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Assessment of digital competencies in higher education students: development and validation of a measurement scale

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Digital competencies represent students' ability to use technology and digital media interactively to enhance their learning experiences. Given their growing importance, there is a need to develop instruments that can be used in different contexts to measure them. This research aims to develop and validate an instrument to measure digital competencies in university students and identify the dimensions that characterize it. Based on a literature review, a scale is designed and validated with students from a Venezuelan university. As a result, a model of 22 variables grouped into four dimensions is presented: Communication and digital security, Access to digital content management, Creation of digital content and use of digital media, and Digital empathy, which can be applied in similar environments. The results of the tests demonstrate the scale's psychometric properties in terms of both validity and reliability.

KEYWORDS

digital competencies, digital skills, digital literacy, university students, higher education

1 Introduction

When planning education and training initiatives to enhance critical skills, many policymakers have shown interest in learning concerns in the digital age (Kryukova et al., 2022). The Internet and other forms of digital technology are deeply embedded in people's routines and activities; therefore, to achieve personal fulfillment and development, employment, social inclusion, and active citizenship, all citizens must acquire digital literacy as a fundamental, lifelong learning skill (Kryukova et al., 2022). Recent reports highlight technology adoption as a key driver of business growth in the coming years (Audrin et al., 2024).

Thus, digital literacy has become one of the essential skills of the 21st century (Wulan et al., 2023); given its necessity for all citizens to function efficiently, it has become indispensable in society (Ramos et al., 2023). Digital competence has become a central term in the debate about the skills and knowledge that people must possess in the knowledge society (Kryukova et al., 2022).

In recent years, it is undeniable that digital transformation has become an unavoidable necessity for the online learning process among teachers and students (Wulan et al., 2023).

University students live in a digital society and use digital technologies for many daily activities; therefore, they are expected to possess specific crucial digital skills (Fan and Wang, 2022), requiring new skills to participate in digital culture (Ramos et al., 2023). The increased reliance on digital technologies in higher education brings significant challenges (Raji et al., 2023). Recently, the development of digital competencies among higher education students has attracted considerable research attention, emphasizing students' employability and the importance of digital skills (Kryukova et al., 2022).

Over time and with the development of digital technologies, the term digital skills has evolved and become a broader term associated with various skills (Fan and Wang, 2022). The knowledge acquisition practices that have emerged with information and communication technologies (ICT) have conditioned all education systems to transform so that their beneficiaries acquire the appropriate form to grasp the limits and potential of digital technologies (Ramos et al., 2023).

The European Digital Competence Framework for Citizens (Riina et al., 2022) has focused on the need to enhance citizens' digital competence for work and employability, learning, leisure, consumption, and participation, grouping digital competence into five areas that denote both technical and behavioral/attitudinal aspects involving critical thinking, reflection, and lifelong learning, information and data literacy, communication and collaboration, digital content creation, innovation, security, and problem-solving.

Higher education has not fully adopted digital competencies as a central and fundamental literacy that addresses mastery of technology and a mindset of digital citizenship. As emerging models challenge traditional teaching and learning paradigms with global connectivity and personalized approaches, existing digital divides may accelerate further. This requires revisiting digital competencies emphasizing the diversity of contexts in which they are developed and the students involved in the lifelong learning continuum (Martzoukou et al., 2020). The educational training a university student receives is reflected in their subsequent job performance, and the digital skills and competencies developed during their educational process will serve as a foundation for their job activities (López, 2023).

Based on their findings, Sotelo-Núñez et al. (2024) emphasize the importance of digital competencies in learning and workforce preparation, affirming their relevance and necessity in higher education. As Kure et al. (2022) argue, globally, digital skills are a crucial aspect of education that schools should systematically develop, and given the limited knowledge about the adoption of technology by students and teachers in educational environments, it is essential to investigate the use of technology and digital skills in these settings. In this regard, Stofkova et al. (2022) highlight the need for digital skills to be part of educational policy, as they can help individuals succeed in the labor market and improve communication with public administration. This research aims to develop and validate a scale model that identifies the dimensions that characterize digital competencies in university students.

This article is structured as follows: Section 2 introduces the conceptualization and review of different initiatives for measuring digital competencies. Section 3 describes the methodological approach used. Section 4 describes the results, analysis, and discussion. Section 5 discusses the implications of these findings. Section 6 addresses the potential threats to the study's validity. At last, the paper concludes with a summary of the research's key contributions and practical implications.

2 Conceptualization of digital competencies

The term digital competence has become one of the most widely used in the world of modern education (Tomaš et al., 2024). Digital competencies are defined as the skills necessary to use digital devices, communication applications, and networks to access and manage information (Varenyk and Piskova, 2024); it is a body of ICT knowledge that includes, among others, technological, informational, multimedia, and creative communication (Alonso-García et al., 2023).

Digital skills refer to individuals' abilities to effectively use digital tools, technologies, and platforms; their underlying theory covers various aspects such as learning, the impact of digital technology on society, and the role of education in equipping individuals with these skills (Sartika et al., 2023). Digital competence involves the safe, critical, and responsible use of digital technologies for learning, work, and participation in society, as well as interaction with these; it also includes the search and management of information and data, communication and collaboration, digital content creation (including programming), security (including digital wellbeing and cybersecurity-related competencies), and problem-solving (Riina et al., 2022).

In education, digital skills are defined as students' ability to interactively use technology and digital media to enhance their learning experiences (Abaddi, 2023). Digital literacy is a multifaceted concept that goes beyond technical competence to encompass critical thinking, problem-solving, and ethical decision-making in digital environments; it is a social and cultural competence essential for effective participation in 21st-century society (Widowati et al., 2023).

Digital competence in university students can be defined as the knowledge, skills, and attitudes they must possess to effectively use digital technologies to evaluate, consume, and produce learning information and to communicate and collaborate with others for learning purposes (Wang et al., 2021). Digital competencies enable students to access and critically evaluate information, communicate and collaborate in virtual environments, use technological tools for learning, and creatively solve problems (López, 2023).

2.1 Measurement of digital competencies

Given the growing importance of digital competencies, it is necessary to develop instruments that can be used across different populations or specific groups to measure their level of digital competencies (Observatorio Nacional de Tecnología y Sociedad - Colección Monográficos Espaa Digital, 2023). The study of digital competencies has been applied in various sectors and at different educational levels. Questionnaires are commonly used for the assessment of digital competencies.

The analysis of digital competencies in university students encompasses various fundamental categories, including learning

and teaching, curriculum design, educational policies, educational technologies, assessment, and socio-labor impacts, among others (Sotelo-Núñez et al., 2024). University students are diverse based on different demographic factors such as age (e.g., mature students), geographic location (e.g., international students), and prior education and work (e.g., students with greater access), which may create demands for different levels of support for digital competencies and potentially accelerate digital inequalities (Martzoukou et al., 2020). Therefore, it is necessary to consider demographic aspects in applying scales for their subsequent validation.

As noted by Audrin et al. (2024), multiple frameworks have been developed to define and measure digital skills from different perspectives and objectives, with the most dominant being those developed by (1) the UK Department of Education, (2) the Science and Knowledge Service of the European Commission (Riina et al., 2022), and (3) (van Laar et al., 2020).

Among other proposals is that of Mengual-Andrés et al. (2016), who designed and validated a questionnaire in Spain using the Delphi method to measure university students' digital skills, which includes five dimensions: technological literacy, access and use of information, communication and collaboration, digital citizenship, and creativity and innovation; Díaz Vera et al. (2023), who measured Mexican students' self-perception of their digital skills concerning the use of communication technologies in higher education; Peart et al. (2020), who developed and validated a questionnaire to measure the digital skills of young people in Spain and the UK that include six dimensions: information, communication and collaboration, digital content creation, digital security, critical thinking, and sociocivic; and Martzoukou et al. (2020), who developed an instrument to evaluate perceptions of digital competencies among European students.

Fan and Wang (2022), based on previous literature and situations in the Chinese educational context, developed and validated a questionnaire to assess university students' digital skills. Although they acknowledge the existence of scale models in the literature, such as that of Mengual-Andrés et al. (2016) and Peart et al. (2020), which have proven effective in measuring digital skills among university students, they argue that these models overlooked the situations of less developed digital competencies or digital inequalities in developing countries, where their validity and reliability have not been confirmed. Additionally, they highlight that the COVID-19 pandemic exposed digital deficits and challenges in the educational systems of developing countries, making it necessary to promote research in this field.

Kryukova et al. (2022) developed an instrument to determine the digital competencies of Russian university students. Urakova et al. (2023) evaluated digital competencies among higher education students in Russia, using the scale developed by Fan and Wang (2022), which had been adapted to the Russian context by Kryukova et al. (2022).

Audrin et al. (2024) developed, based on a literature review and expert opinion, a framework and scale with eight dimensions to measure digital skills at work: technology use, cybersecurity, content management, communication and collaboration, critical research, responsibility, wellbeing, and identity and development, which was validated among professionals.

In Latin America, various studies rely on European references, such as Níñez et al. (2024) and González et al. (2024), who in turn draw from works by Carrera et al. (2011) and Pérez and Vázquez (2023), among others. Other studies focus on different sectors, such as Ramírez-Armenta et al. (2021) on graduate students, Martínez et al. (2023) on secondary students, and García-Marchán (2023) on primary school students, among others.

3 Methodology

Based on the literature review, the Digital Competence Measurement Scale developed by Fan and Wang (2022) and validated by Kryukova et al. (2022) and Urakova et al. (2023) was selected due to its consideration of the digital inequality environment in Venezuela and its recent proposal. The selection criteria include the instrument's availability, the use of a robust method in the analysis, and its validity. Table 1 presents the scale for measuring digital competencies.

The instrument was applied to 127 students selected through non-probabilistic intentional sampling for convenience. Participants agreed to participate in the study after being informed of the research objectives and ensuring anonymity and the use of data for scientific purposes. Along with the 27 questions of the scale, some variables were presented that would be used for its validation.

A non-probabilistic convenience sampling method was used for sample selection. Non-probabilistic samples involve a selection procedure guided by the research's characteristics rather than by a statistical criterion of generalization (Hernández-Sampieri et al., 2014). Convenience sampling is a general term indicating that sample participants were chosen based on ease of access or availability, such as recruiting participants from a group of university students (Zickar and Keith, 2023). As noted by Stratton (2021), convenience sampling can be used to develop hypotheses and objectives for more rigorous research studies.

The study is non-experimental, descriptive, and cross-sectional. Descriptive statistical techniques and exploratory factor analysis were used for data analysis; the latter is widely used to validate and analyze the psychometric properties of measurement instruments used in quantitative research (Méndez, 2024). Exploratory factor analysis, or factor analysis, is a multivariate analysis procedure aimed at identifying structures in large sets of variables (Backhaus et al., 2023); a type of interdependence analysis for dimension reduction that seeks to discover latent factors in a set of quantitative variables (Watkins, 2021). Additionally, to facilitate data processing, Microsoft Excel[1] and SPSS[2] statistical software were used.

Finally, the scale's psychometric properties, primarily validity, and reliability, were analyzed. Validity refers to the ability of a scale to measure what it is intended to measure; in this research, evidence of content validity and construct validity is reported, the former based on a literature review and the latter on the statistical method of factor analysis. As for reliability, which refers to the degree to which repeated application of the scale to the same individual or

1 https://www.microsoft.com/es-cl/microsoft-365/excel

2 https://www.ibm.com/es-es/products/spss-statistics

TABLE 1 Digital competence measurement scale.

Dimension	Variables	
Access to digital content management	ADCM1	I have applications that keep me up to date with the news
	ADCM2	I can search for and access information in digital environments
	ADCM3	I can use different media to store and manage information
	ADCM4	I can search for the information I need on the internet
	ADCM5	I can understand the information I obtain from the Internet
Digital Empathy	DE1	I respect other people in digital environments
	DE2	I take into account the opinions of others in digital environments
	DE3	I can put myself in others' shoes in digital environments
	DE4	I am willing to help other people in digital environments
	DE5	I informed myself before commenting on a topic
Use of Digital Media	UDM1	I can complete digital content related to my tasks
	UDM2	I can use digital media to detect content plagiarism
	UDM3	I use digital media to solve tasks and exercises
	UDM4	I can create and edit digital content required in my studies
	UDM5	I skillfully use digital software to complete learning tasks
Digital Security	DS1	I avoid inappropriate behavior on social networks
	DS2	I am careful with my personal information and that of others
	DS3	I can identify harmful behaviors that can affect me
	DS4	I Before carrying out a digital activity, I evaluate the consequences
	DS5	When sharing digital information, I consider my privacy and security
Communication of Digital Content	CoDC1	I know how to communicate through different digital media
	CoDC2	I can communicate with other people in digital environments
	CoDC3	I know how to communicate with others in different ways (images, texts, videos, etc.)
	CoDC4	I share information and content through digital tools
Creation of Digital Content	CrDC1	I know different ways to create and edit digital content
	CrDC2	I can transform information and organize it in different formats
	CrDC3	I can present what I want to convey in digital environments

object produces the same results (Habu and Henderson, 2023), it is based on the internal consistency of the scale, measured using Cronbach's Alpha coefficient.

4 Results, analysis, and discussion

4.1 Descriptive analysis: sample characterization

Of the 127 students surveyed, 24% (30) are from the Industrial Engineering program, and 66% are in the basic cycle of their studies, with 40% being under 20 years old. 74% of the students are male. 91% of the respondents have regular internet access, 100% own a mobile phone, and half of the students are currently working. Table 2 summarizes the results of this general data.

4.2 Factor analysis: dimensions of digital competencies

For the application of the Exploratory Factor Analysis technique, three main phases were followed: (a) evaluation of sample adequacy or data suitability, (b) factor extraction, and (c) rotation and interpretation of factors (Shrestha, 2021).

Although care may have been taken in selecting the variables and participants, it is essential to verify that the measured variables are sufficiently intercorrelated to justify the factor analysis (Watkins, 2018); thus, for the evaluation of sample adequacy, starting from this need for high correlations between variables, the determinant of the correlation matrix among the variables and the Kaiser-Meyer-Olkin (KMO) index was calculated. The determinant of the matrix should be sufficiently small to deviate

TABLE 2 General data of the sample.

Description		Frequency	Percentage (%)
Gender	Female	33	26
	Male	94	74
Age (years)	20 years	61	48
	20–25 years	31	24.4
	25–30 years	16	12.6
	30 years	19	15
Program	Industrial engineering	30	23.6
	Others	97	76.4
Semester	1–4 (Basic cycle)	84	66.1
	5–10 (Professional cycle)	43	33.9
Regular internet access	Yes	115	90.6
	No	12	9.4

TABLE 3 Rotated component matrix for digital competence scale data.

	Component			
Variable	1	2	3	4
CoDC2	0.79			
DS1	0.77			
CoDC1	0.75			
DS3	0.75			
DS4	0.73			
CoDC3	0.73			
DS2	0.7			
ADCM4		0.77		
ADCM2		0.76		
ADCM3		0.76		
ADCM5		0.69		
ADCM1		0.56		
CrDC1			0.78	
UDM5			0.7	
CrDC3			0.69	
CrDC2			0.67	
UDM4			0.63	
UDM2			0.62	
DE8				0.73
DE9				0.71
DE9				0.63
UDM3				0.56

from the unit matrix, in which case it would be 1. The KMO, in turn, is used to check the degree of joint relationship between the variables, allowing us to assess to what extent each variable is predictable from the others and is distributed in values between 0 and 1, with recommended values above 0.80 (Watkins, 2021).

The correlation coefficient matrix analysis results among the variables show a determinant equal to $5.31 \times 10^{-}11$ and a KMO statistic of 0.929, indicating that the data matrix is suitable for conducting exploratory factor analysis. The principal components method was used for factor extraction, with eigenvalues greater than 1. Varimax rotation was selected, converging in 8 iterations. Parsimony criteria were applied to choose model variables. As summarized by Watkins (2018), at least three measured variables are needed for statistically identifying a factor, although more indicators are preferred; on the other hand, variables that depend on each other should not be included.

Finally, 22 of the 27 variables met the parsimony criteria were included. The data structure is represented in 4 factors that group 22 variables and explain 70.692% of the total variance, with 23.524%, 18.613%, 16.749%, and 11.806% for each factor, respectively. Table 3 presents the rotated component matrix.

The first factor groups seven variables that represent Communication and Digital Security. This group converges the variables of communication in digital environments and digital security dimensions from the theoretical model, including aspects such as the ability to communicate with others in digital environments, appropriate behavior on social networks, the ability to communicate through different media, and the ability to identify harmful behaviors in digital environments, among others. This factor includes the well-being and cybersecurity variables defined by Audrin et al. (2024), which describe the skills necessary to protect oneself and others from threats to integrity and health arising from the use of digital technology, as well as the skills required to identify and apply the most appropriate cybersecurity measures to protect institutional and personal data and ensure privacy.

The second factor groups the variables related to access to digital content management with a more user-oriented role in these resources. It includes variables such as the ability to search for and access information on the Internet and in other digital environments, the ability to use different media to store and manage information, the ability to understand the information obtained from the Internet, and the availability of applications to stay updated with the news.

The third factor groups the creation of digital content and the use of digital media with a more content creator-oriented profile, differentiating it from the second factor with a more user-oriented profile. This factor includes knowledge of different ways to create and edit digital content, the use of digital software to complete learning tasks, the ability to present what is intended to be conveyed in digital environments, the ability to transform information and organize it into different

formats, the ability to create and edit digital content required in studies, and the ability to use digital media to detect content plagiarism.

This factor, identified by Audrin et al. (2024) as content management, is the skills to select and use digital tools to find relevant online information, organize information, and develop appropriate content. The second and third factors differ in user profiles, focusing on resource use and understanding and the other on design and creation.

The fourth factor includes digital empathy variables such as the ability to put oneself in others' shoes in digital environments, consideration of others' opinions in digital environments, willingness to help others in digital environments, and the ability to use digital media to solve tasks and exercises; the latter from the theoretical dimension of Digital Media Use, which in this case integrates with empathy, giving relevance to this skill to integrate with soft skills.

According to Friesem (2016), digital empathy is the cognitive and emotional capacity to be reflective and socially responsible in the strategic use of digital media; it is a theory that combines social, emotional, and cognitive skills in a media literacy curriculum (Friesem, 2016). For their part, Unay-Gailhard et al. (2023) define it as the traditional empathetic characteristics that include emotional empathy (emotional reactions) and cognitive empathy (interpretive and exploratory engagements) through text-based online communications.

The tools and technologies available in Industry 4.0 are markedly digital, so it is vitally important that engineers are well-versed in digital skills to function at the highest possible engineering level (Irons, 2023). The innovative potential of emerging technologies clearly shows the need for digital skills to take advantage of the opportunities offered by these tools and manage the potential risks they entail (Raveica et al., 2024). In this regard, the widespread adoption of digital technologies requires a rethinking of approaches to work, education, and daily life, underscoring the need for constant updating of knowledge and skills to ensure competitiveness in the labor market and to adapt to a rapidly changing environment (Dandan et al., 2024).

To determine the validity of the Digital Competence Measurement Scale, it was developed by Fan and Wang (2022) and validated by Kryukova et al. (2022) and Urakova et al. (2023), providing evidence of content validity; additionally, the factor analysis performed represents evidence of construct validity. For the reliability analysis, internal consistency indices were calculated for each factor. The reported Cronbach's Alpha coefficients are $\alpha_1 = 0.939$; $\alpha_2 = 0.896$; $\alpha_3 = 0.869$; and $\alpha_4 = 0.813$, providing evidence of the reliability of the scale used. Fan and Wang (2022) reported Cronbach's Alpha coefficient values between 0.778 and 0.874, while Kryukova et al. (2022) found values between 0.907 and 0.985.

Thus, the results demonstrate the scale's psychometric properties, validity, and reliability. Regarding sample adequacy, Mavrou (2015) argues, based on other authors, that the sample size should exceed 100 and that obtaining a stable factorial solution is possible when the sample size approaches 20 times the number of factors. Authors such as Hai et al. (2024) and Kline (1994) recommend working with sample sizes greater than 100.

5 Discussion

The findings of this study underscore the critical importance of digital competencies in higher education, specifically among engineering students at the University of Carabobo. The identification of four key dimensions' Communication and Digital Security, Access to Digital Content Management, Creation of Digital Content and Use of Digital Media, and Digital Empathy-provides a robust framework for understanding the essential digital skills required in contemporary educational settings.

This study aligns with previous research highlighting the necessity of digital literacy as a fundamental skill in the 21st century. The congruence between the identified factors and established frameworks, such as the European Union's DigComp, suggests that these competencies are relevant and globally applicable. The differentiation between user-oriented and content-creator profiles within the identified factors reveals that digital education must address both digital media's consumption and production aspects. This dual approach is essential for equipping students with the comprehensive digital skills needed in today's digital society.

Additionally, the emergence of digital empathy as a distinct dimension emphasizes the growing need to integrate emotional intelligence with technological proficiency. This is particularly pertinent in online learning environments, where students are increasingly required to navigate complex social and emotional landscapes using digital tools. The inclusion of digital empathy in the competency model suggests that future educational initiatives should prioritize developing soft and hard digital skills to foster well-rounded digital citizens.

6 Threats to validity

While this study provides valuable insights into the digital competencies of engineering students, several limitations must be acknowledged. First, using non-probabilistic sampling inherently limits the generalizability of the findings. Although the sample was carefully selected to represent the student population at the University of Carabobo, the results may not fully capture the diversity of experiences in different institutions or regions.

Second, the reliance on self-reported data through questionnaires introduces the possibility of response bias. Students' self-assessments of their digital competencies may not accurately reflect their true abilities, potentially leading to skewed data. This is a standard limitation in studies relying on self-reporting, and future research could benefit from incorporating more objective measures of digital skills.

Third, the study's focus on a specific national context-Venezuela-may limit the applicability of the findings to other educational environments, particularly in countries with differing levels of digital infrastructure and educational support systems. Venezuela's unique socio-economic and technological conditions may have influenced the students' digital competencies in ways that are not directly comparable to those in other regions.

Finally, this study's cross-sectional design provides a snapshot of digital competencies at a single point in time. Given the rapid

pace of technological change and the evolving nature of digital education, longitudinal studies are necessary to understand how these competencies develop and change over time. Such studies would provide a more dynamic understanding of digital skill acquisition and its long-term impacts on academic and professional outcomes.

7 Conclusions

This study identifies and validates a model of digital competencies that is relevant and applicable to higher education students, specifically within engineering education at the University of Carabobo. The four dimensions identified-Communication and Digital Security, Access to Digital Content Management, Creation of Digital Content and Use of Digital Media, and Digital Empathy-offer a comprehensive view of the digital skills required for success in today's educational landscape.

While the structure of the identified model differs from the one proposed by Fan and Wang (2022), it retains the core elements necessary for measuring digital competencies, making it a valuable tool for educators and policymakers. The model's alignment with established frameworks, such as DigComp, further supports its utility in a broader context.

Although the study results demonstrate the reliability and validity of the scale used, it should be noted that the sample was selected for convenience, which must be considered when generalizing the results. Similarly, a confirmatory factor analysis should be considered in future applications to support further evidence of validity and reliability. However, the study also highlights the need for additional research, particularly in diversifying the contexts and populations in which these competencies are measured. The findings suggest that digital competencies are not static but evolve with technological advancements and educational practices. As such, future research should explore the longitudinal development of these skills and their impact on students' academic and professional trajectories.

In conclusion, the validated model provides a solid foundation for assessing digital competencies in higher education, with implications for curriculum development, instructional design, and policy-making. The inclusion of digital empathy as a critical competency underscores the importance of holistic digital education that integrates technical skills and social-emotional learning, preparing students for academic success and active, responsible participation in the digital world.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the participants was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

AM-A: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. MD'A: Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing, Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation. EV-C: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. JC-C: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. CV-S: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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