support a conception of digital media literacy as a multidimensional and interrelated, yet non-redundant, construct in which different competencies contribute in distinct ways to understanding adolescents’ use of social media.

4 Reflections and Conclusions

The findings of this study contribute to advancing the understanding of digital media literacy in adolescents from a multidimensional and empirically grounded perspective. The identification of an eight-dimensional structure, coherent from both theoretical and statistical perspectives, supports the idea that the competencies involved in social media use do not operate independently, but rather are configured through a network of interdependent relationships integrating critical, emotional, ethical, and self-regulatory dimensions.

In this sense, one of the main contributions of the study lies in providing empirical evidence on the internal organization of digital media literacy in adolescents by operationalizing this construct in a rigorous and systematic manner. Unlike previous approaches focused on partial dimensions or specific contexts, the proposed structure systematically integrates adolescents’ dual role as consumers and creators of content [5], allowing the complexity of contemporary digital practices to be captured. This integrative perspective represents a relevant contribution to the field by offering a conceptual and analytical basis for future research.

Likewise, the empirical evidence obtained supports the relevance of the ESEM approach [12] for the study of digital competencies by providing a more realistic representation of complex latent structures. The substantial improvement in fit indices compared to the simple-structure CFA model suggests that digital media literacy

competencies may not be adequately represented under assumptions of strict factorial independence. On the contrary, the findings suggest that these competencies overlap and are articulated according to contexts of use, reinforcing the need for flexible methodological approaches sensitive to these interrelations.

The descriptive results also reveal relevant patterns within the analyzed sample. Lower involvement in content creation compared to content consumption, together with relatively high levels of self-regulation and critical thinking, suggests the coexistence of developed competencies alongside areas that still require strengthening, particularly identity and privacy management. These challenges have already been highlighted in previous studies [7] examining the figure of kidfluencers. This configuration reflects the existence of heterogeneous digital media literacy profiles, opening the possibility for future studies focused on identifying user typologies and developmental trajectories of digital competencies.

Beyond the specific findings, the study proposes a multidimensional structure with potential applications across different sociocultural contexts and longitudinal research designs. The possibility of replicating this factorial organization in other settings may contribute to the development of cumulative knowledge in the field of digital media literacy, overcoming the limitations associated with fragmented or weakly comparable approaches. In this sense, the identified structure constitutes not only a result in itself, but also a platform for future research aimed at deepening the understanding of digital competencies and their relationship with educational, social, and technological variables.

Regarding limitations, the cross-sectional design does not allow changes over time or causal relationships among the identified dimensions to be examined. In addition, EFA, CFA, and ESEM were conducted on the same sample. Although this strategy allowed alternative representations of the internal structure to be compared, it does not constitute independent cross-validation and may capitalize on sample-specific characteristics. Future studies should replicate the eight-dimensional structure using an independent sample or separate exploratory and confirmatory subsamples. They should also examine additional sources of validity evidence, including convergence with related measures, relationships with relevant behavioral or educational criteria, predictive capacity, temporal stability, and measurement invariance across sociodemographic groups. The use of self-report measures may also be influenced by social desirability biases or discrepancies between subjective perceptions and actual digital practices.

Overall, the findings reinforce the need to approach digital media literacy through integrated perspectives that recognize the complexity of contemporary digital practices. The identification of a multidimensional structure represents an important step in this direction by providing a promising empirical basis for the measurement, monitoring, and intervention of digital competencies in adolescents, contributing both to the advancement of scientific knowledge and to the development of educational strategies aimed at promoting a critical and responsible use of digital technologies.

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