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DESIGN REQUIREMENTS AND CONCEPTUAL ARCHITECTURE OF A DIGITAL FINANCIAL LEARNING PLATFORM FOR UNIVERSITY WOMEN ENTREPRENEURS

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Abstract

Financial literacy is a fundamental determinant of entrepreneurial sustainability, financial inclusion, and informed decision-making in increasingly digitalized environments. This study examined digital financial literacy among university women entrepreneurs, examined the psychometric properties of a multidimensional measurement instrument, and proposed the conceptual architecture of a digital financial learning platform. A quantitative, exploratory-descriptive, cross-sectional design was employed with a purposive sample of 57 university women entrepreneurs from southern Mexico. Data were collected using a structured questionnaire comprising four dimensions: financial knowledge, digital competencies, financial attitudes, and financial behavior. Internal consistency was assessed using Cronbach's alpha and McDonald's omega, while the instrument's internal structure was explored through principal component analysis (PCA) with Varimax rotation. The results demonstrated satisfactory reliability for financial knowledge, financial attitudes, and financial behavior, whereas digital competencies exhibited moderate internal consistency. The PCA yielded a four-factor structure explaining 82% of the total variance, providing evidence of construct validity. Participants also reported favorable digital competencies and expressed strong interest in technology-mediated financial education as all participants rated the usefulness of a digital learning platform in the two highest categories of the scale. Based on these findings, a conceptual architecture for a digital financial learning platform was developed, integrating educational modules, interactive learning tools, and assessment mechanisms. The study contributes a preliminarily evaluated measurement instrument and an evidence-based conceptual framework to support digital financial education for university women entrepreneurs.

Keywords

Digital Financial Literacy; Women Entrepreneurs; Digital Learning; Financial Education; Entrepreneurial Education

1. Introduction

Financial literacy has become a fundamental driver of entrepreneurship, economic development, and financial inclusion. According to Lusardi and Mitchell (2007), financial literacy equips individuals with the

knowledge and skills required to understand financial products, manage financial risks, and make informed financial decisions. In the entrepreneurial context, these competencies are particularly important because entrepreneurs must continuously allocate financial resources, evaluate investment opportunities, establish pricing strategies, and maintain sustainable cash flows (Wise, 2013; Fatoki, 2014; Parker, 2018). Consequently, financial literacy has been recognized as a critical factor influencing entrepreneurial success, business sustainability, and long-term economic resilience.

The literature conceptualizes financial literacy as a multidimensional construct comprising financial knowledge, financial attitudes, and financial behavior (Huston, 2010; Remund, 2010). Rather than representing only the acquisition of financial knowledge, financial literacy also encompasses the attitudes and behavioral patterns that shape individual financial decision-making. Empirical evidence indicates that individuals with higher levels of financial literacy are more likely to plan for retirement, save regularly, and avoid excessive indebtedness (Lusardi & Mitchell, 2011). Likewise, Tang et al. (2015) demonstrated that financial knowledge influences financial behavior through attitudinal and psychological mechanisms. These findings are consistent with Hilgert et al. (2003), who reported a positive relationship between financial knowledge and responsible financial management practices, suggesting that individuals with greater financial knowledge are more likely to adopt sound financial behaviors. Aprea et al. (2026) reported that greater financial literacy is associated with improved financial outcomes, including higher economic stability, greater resilience to unexpected events, and enhanced financial well-being.

This multidimensional perspective has also been supported in Latin American contexts. Mena (2022) argues that financial literacy should be understood as the interaction of financial knowledge, attitudes, and behaviors, emphasizing that these dimensions jointly explain individuals' financial decision-making capacity. This regional evidence reinforces the conceptual framework adopted in the present study.

Within entrepreneurship research, financial literacy has consistently been associated with superior entrepreneurial performance. Lara et al. (2025) argue that strong financial literacy significantly increases the probability of business sustainability over the medium and long term. Similarly, Regala and Gabronino (2025) found that financially literate entrepreneurs exhibit greater confidence in performing entrepreneurial tasks and stronger entrepreneurial intentions. Wise (2013) demonstrated that financial education contributes significantly to the survival of new ventures, while Tarrillo et al. (2025) reported that entrepreneurs with higher levels of financial literacy are more likely to implement effective financial management practices. These findings suggest that financial literacy not only supports business creation but also enhances entrepreneurs' capacity to adapt to changing economic conditions and sustain competitive businesses.

Despite its recognized importance, access to financial literacy remains unequal across population groups. Previous studies indicate that women entrepreneurs continue to face structural barriers related to financial education, access to financial services, and financing opportunities, limiting their entrepreneurial development and business growth (Jennings & Brush, 2013; Brush et al., 2018). These findings are also supported by Minniti and Naudé (2010), who argue that institutional, economic, and sociocultural conditions continue to shape women's entrepreneurial participation across countries, influencing business creation, growth, and access to financial opportunities. These inequalities are particularly evident in emerging economies, where institutional and socioeconomic constraints often reduce access to financial resources and entrepreneurial support systems.

Simultaneously, digital technologies have profoundly transformed both entrepreneurship and education by expanding access to knowledge, financial services, and collaborative networks (Nambisan, 2017; Autio et al., 2018). The widespread adoption of digital platforms has created new opportunities for entrepreneurial learning while increasing the demand for digital financial literacy, defined as the ability to understand, evaluate, and responsibly use financial services within digital environments (OECD, 2022). Moreover, digital learning environments incorporating multimedia resources, microlearning strategies, simulations, and interactive activities have demonstrated considerable potential for improving learning outcomes and strengthening entrepreneurial competencies (Mayer, 2014; Zhang, 2021).

These challenges are especially relevant in emerging economies such as Mexico. In southern Mexico, university entrepreneurship frequently develops in contexts characterized by limited access to formal financing, the predominance of microenterprises, and the accelerated adoption of digital technologies (OECD, 2019). Under these conditions, higher education institutions play a strategic role in strengthening entrepreneurial capabilities and promoting financial competencies among young entrepreneurs through innovative educational approaches (Lara et al., 2025).

Recent evidence from Mexico also indicates that digital skills are unevenly distributed according to socioeconomic and regional characteristics, suggesting that digital inequalities continue to influence

individuals' capacity to access and effectively use digital technologies (Sánchez, 2025). These disparities highlight the importance of designing educational interventions that simultaneously strengthen digital competencies and financial literacy among university entrepreneurs.

Against this background, the present study aims to examine the psychometric properties of a multidimensional financial literacy measurement instrument and identify the design requirements for an interactive digital financial learning platform tailored to university women entrepreneurs. By integrating financial literacy, entrepreneurship, and digital education, this research contributes both a psychometrically examined assessment instrument and a set of evidence-based design requirements to support the development of digital learning environments that foster entrepreneurial financial capabilities.

Therefore, this study addresses an important gap in the literature by integrating psychometric validation with evidence-based design requirements for a digital financial learning platform specifically tailored to university women entrepreneurs.

2. Methods, techniques, and instruments

2.1 Research Design

The present study was conducted using a quantitative approach with an exploratory-descriptive scope and a cross-sectional non-experimental research design. It sought to examine the level of digital financial literacy among university women entrepreneurs and to evaluate the psychometric properties of an instrument specifically developed to measure this construct. The study is also conceived as an instrumental validation study, as one of its primary objectives was to determine the reliability and construct validity of the questionnaire employed.

The exploratory nature of the research is justified by the limited empirical evidence on digital financial literacy among university women entrepreneurs in emerging economies, particularly in southern Mexico, where economic informality, restricted access to financial services, and the increasing integration of digital technologies into entrepreneurial activities converge.

2.2 Participants and Sampling

The study was conducted with students from the Universidad Tecnológica de la Mixteca (UTM), located in the Mixteca region of the state of Oaxaca, Mexico. The target population consisted of female university students engaged in entrepreneurial activities while pursuing their higher education. The final sample comprised 57 participants selected through purposive non-probability sampling. Inclusion criteria required participants to be actively enrolled university students, operate their own entrepreneurial venture or business, and voluntarily agree to participate by providing informed consent.

The participants were primarily involved in micro-enterprises operating in the commerce, food, service, creative, and digital service sectors. Most businesses were in the early stages of development, characterized by low income levels and a high degree of business informality.

2.3 Instrument

Data were collected using a structured questionnaire consisting of 23 items distributed across four theoretical dimensions: financial knowledge (5 items), digital competencies (3 items), financial attitudes (6 items), and financial behavior (9 items). Responses were recorded on a five-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). The instrument was developed based on the conceptual frameworks proposed by Lusardi and Mitchell (2007), Huston (2010), and the OECD (2022), and was subsequently adapted to reflect the characteristics of the Mexican university entrepreneurship context. Content validity was established through expert judgment by three specialists in financial education, entrepreneurship, and research methodology. The experts assessed the clarity, relevance, and theoretical coherence of each item, enabling refinements in wording and ensuring the conceptual consistency of the instrument.

2.4 Data Collection Procedure

The questionnaire was administered electronically during academic activities related to entrepreneurship. Before completing the survey, participants were informed about the objectives of the study, the confidentiality of the data, the voluntary nature of their participation, and the exclusive scientific use of the information collected. Anonymity and compliance with ethical principles governing research involving human participants were guaranteed throughout the study.

2.5 Data Analysis

Statistical analysis was conducted in three stages. All statistical analyses were performed using IBM SPSS Statistics version 27.0 (IBM Corp., Armonk, NY, USA). The software was used to calculate descriptive statistics, reliability coefficients (Cronbach's alpha and McDonald's omega), and principal component analysis (PCA). First, descriptive statistics (means and standard deviations) were calculated to characterize the study variables. Second, the internal consistency of the instrument was assessed using both Cronbach's alpha (Cronbach, 1951) and McDonald's omega (McDonald, 1999) coefficients, the latter being included because it provides more robust reliability estimates when factor loadings are heterogeneous.

Finally, construct validity was explored through Principal Component Analysis (PCA) with Varimax orthogonal rotation, used as an exploratory data-reduction technique to identify the underlying factorial structure and determine the proportion of variance explained by each dimension of the instrument.

3. Results

3.1 Digital competencies

The descriptive statistics indicate that the participants exhibit a favorable level of digital competencies across the three items

evaluated. The highest mean score was observed for comfort with digital devices (M = 4.16, SD = 0.80), indicating a high degree of familiarity with smartphones, computers, and other technological resources commonly used in academic and entrepreneurial activities. Likewise, digital skills achieved a mean score of 3.81 (SD = 0.79), suggesting that the participants perceive themselves as possessing sufficient capabilities to operate effectively in digital environments.

Use of digital tools had the lowest mean score (M = 3.70, SD = 0.88), which was above the scale midpoint. Overall, these findings suggest that the sample possesses a solid technological foundation that supports the implementation of digital financial literacy strategies. The high level of familiarity with digital devices reduces barriers to participation in technology-mediated learning processes and supports the feasibility of implementing an interactive digital financial learning platform aimed at strengthening the financial knowledge, attitudes, and behaviors of university women entrepreneurs (Table 1).

Table 1. Descriptive statistics of digital competencies

Variable	Mean	SD
Digital skills	3.81	0.79
Use of digital tools	3.70	0.88
Comfort with digital devices	4.16	0.80

3.2 Reliability analysis

The reliability analysis indicates that financial attitudes ($\alpha = 0.82$; $\omega = 0.88$) and financial behavior ($\alpha = 0.81$; $\omega = 0.87$) exhibit good internal consistency, indicating that the items within these dimensions measure their underlying constructs with a high degree of reliability. Financial knowledge also demonstrates satisfactory reliability ($\alpha = 0.78$; $\omega = 0.84$), with both coefficients exceeding the commonly accepted threshold of 0.70. In contrast, the digital competencies dimension shows lower reliability ($\alpha = 0.60$; $\omega = 0.60$), suggesting moderate internal consistency that may be attributable to the limited number of items (three) or to the heterogeneous nature of digital skills among participants. Overall, these findings provide evidence that the instrument possesses adequate psychometric properties for assessing digital financial literacy among university women entrepreneurs, while indicating that the digital competencies scale could benefit from further refinement in future applications (Table 2).

Table 2. Reliability analysis

Dimension	Cronbach's Alpha (α)	McDonald's Omega (ω)	Number of Items
Financial attitudes	0.82	0.88	6
Financial knowledge	0.78	0.84	5
Financial behavior	0.81	0.87	9
Digital competencies	0.60	0.60	3

Note. Higher values of Cronbach's alpha (α) and McDonald's omega (ω) indicate greater internal consistency.

3.3 Principal component analysis

The results indicate that the financial behavior factor accounts for the largest share of the explained variance (32%), suggesting that behavioral practices constitute a central component of digital financial literacy among university women entrepreneurs, although this proportion is partly influenced by the larger number of items in this dimension (nine items). The financial attitudes factor explains an additional 21% of the variance, highlighting the importance of psychological dispositions toward financial planning and resource management. Digital competencies contribute 15% of the explained variance, reflecting the relevance of technological capabilities in accessing and using financial information in digital environments.

Finally, financial knowledge accounts for 14% of the variance, indicating that conceptual understanding of financial principles represents an essential, although comparatively less dominant, dimension of the construct. Collectively, the four factors explain 82% of the total variance, providing preliminary evidence regarding the instrument's internal structure captures the multidimensional structure of digital financial literacy and demonstrates satisfactory construct validity (Table 3).

Table 3. Variance explained

Dimension	Variance explained (%)	Cumulative variance (%)
Financial behavior	32	32
Financial attitudes	21	53
Digital competencies	15	68
Financial knowledge	14	82
Total	**82**	**82**

Note. Percentages indicate the proportion of total variance explained by each extracted factor.

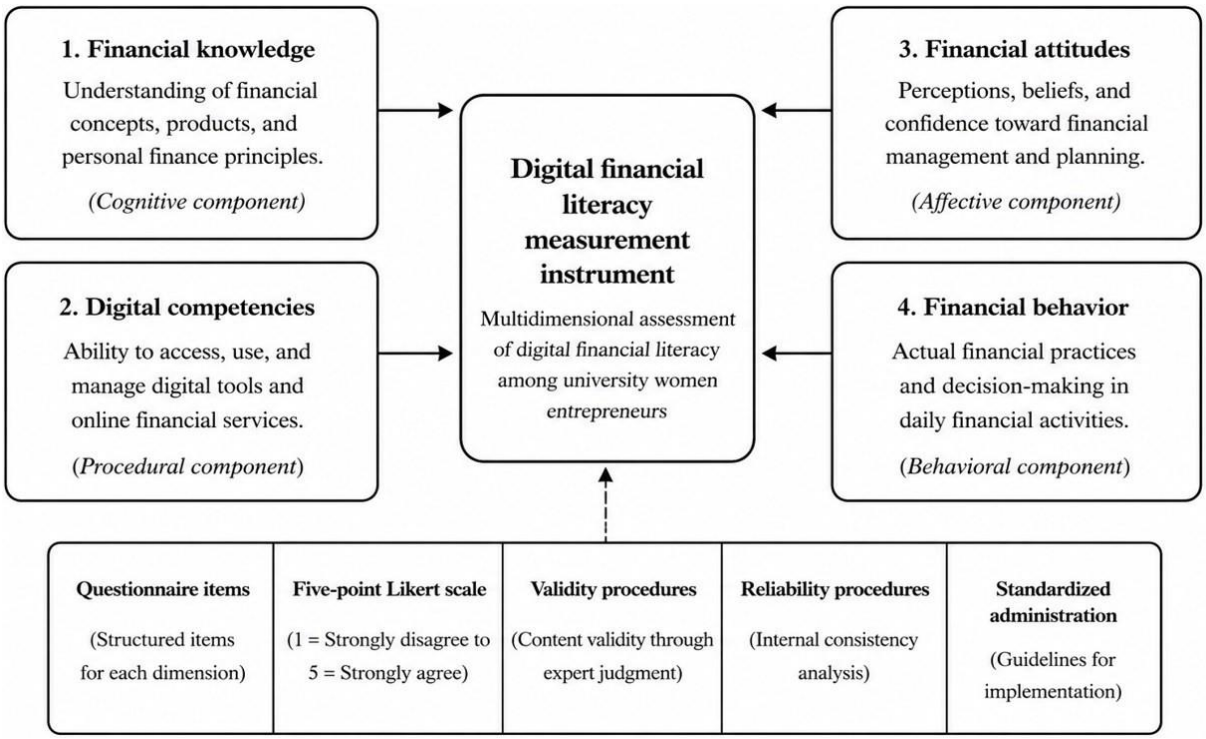
3.4. Conceptual structure of the instrument

The conceptual structure of the financial literacy measurement instrument integrates four core dimensions (financial knowledge, digital competencies, financial attitudes, and financial behavior) that constitute the theoretical foundation of digital financial literacy. These dimensions are operationalized through four assessment components: cognitive, procedural, affective, and behavioral. The instrument also incorporates key methodological elements, including questionnaire items, a five-point Likert response scale, validity and reliability procedures, and standardized administration guidelines. Collectively, these components provide a

comprehensive framework for assessing digital financial literacy among university women entrepreneurs (Figure 1).

The four-factor structure identified through the principal component analysis is consistent with this conceptual framework and supports the multidimensional nature of financial literacy proposed by previous studies (Huston, 2010; Remund, 2010). Moreover, the inclusion of the digital competencies dimension reflects the increasing digitalization of financial services and learning environments. Overall, the observed factor structure suggests that the digital financial literacy of university women entrepreneurs depends not only on financial knowledge but also on attitudinal and technological capabilities that support effective financial decision-making.

Figure 1. Conceptual structure of the digital financial literacy measurement instrument



Note. The figure illustrates the conceptual structure of the digital financial literacy measurement instrument proposed in this study

3.5. Digital financial learning platform

According Regarding preferences for a digital financial learning platform, all participants rated its usefulness in the two highest categories of the scale (84.2% gave the maximum score and 15.8% a score of 4). The most frequently selected topics were budgeting (80.7%), saving and financial goal setting (73.7%), pricing (71.9%), and tax education (71.9%), followed by sales and income recording (63.2%), expense and investment management (56.1%), and responsible credit and loans (54.4%). As for learning formats, participants preferred short videos (80.7%), interactive exercises or quizzes (68.4%), and financial calculation simulators (66.7%), whereas infographics (33.3%) and short texts or simple articles (26.3%) were the least selected. Regarding access, 40.4% preferred a platform available on any device and 38.6% preferred mobile phones, while 15.8% preferred a computer or laptop and 5.3% a tablet. Most participants (54.4%) reported that they would spend between 15 and 30 minutes per day on the platform. Based on these findings, a conceptual architecture for a digital financial learning platform was developed to support the acquisition of digital financial literacy among university women entrepreneurs.

The proposed platform is grounded in the empirical findings of this study and pedagogical principles associated with digital learning and microlearning. Conceived for web and mobile access, it is organized into three integrated components: educational modules, which provide essential financial management content; learning tools, which support interactive and experiential learning; and assessment and feedback, which monitor learning progress and reinforce knowledge acquisition. Together, these components create a

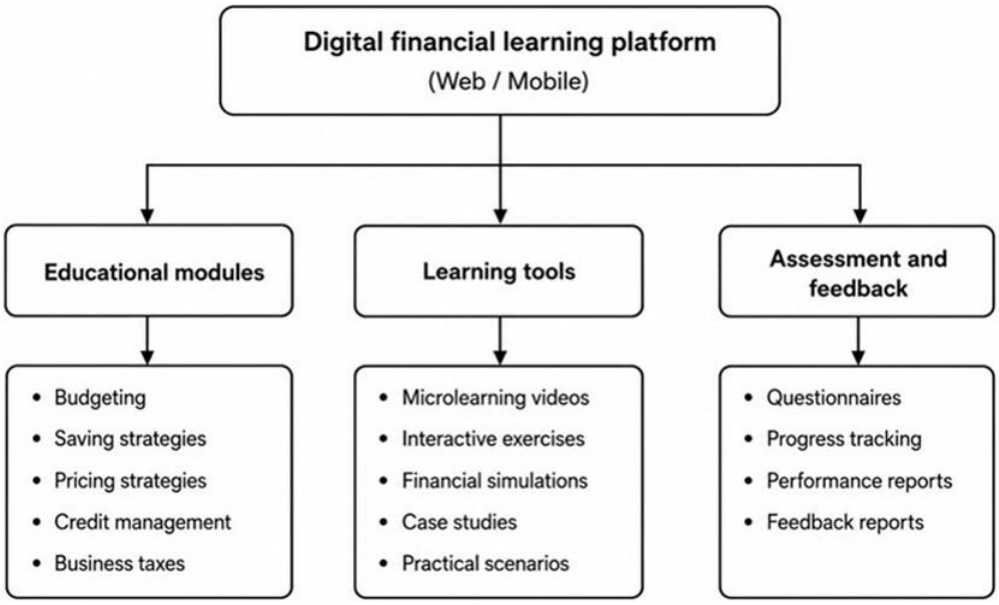
structured digital environment for developing financial literacy and entrepreneurial capabilities (Figure 2).

Unlike existing digital financial education initiatives that are generally designed from theoretical or pedagogical perspectives, the proposed platform derives directly from the empirical evidence generated in this study. The measurement instrument not only identified the multidimensional structure of digital financial literacy but also revealed the specific competencies and learning preferences of university women entrepreneurs. Consequently, the educational modules, interactive learning resources, and assessment mechanisms incorporated into the platform constitute evidence-based design requirements, establishing a direct methodological link between empirical assessment and educational technology design. This integration represents the principal scientific contribution of the study by transforming psychometric evidence into a practical framework for developing digital financial education interventions. The first component consists of the educational modules, which include content related to fundamental financial management topics for small-scale businesses. This content includes budgeting, savings strategies, pricing, credit management, and basic taxes.

The second component comprises interactive learning tools designed to facilitate the understanding and practical application of financial knowledge. These tools include microlearning videos, interactive exercises, financial simulations, case studies, and practical scenarios. The financial simulations are particularly relevant because they allow users to experiment with hypothetical financial scenarios, such as cash flow management and pricing decisions.

The third component comprises assessment and feedback mechanisms that enable continuous monitoring of learning progress. These mechanisms include questionnaires and interactive quizzes, progress tracking, performance reports, and personalized feedback reports. From a pedagogical perspective, this architecture is based on active and constructivist learning approaches that promote learners' active participation in knowledge construction (Mayer, 2014). Furthermore, the platform's design responds to growing evidence indicating that digital learning tools can significantly improve the acquisition of financial skills among young entrepreneurs (Zhang, 2021; Mancone et al., 2024). Consequently, implementing a digital financial learning platform with these characteristics could strengthen the financial capabilities of university women entrepreneurs and contribute to the long-term sustainability of their entrepreneurial ventures.

Figure 2. Conceptual architecture of the digital financial learning platform



Note. The figure presents the proposed conceptual architecture of a digital learning platform designed to strengthen digital financial literacy among university women entrepreneurs.

4. Discussion

The findings of this study reinforce the multidimensional nature of digital financial literacy and provide empirical evidence supporting the integration of financial knowledge, financial attitudes, financial behavior, and digital competencies into a single measurement framework. This result is consistent with the conceptualizations proposed by Huston (2010) and Remund (2010), who argue that financial literacy extends beyond factual knowledge to include behavioral and attitudinal dimensions that influence financial decision-making. Similarly, the OECD (2022) emphasizes that financial literacy should be understood as the combination of knowledge, skills, attitudes, and behaviors required to make sound financial decisions in contemporary societies.

The principal component analysis yielded a four-factor structure explaining 82% of the total variance, providing preliminary evidence of construct validity and supporting the theoretical organization of the proposed instrument. This finding is aligned with previous studies and reviews reporting that multidimensional instruments provide a more comprehensive assessment of financial literacy than approaches focused exclusively on financial knowledge (Huston, 2010; Aprea et al., 2026). Furthermore, the satisfactory reliability observed for financial knowledge, attitudes, and behavior supports the psychometric adequacy of the instrument, although the comparatively lower reliability of the digital competencies dimension suggests that future studies should expand the number of indicators to better capture the diversity of digital financial skills. Similar methodological challenges have been reported in studies addressing digital financial literacy in emerging economies (Koskelainen et al., 2023; Uthaileang & Kiattisin, 2023).

Although previous studies have emphasized financial knowledge as the principal determinant of financial literacy, in the present study the behavioral dimension accounted for the largest proportion of explained variance (32%), whereas digital competencies (15%) and financial knowledge (14%) contributed similar proportions. Because the variance attributed to each component also depends on the number of items, this pattern should be interpreted with caution. This result highlights the importance of considering digital financial literacy as a multidimensional capability in which technological competencies and financial behaviors play a central role alongside conceptual financial knowledge.

An important finding concerns the high level of digital competencies reported by participants. Participants' familiarity with digital devices and online tools suggests favorable conditions for implementing technology-mediated financial education. These results are consistent with recent evidence indicating that digital competencies have become an essential prerequisite for accessing digital financial services and participating effectively in entrepreneurial ecosystems (Nambisan, 2017; Autio et al., 2018; Xie & Chen, 2025). In this regard, digital financial literacy should not be viewed as an extension of traditional financial education but rather as a distinct competence that integrates financial decision-making with digital capabilities in increasingly technology-intensive environments. In addition, Rapina et al. (2023) found that financial literacy and responsible financial behavior positively influence entrepreneurial motivation, reinforcing the importance of developing financial competencies alongside digital capabilities in entrepreneurship education.

The proposed conceptual architecture for the digital financial learning platform also represents a practical contribution of this research. By integrating educational modules, interactive learning resources, and continuous assessment mechanisms, the proposed architecture incorporates pedagogical principles associated with active learning, multimedia learning, and microlearning. This approach is consistent with Mayer's (2014) multimedia learning theory and with recent studies demonstrating that interactive digital environments, financial simulations, and gamified learning experiences improve learners' engagement and financial capability development (Torres Barreto et al., 2020; Zhang, 2021; Mancone et al., 2024; Tarrillo et al., 2025).

The implications of these findings extend beyond the university context. Financial literacy has been identified as a determinant of entrepreneurial sustainability, business resilience, and economic inclusion (Lusardi & Mitchell, 2007; Wise, 2013; Fatoki, 2014; Parker, 2018). Moreover, women entrepreneurs continue to face structural barriers related to financial education and access to financial resources (Jennings & Brush, 2013; Brush et al., 2018; ECLAC, 2024). Consequently, digital learning platforms specifically designed for university women entrepreneurs may contribute to reducing these inequalities by providing accessible, flexible, and evidence-based financial education aligned with the digital transformation of entrepreneurial ecosystems.

Overall, this study advances the literature by combining psychometric validation with the design of a technology-based educational solution. Rather than limiting its contribution to measuring digital financial literacy, it translates empirical findings into a conceptual framework that can guide the development of educational interventions, institutional strategies, and public policies aimed at strengthening financial inclusion and entrepreneurial development in emerging economies.

5. Conclusions

This study provides empirical evidence on digital financial literacy among university women entrepreneurs and contributes to the validation of a multidimensional measurement instrument designed to assess this construct. The findings confirm that digital financial literacy encompasses not only financial knowledge but also digital competencies, financial attitudes, and financial behavior, reflecting the complex set of cognitive, technological, affective, and behavioral capabilities required for effective financial decision-making in digital environments.

The principal component analysis identified a four-factor structure that explained a substantial proportion of the total variance, while the reliability analysis demonstrated satisfactory internal consistency for most dimensions. These findings provide preliminary support for the construct validity and psychometric adequacy of the proposed instrument. Although the digital competencies dimension exhibited comparatively lower reliability, its inclusion remains theoretically justified because of the increasing integration of digital technologies into financial services, entrepreneurial activities, and higher education.

This study contributes to the literature by extending traditional financial literacy frameworks through the incorporation of digital competencies as a core dimension of digital financial literacy. The instrument provides a promising tool for assessing this construct in higher education contexts, while the proposed conceptual architecture offers a practical framework for designing technology-mediated financial education programs. These findings may support universities, entrepreneurship support organizations, and policymakers in developing digital strategies that strengthen the financial capabilities of university women entrepreneurs.

This study is limited by its cross-sectional design, the relatively small sample size (n = 57) in relation to the number of items, the use of principal component analysis rather than common factor analysis, and the use of a sample drawn from a single public university, which may restrict the generalizability of the findings. Future research should validate the proposed instrument using larger and more diverse samples, perform confirmatory factor analysis to verify the stability of the measurement model, and evaluate the effectiveness of the proposed digital financial learning platform through longitudinal or experimental research designs.

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Supplementary information
No supplementary information is available.

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Contribution of the authors in the development of the work
Daniela Sherlyn Peña Martínez: Conceptualization, investigation, data collection, instrument development, data curation, writing original draft, and writing review and editing.
Conrado Aguilar Cruz: Research design, methodology, formal analysis, instrument validation, interpretation of results, supervision, and final approval of the manuscript.
Mario Alberto Moreno Rocha: Conceptualization of the digital financial learning platform, usability analysis, development of the conceptual architecture, visualization, and technical revision of the manuscript.
All authors contributed to the discussion of the results, critically reviewed the manuscript, and approved the final version for publication.

Conflict of interest
The authors declare that they have no conflict of interest.

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