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Validation of a Scale to Measure Digital Competence in the Elderly Population

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The aim of this work arises, on the one hand, from the need to digitally include people over 65 so that they can participate fully in today's society, and, on the other hand, to involve university students in their own training process through a research and participatory action project with older people. A process of adaptation and validation of an instrument to measure the level of digital competence of older people was carried out by means of an expert judgement, a pilot test and a final application to a sample of 210 older people. The 16 items of the instrument show stable and consistent measurements, fulfilling the required demands, and could be very useful for researchers working with this group, as it will allow them to know the starting point of the elderly at a digital level and design strategies that favour their technological inclusion.

Keywords: elderly person, e-inclusion, digital competence, social education, university research

INTRODUCTION

We live in a digital society, characterised by the prevalence of information, communication, and network technologies. Technologies and digital connectivity have permeated all facets of society, encompassing professional, personal, and recreational spheres. The continuous interplay between technology and the digitisation of data is fostering a Network Society model, in constant transformation and lifelong learning (Salleh et al., 2019). The omnipresence of the Internet has given rise to virtual or digital spaces, engendering shifts in social dynamics, organisational structures, employment relationships, service provision, and educational frameworks, etc. (Hidayat et al., 2020; Van Dijk, 2020). The COVID-19 health crisis not only accelerated this transformation, but also demanded an inclusive digital transition (Neves et al., 2020). We thus need to

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foster a digitally skilled populace who can contribute to the creation of a more sustainable, competitive society, that will enhance our prospects for the future (Silva & Lázaro, 2020).

Contemporary citizens should possess a set of digital competencies that includes the knowledge, skills, and attitudes, that enable them to participate and develop in society throughout their lives. Enhancing these digital proficiencies, to achieve a complete digital transformation, is among the European Union's main priorities. According to the European Commission (2018, p.4), Digital Competence is defined as a vital competency for every citizen, essential from early childhood through adulthood. Furthermore, it also indicates that the development of Digital Competence must occur continually through formal, non-formal, and informal education channels. In this context, the Digital Competencies Framework for Citizenship (DigComp) was created in 2013 (European Commission, 2013). It established a common language to identify and describe these competencies, in terms of knowledge, skills and attitudes, while also offering defined levels of achievement within each competence. This framework has evolved from its initial version DigComp 1.0 to DigComp 2.1 in English and DigComp 2.2 in Spanish. It offers comprehensive guidance on its application for the development and understanding of digital skills and incorporates numerous illustrative examples. Its primary objective is to assist policymakers in countries develop strategies and initiatives aimed at enhancing the digital skills of all demographic groups and social collectives. The framework establishes 21 specific competencies grouped into five areas: information (Searching and filtering data, information and digital content, evaluating data and managing data), communication and collaboration (Interacting, sharing, citizen participation and collaboration through digital technologies), digital content creation (Collaboration through digital technologies, online behaviour, digital identity management, content development, copyright and intellectual property licences and programming), security (Device protection, personal data protection and privacy, health and welfare protection and environmental protection) and problem solving (Technical problem solving, identification of technology needs and answers and creative use of digital technology). Within each area, eight levels of depth are established to specify the required knowledge, skills and attitudes needed to be digitally competent. Thus, this framework would establish a starting point on the citizen's digital competencies and a reference of the level to be reached in these competencies. On this basis, the Europe Commission advocates for a 'Digital Transformation'. Within the current European political strategies, defined in its 2030 agenda, it aims to train both companies and citizens for a digital future that is sustainable, prosperous and centred on the human being. Based on the digital competence standard established in DigComp, the European Commission (2022) has signed the European Declaration on Digital Rights and Principles. This document reflects its commitment to ensuring digital technologies protect people's rights, and support democracy and the technology sector will act responsibly and safely for the citizen. Every individual should have the liberty to navigate the Internet in a democratic manner, with control over their own data, while remaining safe from dangers, and have the ability to adapt to emerging technological trends. Technology should foster solidarity, and bring people together, not separate them. Universal internet access, and the digital skills needed to access digital public services and promote fair employment conditions facilitated by technology, must be ensured for all. Furthermore, digital devices should contribute to sustainability and ecological transition. To achieve this, citizens should possess awareness of the environmental impact and energy consumption associated with their devices.

Digital skills and older people

While digital skills undoubtedly contribute to societal advancement, they also heighten the risk of exclusion among various social segments. Many people have been affected by this digital divide and have had to develop adaptation strategies to increase their sociability through the use of digital tools, as observed during the COVID-19 pandemic (Buffel et al., 2023; Manzanera-Román and Braändle, 2022; Quinayás, 2022; Seifert, 2020). The elderly aged 65 and older are a significant demographic within the digital society. The United Nations' 'World Social Report 2023' projects a significant global trend of population ageing, with an estimated 1.6 billion elderly individuals worldwide by 2050. While global life expectancy is increasing, this report highlights a increase in inequalities within an ageing society (Olsson and Viscovi, 2023). Lifelong learning and appropriate training initiatives are important for older adults, as they can develop complex digital skills, expand their digital opportunities and it ensures that the physical and cognitive limitations inherent to age do not become a factor of digital exclusion (Hidayat et al, 2022; Escuder et al., 2020; Tomczyk et al., 2022). A recent study done in England on the perception of older people in the use of technologies, concludes that older people should be considered when offering digital services with digital connection, in order to facilitate their access and thus avoid their social exclusion. But it also recommends that these online and digital communication services for seniors should be part of a broader program that can complement face-to-face personal care (Wilson et al., 2023).

We must acknowledge diverse ageing experiences, shaped by factors such as education, economic situation, relationships maintained with family, social connections, cultural engagement, and integration and involvement with the community (Coelho, 2022; Friemel, 2016). These factors impact the assessment of a digital divide within this demographic, but they are not the sole considerations to bear in mind. Elements such as cognitive age, technological anxiety, willingness to embrace technology, equipment and installation costs, often wield more influence than the inherent physical limitations of age such as vision, manual dexterity or cognitive changes when it comes to acquiring digital skills (Peral-Peral et al., 2015). Another study on the digital inclusion of the elderly in Spain indicates that the willingness of older people to access the Internet is strongly influenced by their socio-educational background. These results show that sociodemographic characteristics will be decisive when considering how to optimise elderly people's capabilities, both so that they can acquire the necessary basic digital skills, and to encourage their use (Tirado-Morueta et al., 2023). Misconceptions about technology use also influence elderly people's inclination towards adopting technology: The Internet is useless, or dangerous, or it is only for young people, etc. Such beliefs hinder both the learning and use of technology among this demographic (Escuder et al., 2020). Conversely, if older individuals believe that digital tools can be beneficial in their daily lives and receive positive feedback from their social circle regarding their use, their inclination to engage with these tools will increase (Martin-Hammond et al., 2019).

Objective of this work

At this point, several questions emerge that shape the basis of this research study. What would be elderly people's starting or baseline level of digital competence or knowledge? Is there a reliable and valid instrument available to assess their digital competence aligning with European standards that can extract data and allows proposals for actions that favour their digital inclusion, reduces their social isolation and, in general, enables their independent engagement in society's digital initiatives?

These questions underscore the need to validate an instrument capable of extracting precise information regarding the digital competence level of elderly individuals in our society. Therefore, the principal objective of this study is to adapt and validate a scale, in accordance with the guidelines provided by the European Commission's Digital Competencies Framework for Citizens, aligning with the principles outlined in DigComp 2.1 and 2.2 to measure the basic user-level digital competence of individuals aged 65 and above.

METHOD

The methods used in this research were those used for the validation of a questionnaire. To obtain information that will enable us to provide answers, a Participatory Action Research was proposed by the University, involving 50 students from the 2nd year of the Degree in Social Education and several institutions for the elderly (residences and day centres). This active methodology will also help social transformation through the involvement of different groups that generate new knowledge from their own experiences.

Participants

The research study was carried out in the province of Valencia, specifically, its capital and surrounding towns. It is one of the most populated regions in the country and is one of the five most important cities in Spain. The province is home to approximately 173,324 elderly residents, comprising 21.41% of the total population, based on municipal figures published on 1 January 2023, which estimate the overall population of Valencia at 809,501 inhabitants, with 47.5% being male and 52.5% female.

For this study, data were extracted from a supplied sample of 210 people aged 65 and above, using a structured, self-administered survey. The average age of respondents was 75.97 (SD = 6.83), with 65 being the minimum age and 99 the maximum. Of the participants, 35.71% were males and 64.29% were females. Regarding sociodemographic data, the study found that 30% of the participants live alone, 56.67% resided with family members or companions, and 13.33% resided in care facilities or residences. Regarding qualifications in their pre-retirement professions, 49.04% of the sample had no formal qualifications, while the remaining 50.96% held positions with varying degrees of authority, including higher, intermediate, or technical roles within their respective occupations.

Procedure

The European Framework of Digital Competences for Citizenship Digcomp 2.2. was taken as a reference, with 5 dimensions (D1-Searching and managing information and data; D2-Communication and collaboration; D3-Creating digital content, D4-Security and D5-Problem solving). The first three areas refer to competences that can be perceived in specific activities and uses. Areas 4 and 5, are cross-cutting as they apply to any type of activity carried out through digital media. The sub-competences of area 6 would be present in all the others, but a specific area has been established due to the importance of this aspect for the appropriation of technology and digital practices. In this framework, four levels of competence attainment are envisaged (basic, intermediate, advanced and highly specialised), with the basic level being used for this research due to the specific characteristics of the sample (older people). Therefore, the descriptors of the basic level of each of the competences in their five dimensions established in the Digcomp were compiled to form the 21 starting items of the measurement scale. The items were then evaluated by a panel of experts with the intention of improving their clarity, relevance and effectiveness, taking into account the profile of the target audience.

The items were then evaluated by a panel of experts with the intention of improving their clarity, relevance and effectiveness, taking into account the profile of the target audience (Babbie, 1992). This panel of experts comprised four university professors, two who specialised in the field of the elderly population and the other two in educational technology. In addition, six individuals aged 65 and above, representing diverse socioeconomic backgrounds, were included as part of this expert panel. All members of the group provided the researchers with their evaluations through a pre-written document that allowed them to collect suggestions and build off them to develop more valid constructs, tailored to the intended user profile. Consequently, all items from the DigComp 2.2 dimensions were deemed valid, with minor adjustments needed for two aspects. First, we decided to assign consecutive numbering to all the items, ranging from 1 to 21. Second, the items were simplified by aligning them with competency descriptions and employing simple and meaningful examples suitable for elderly respondents, to ensure they would be easily comprehensible to the final recipient while preserving the original meaning. This resulting questionnaire was tested through a pilot study using a convenience sample of 50 participants, also made up of people aged 65 and above. The results were assessed for reliability using Cronbach's alpha and item-total correlations. Following the initial refinement, the retained elements were checked to develop a standardised measurement and framework for dimension articulation.

The final instrument comprised two sections: one addressing the participants' sociodemographic profile, and the other containing a questionnaire assessing basic-level digital skills for older individuals. This questionnaire consisted of 21 items grouped into 5 factors, aligned with the starting DigComp areas: Information and data retrieval and management (3 items), communication and collaboration (6 items), digital content creation (4 items), security (4 items) and problem solving (4 items). To ascertain an appropriate sample size, the guidelines outlined by Hair et al. (2018) were adhered to, suggesting a minimum of ten participants for each item in the questionnaire. In our case, this criterion was met with a total of 210 participating subjects.

Ethical considerations

The study adhered to ethical standards essential in all research and obtained approval from the Ethics Committee under permit number UCV/2021-2022/155 at the Catholic University of Valencia. The Committee reviewed and certified the essential procedures on voluntary participation, informed consent, study objectives disclosure, personal data protection, and assurance of participant confidentiality and non-discrimination. Data collection was carried out with hard copy questionnaires as online surveys were deemed impractical due to the specific attributes of the elderly participants. Trained researchers were enlisted to assist in data collection, as there were frequent instances where personalised guidance was required to address and resolve participant queries during the data completion process. The data collection method took place from November 2022 to January 2023.

To obtain greater response rates, the survey was carried out in elderly institutions selected by the students where they conducted workshops on the use of smartphones and digital applications for the elderly. The criteria and objectives of the study were explained to the participants beforehand, in small groups and in several shifts, which facilitated their understanding and the completion of the questionnaire.

Statistical analysis

We used SPSS v.24 and JASP v0.16 to carry out the different statistical analyses. We used the Parallel Analysis procedure to determine the appropriate number of factors. To check the fit of the instrument, the root mean square residuals (RMSR) and the gamma index or Goodness of Fit Indices (GFI) were analysed (Tanaka and Huba, 1989). Internal consistency was analysed using Cronbach's alpha, ordinal alpha and McDonald's omega values. Data fit was assessed using the homogeneity test, Kaiser-Meyer-Olkin (KMO) sampling adequacy measure index, and Bartlett's test of sphericity. Using confirmatory factor analysis (CFA), we checked whether the data fit the solution given by the EFA. We employed the diagonally weighted least squares estimation method for the CFA. The fit indices assessed included Chi-squared, root mean square error of approximation (RMSEA), comparative fit index (CFI), and the Tucker-Lewis index (TLI). A non-significant chi-squared test indicates an adequate fit to the data. An RMSEA close to zero and a CFI and TLI close to 1.0 indicate an excellent fit to the data (Hu and Bentler, 1999).

FINDINGS

Descriptive statistics

Table 1 displays the descriptive statistics, means, standard deviations, skewness, and kurtosis for the scale. Scores surpassing the midpoint of 1.50 on a 3-point Likert scale (1: I don't know how to do it, 2: I can do it with help, and 3: I do it alone) indicate a higher item rating. Normality was assessed by examining skewness and kurtosis values, all of which were lower than the threshold of 3.0 recommended by Hu and Bentler (1999), with the exception of item number 13 (D3-13), which was clearly higher with a skewness of 6.22, and kurtosis at 42.61. Consequently, item number 13 was excluded from subsequent analyses, leaving a total of 20 items.

Table 1
Mean, standard deviations, skewness and kurtosis of the scale

Ítems	Media	Dt	Asimetría	Curtosis
D1-1. I know how to search for information on the Internet (e.g. through Google)	2.08	0.91	-0.13	-1.78
D1-2 I know how to detect if the information that reaches me through the Internet (e.g. WhatsApp, Google, Mail ...), is true or not.	1.79	0.91	0.43	-1.67
D1-3 - I know how to organize, save and retrieve data from the Internet (e.g. WhatsApp data).	1.81	0.93	0.37	-1.76
D2-4 I can participate in Internet groups, video calls, networks... (e.g. through WhtasApp).	2.18	0.92	-0.35	-1.74
D2-5 I know how to send photos, videos or messages over the Internet (e.g. WhtasApp messages).	2.24	0.90	-0.50	-1.60
D2-6 I know how to participate in online citizen surveys (e.g. WhatsApp, email, social networks...).	1.39	0.73	1.51	0.56
D2-7 I can collaborate online with other people (e.g. with Google Drive, Dropbox...).	1.31	0.68	1.91	1.92
D2-8 I know how to detect inappropriate behavior in the use of cell phones or other devices.	1.52	0.82	1.09	-0.60
D2-9 S I know what personal data I can and cannot send.	1.87	0.94	0.25	-1.84
D3-10 I know how to make a simple video or put a text to a photo (e.g. add WhatsApp statuses).	1.94	0.94	0.15	-1.87
D3-11 I know how to add text and tags to other people's videos or photos with my cell phone.	1.61	0.84	0.81	-1.08
D3-12 I know how to search for (Internet) images without copyrights (without CopyRight).	1.35	0.72	1.67	1.06
D3-13 I know how to write simple instructions for a program to solve.	1.03	0.21	6.22	42.61
D4-14 I know how to protect my cell phone from malware.	1.49	0.74	1.11	-0.27
D4-15 I am aware of the data privacy policy of Internet programs (e.g. WhatsApp).	1.62	0.85	0.80	-1.15
D4-16 I know that cell phone addiction can cause physical and psychological damage.	2.30	0.92	-0.64	-1.52
D4-17 I am aware of the environmental impacts of cell phone use (e.g. carbon emissions, pollution from telecommunication towers...).	1.92	0.96	0.15	-1.92
D5-18 I know how to solve simple technical problems (e.g. connect wifi, change battery...).	1.72	0.90	0.57	-1.53
D5-19 I know how to change font sizes, change language, adapt screens, ...	1.74	0.89	0.53	-1.55
D5-20 I know how to participate in thematic video channels (e.g. Youtube)	1.47	0.80	1.23	-0.30
D5-21 I learn with the Internet (e.g. watching video tutorials, reading google pages, ...).	1.69	0.91	0.64	-1.48

Exploratory factor analysis

Following the process recommended by Lloret-Segura et al. (2014), an EFA was conducted on the 20 retained items related to digital competence in the elderly, considering the dimensions outlined by Europe at the basic level of attainment. The Parallel Analysis and the factorial solution that best fit the object of study were verified. Nonetheless, four items (D4-14, D1-3, D5-20, D3-10) were excluded from the analysis due to theoretical inconsistencies and factor loadings that either fell below 0.40 or exceeded it in two or more factors, as detailed in Table 2, which illustrates the rotated factor structure of the scale, commonalities, and Cronbach's alpha. As a result, a subsequent exploratory factor analysis was carried out.

Table 2
Rotating factor structure of the scale of impacts perceived by residents, commonalities and Cronbach's alpha

Ítems	Factor 1	Factor 2	Factor 3	Factor 4	Commonalities
Factor 1					
D4-14	0.678		0.404		0.350
D2-7	0.752				0.524
D4-15	0.779				0.478
D2-6	0.781				0.539
D2-8	0.781				0.510
D1-3	0.492	0.490			0.421
D5-20	0.453		0.543		0.449
D3-11	0.413				0.530
D3-12	0.408				0.667
Factor 2					
D2-5		0.840			0.305
D2-4		0.802			0.444
D1-2		0.734			0.543
D1-1		0.760			0.586
D3-10		0.444	0.596		0.405
Factor 3					
D5-19			0.867		0.317
D5-18			0.812		0.467
D5-21			0.728		0.645
Factor 4					
D4-16				0.807	0.188
D4-17				0.750	0.532
D2-9				0.832	0.525
Alfa de Cronbach	0.78	0.79	0.76	0.72	
Varianza explicada (%)	16,9	14,3	13,4	8,3	
Nº ítems	6	4	3	3	

The results of this new factor analysis showed a good fit of the factor structure, since the RMSR index was 0.03 and lower than the recommended cut-off point (< 0.50). The GFI index yielded a value of 0.93, higher than the recommended cut-off point (> 0.90). All item loadings were greater than 0.40 and no loadings greater than this saturation were observed on two or more factors. Finally, the 16 retained items were categorised into four factors, collectively accounting for 52.9% of the variance. The four extracted factors were named as follows, based on their original areas in DigComp and their initial meaning: 'D1. Online collaboration through digital devices'; 'D2. Creation of digital content, participation and simple searches'; 'D3. Basic problem solving and network training', and 'D4. Safety and knowledge of device use.'

Confirmatory factorial analysis

Once the EFA was carried out, a subsequent CFA was conducted involving five key steps: instrument specification, identification, estimation, instrument fit assessment, and instrument respecification (Tabachnick and Fidell, 2001). The resulting 4-factor questionnaire, which was called the Basic Digital Competencies in Older People questionnaire (DigCompB_PM), was submitted to the CFA with a total of 16 items. Goodness-of-fit indices showed that the model fit the data perfectly. This is corroborated in Table 3, where the chi-squared statistic for the obtained model was significant (S-Bχ2 = 271.015, $p < 0.001$). Furthermore, the normalised chi-squared value ($\chi 2/df = 2.39$) fell below the recommended cut-off value of less than 3.0. The RMSEA (0.08) also indicated a reasonable fit, while the CFI (0.91), GFI (0.95), and IFI (0.91) exceeded the suggested cut-off value (> 0.90) (Hu and Bentler, 1999, Loehlin and Beaujean, 2017).

Table 3
Goodness-of-fit indices of the scale of basic digital competencies in the elderly (DigCompB_PM)

Model	S-Bχ2	df	S-Bχ2 /df	RMSEA	CFI	GFI	IFI
4 Factors - 16 items	227.806	98	2.32	0,08	0.91	0.95	0.91

Note. S-Bχ2 = Satorra-Bentler Scaled Chi-Square; df= Degrees of Freedom; RMSEA= Root Mean-Square Error of

Reliability assessments for the perceived impact factors were examined by assessing the values of Cronbach's alpha coefficient, composite reliability (CR), and average variance extracted (AVE), as presented in Table 4. The Cronbach's alpha values for the factors exceeded the recommended threshold of 0.70 (Fornell and Larcker, 1981). Finally, the AVE values for the factors encompassing perceived positive and negative impacts ranged from 0.59 to 0.68, exceeding the recommended threshold of 0.50 (Bagozzi and Yi, 1988).

Table 4
Reliability of the scale associated with basic digital competencies in the elderly (DigCompB_PM)

Model	Factor 1	Factor 2	Factor 3	Factor 4
CR	0.79	0.79	0.78	0.75
AVE	0.61	0.63	0.67	0.64
√AVE	0,77	0,79	0,82	0,79
α	0.78	0.79	0.76	0.72

Note: CR = composite reliability; AVE = Average Variance Extracted; α = Cronbach's alpha

Furthermore, discriminant validity was assessed, with the corresponding data presented in Table 5, which involved analysing the correlation values between factors. The outcomes demonstrated that all loadings between factors were notably lower than the recommended threshold of 0.85 as suggested by Kline (2005) in each of the dimensions. Additionally, it is evident that the Fornell and Larcker (1981) criterion is satisfied, as it requires the square root of the AVE to be greater than each pair of correlations.

Table 5
Discriminant validity of the scale basic digital competencies in the elderly (DigCompB_PM)

Model	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1	0,773			
Factor 2	0,632*	0,785		
Factor 3	0,613*	0,607*	0,821	
Factor 4	0,546*	0,578*	0,554*	0,797

Note: * indicates that the correlation is significant at the 0.01 level (bilateral). The diagonal offers the values of the √AVE.

DISCUSSION AND CONCLUSION

The research results affirm that the scale developed to assess the basic level of digital skills in elderly people (see in Appendice A) has adequate psychometric properties for measuring digital competence across various dimensions as outlined in the Digital Competencies Framework for Citizens (DigComp). This aligns with the standards set by the EU within the framework. The four final factors comprising the scale show high internal consistency, as suggested by Hair et al. (2018). Furthermore, the requisite criteria for ensuring both convergent and discriminant validity have been met. In view of these findings, the instrument fulfils the necessary criteria for evaluating digital competence in elderly people, encompassing the specific subcompetencies it comprises. Moreover, the four factors exhibit satisfactory reliability indices, aligning with the criteria reviewed in the literature, with values exceeding 0.70 for all four proposed factors.

The challenges posed by this research, such as planning, organisation, control of the student-elderly group or readjustments due to unforeseen events, have been satisfactorily resolved thanks to Participatory Action Research. The students have become professionally involved with the group of elderly people, contributing with their efforts to a university research. They have also made it possible to make visible what the reality of the elderly is with respect to digital competences within society, promoting their respect and digital integration, as established by Europe as priorities to be achieved for a true social digital transformation. The concept of digital literacy encompasses not only the technical knowledge required to utilise digital devices effectively, but also the ability of users to employ technological devices, as well as the information they provide and the critical thinking that enables them to make informed decisions about the information obtained (Arvianto & Andayani, 2023). In this sense, the DigComp framework is an instrument that should not exclude anyone. It is true that there are similar studies that try to explain the level of digital literacy in specific groups, especially in the field of education. Recent studies include those by Reyes and Gurubel-Tec (2024), Ballester-Esteve et al. (2023), Cabaron (2023), Ergül and Tasar (2023); Gümüs y Kubul (2023), Gutiérrez-Santiuste et al. (2023) or Pedaste et al. (2023). However, it is difficult to find such studies for the specific group of older people, despite the fact that social digitalisation influences this group by providing them with opportunities and advantages in their daily lives (Sen et al., 2022). We start from the proven importance of the incorporation of older people into the digital world to favour their active ageing, their inclusion in the digital society and their positive relationship with other types of emotions such as reducing isolation and digital empowerment of this sector, which is so important for the elderly.

From the results obtained, it is shown that the DigcompB_PM scale, to establish the basic level of digital competencies in the elderly, presents adequate psychometric properties to measure the digital competencies established by the Digital Competencies Framework for Citizenship (DigComp). The four factors and 16 final items that make up the scale show high internal consistency and also meet the criteria necessary to ensure convergent and discriminant validity. With all this, it is suggested that the instrument meets the demands required to measure digital competence in the elderly at a basic level of acquisition of the specific subcompetencies that comprise it. The work carried out confirmed the need to review the subcompetencies and adapt the descriptions, making them more understandable and with meaningful examples, in line with previous research indicating that the elderly use technologies better if these are adapted to their beliefs, socioeconomic level or social reality (Coelho, 2022; Friemel, 2016). These modifications have been refuted with the necessary statistical research. The final scale of the study simplifies the understanding of the items and more realistically fits the profile of older people. Digital skills are fundamental to enhance or limit essential aspects of quality of life in older people. Therefore, the data that can be obtained from this scale will make it possible to adjust intervention proposals and carry out truly effective actions that favor their digital and social inclusion. It will also help to eliminate false beliefs and perceptions about the use that this group makes of technology, based on the negative view they perceive society has of the changes that come with age (Levy, 2009), favoring their learning if necessary, and helping the agents responsible for their inclusion to design the most appropriate training (Coelho, 2022) since it is not only important to ensure access, but also adequate interaction in the digital society (Barrio & Vaerenbergh, 2023). The use of a 3-choice Likert scale was especially useful when surveying older people, since it facilitated the understanding of the response. Recently, several studies related to the elderly have evaluated different constructs through scales with 3 response options (Ge et al., 2022). On the other hand, studies such as that of Heponiemi et al. (2022), which analyzed the digital competence of elderly people associated with health services using an online scale, have already pointed out the need to code the responses in 3 options. Meanwhile, works such as those of Li (2013) point out that a longer list of response options can lead to a certain apathy when answering the questionnaire.

The current study is not devoid of limitations, which are inherent to the complexities of adapting and validating a measurement instrument. Developing research instruments is a lengthy and intricate process, as underscored by previous similar investigations (Abdollahpour et al., 2011; Zamanzadeh et al., 2015; Zamora-de-Ortiz et al., 2020). Nonetheless, the short-term goal and commitment of the researchers behind this study is to further examine additional evidence from DigcompB_PM by broadening the sample of elderly people in different Spanish regions. This is done while acknowledging that one of the limitations to expanding the sample size is the inherent characteristics of the population being examined. Notwithstanding the careful pre-selection process, certain challenges persist in terms of accessing and completing the questionnaire, stemming from various factors: the age range (65 to 99), their dispersion (individual households or residences), variations in cognitive abilities (which may be partially diminished due to age), and disparities in the availability of digital resources (such as mobile phones, tablets, and computers). Another limitation is that the conclusions drawn from this study are based on a group of Spanish elderly people. Given that digital competence might be taught and developed differently in other countries, particularly outside the EU, the baseline competence of elderly people could vary significantly from one country to another. This is especially true in regions with significant cultural and social differences, as the items are tailored to the level of significance for an older Western European individual with an average sociocultural background (although all possible socioeconomic groups were taken into account for their validation). Therefore, one of the long-term objectives of this study could be the verification of DigcompB_PM in other countries, both within the European Union and outside it, to ensure its international validity and reliability.

For now, this study offers a valuable contribution by providing a psychometrically validated tool, DigcompB_PM, which can be used by researchers and professionals working in the field of elderly care. It can be used to evaluate the digital skills of this population across four dimensions and 16 specific items, and to compare the results with similar groups of seniors in age groups starting from 65. The results of our study support the potential for developing ongoing training initiatives aimed at integrating elderly people into full and active participation in the digital society, thereby preventing their social exclusion, and being aware that the learning of digital competences is subject to the different experiences and situations in which they occur (Hunsaker et al., 2019). Our findings can help the research community develop new strategies for integrating elderly people into the digital society, concurring with previous researchers' conclusions (Pani-Harreman et al., 2021; Wilson et al., 2023). Obviously, the incorporation of digital services does not replace face-to-face services or personal attention from loved ones, which every elderly person needs to be happy. But effective technology use will facilitate their connection with family and friends, give them access to vital information and digital resources, and mitigate the personal isolation they frequently experience. And certainly, this will also contribute to their personal satisfaction and motivation. Moreover, lifelong learning contributes to maintaining stimulated cognitive capacity, thus improving personal development and general well-being. In this regard, embracing technology as a learning tool is a valuable opportunity for empowering older individuals and bridging digital divides, which is a pressing concern for a substantial portion of the elderly population.

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APPENDIKS A

Scale of Basic Digital Competencies in the Elderly (Spanish Version) (DigCompB_PM)

Level*:	1	2	3
F1: Online collaboration through digital devices			
1- I can collaborate online with other people (e.g. with Google Drive, Dropbox...).			
2- I am aware of the data privacy policy of Internet programs (e.g. WhatsApp).			
3- I know how to participate in online citizen surveys (e.g. via WhatsApp, email, social networks...).			
4-I know how to detect inappropriate behavior in the use of cell phones or other devices.			
5- know how to add text and tags to other people's videos or photos with my cell phone.			
6- I know how to search for (Internet) images without copyrights (without CopyRight).			
F2: Digital content creation, participation and simple searches			
7- I know how to send photos, videos or messages over the Internet (e.g. WhtasApp messages).			
8- I can participate in Internet groups, video calls, networks... (e.g. through WhtasApp).			
9- I know how to detect if the information that comes to me through the Internet (e.g. WhatsApp, Google, Mail ...), is true or not.			
10- I know how to search for information on the Internet (e.g. through Google).			
F3: Basic troubleshooting and networking training			
11- I know how to change font sizes, change language, adapt screens, ...			
12- I know how to solve simple technical problems (e.g. connect wifi, change battery...).			
13- I learn with the Internet (e.g. watching video tutorials, reading google pages, ...).			
F4: Safety and knowledge of use of the devices			
14- I know that cell phone addiction can cause physical and psychological damage.			
15- “I am aware of the environmental impacts of cell phone use (e.g. carbon emissions, pollution from telecommunication towers...).			
16- I know what personal data I can and cannot send.			

* 1: I don't know how to do it
2: With assistance I can
3: I do it with a certain autonomy