Social Education Research
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UNIVERSAL WISER PUBLISHER

Research Article

Digital Adaptation by Adults Aged 50-75 Years: A Study in Cyprus

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Received: 26 May 2025; **Revised:** 15 September 2025; **Accepted:** 17 November 2025

Abstract: The study examines the digital competencies of Cypriot adults in the following three age brackets, 50-64, 65-74, and 75+, distinguishing between basic digital skills (e.g., browsing, messaging, using digital devices to search for information online, downloading files, visiting websites, sending private messages) and advanced skills (e.g., problem-solving, content creation, critical evaluation). It explores how age, gender, education, and place of residence shape digital literacy outcomes. Using a 10-item self-report-questionnaire based on the Digital Skills Indicator (DSI), adapted for older populations and validated in the Cypriot context, we collected data from a convenience sample of 287 Cypriot citizens aged 50-75 years. A part of our subjects completed online forms while we interviewed others in adult day-care facilities. We analyzed the data using factor analysis and chi-square test. Factor analysis revealed two distinct aspects of digital competence: (a) Basic operational digital skills and advanced digital skills. Participants in the 'younger' age bracket (50-64) demonstrated greater autonomy in handling digital tasks than our older subjects (64+), although higher education levels mitigated age-related disparities. Urban residents demonstrated an advantage in digital content creation, while men and women differed regarding their perceptions of the ease of digitalization. Our research reveals that although many older persons engage in digital activities, there are substantial disparities in digital engagement based on age, education, and geographic location. Policy interventions must move beyond access to address targeted training, especially for rural, less educated, and older subgroups, to prevent their exclusion from the digital society.

***Keywords*:** digital communication, digital divide, third age, digital skills, digital trans-formation

1. Introduction

1.1 *Background and theory*

The rapid spread of digital technologies is transforming people's everyday lives, providing them with opportunities for new forms of communication, learning, and social participation. However, it may also underpin inequalities in accessibility and competence, particularly among older adults, who have fewer opportunities for training, empowerment, and effective integration of digital skills (Pihlainen et al., 2021). In the current study, we apply the term "*digital literacy*" to refer to the bundle of abilities and competencies necessary to navigate a complex online information ecosystem, utilize multiple digital devices effectively, and critically engage with digital technology (Herrmann et al., 2021; Fitriana & Ikawati, 2023; Tsai et al., 2017). It involves the technical ability to operate devices and the capacity

DOI: https://doi.org/10.37256/ser.7120267294

to access, evaluate, and responsibly use digital information for learning, work, and social participation (Chaw & Tang, 2022). The European Digital Competence Framework (Council of the European Union, 2018; Vuorikari, 2022) outlines a range of competencies, including information management, communication, content production, problem-solving, and digital safety, each of which is becoming increasingly essential for active participation in society.

Despite the prevalence of digital tools, there is an uneven distribution of online engagement across populations. Older adults frequently face barriers, including limited prior exposure, lower confidence and self-efficacy, as well as restricted opportunities to learn in supportive environments (Köttl et al., 2021; Yao et al., 2021). Institutional and societal factors frequently magnify these challenges, particularly regarding the digitization of services within healthcare, banking, and public administration, which presuppose a fundamental level of access and expertise (Friemel, 2016; Seifert et al., 2017). The COVID-19 pandemic intensified these dynamics: sudden shifts to online services increased reliance on Information and Communication Technology (ICT) for essential tasks, magnifying existing gaps in access and skills, and, for many, created feelings of disconnection from a digitally connected society (Cheung et al., 2023; Tinmaz et al., 2022; Seifert et al., 2021), and created new challenges for adults above 50 years to stay connected to the latest technological reality (Coleman, 2021; Lai & Widmar, 2021). At the same time, many older adults showed a significant readiness to adapt, expanding their use of social media and communication platforms to maintain social ties, underscoring both the capacity and the constraints that characterize digital engagement in later life (Khan et al., 2016; Ollevier et al., 2020; Nimrod, 2020).

Persistent preconceptions (stereotypes) also impact the relationship between aging and technology. While we assume that younger people are uniformly "tech-savvy", we often position older adults at the lower end of the digital skills distribution (Quan-Haase et al., 2016). The research downplays the importance of education, employment history, health, and local infrastructure, and it obscures the significant variety within older populations (van Deursen & Helsper, 2015). Furthermore, gendered life trajectories and caregiving obligations may variably shape the chances for acquiring and applying digital skills throughout one's life (Hargittai & Dobransky, 2017). Understanding this complexity is crucial for developing interventions that address the realities of aging.

We employ two complementary frameworks to clarify these inequalities. Van Dijk's "Access-Skills-Usage" framework (Van Dijk, 2005; 2020), which depicts digital inequality as a sequential process, advancing from motivational and material access to skills and ultimately to usage access. This model is particularly relevant for distinguishing between basic competencies (e.g., operational skills such as browsing or messaging) and advanced competencies (e.g., strategic skills such as content creation or problem-solving), which we explore in this paper. Meanwhile, according to Helsper's typology of digital inclusion (Helsper, 2012; Helsper & Reisdorf, 2017), digital inequalities are not just technical gaps; they are closely related to pre-existing social inequalities. Whether individuals fully engage in the digital world or experience digital marginalization depends on their individual narratives, professional trajectories, and sociocultural contexts. While Van Dijk's model sheds light on the practical implementation and evaluation of digital competencies, Helsper's typology attempts to interpret how differences in demographics (age, gender, education, and geography) reflect wider disparities within Cypriot society. The integration of the two theoretical models produces a structural and sociocritical foundation. In combination, these theoretical models establish the analytical basis for this study: Van Dijk's model (2005; 2020) outlines the measurement of digital skills, while Helsper's (2012) approach situates differences in digital competence within broader patterns of inequality.

1.2 *Cyprus context and study objectives*

Cyprus faces the challenge of expediting its transition to the digital world while ensuring the fair treatment of all demographic groups in the process. Looking at the general population, the Digital Economy and Society Index (DESI) for 2021 showed that Cyprus ranked 23rd in the European Union (EU) in terms of the human parameter. Cypriots' primary digital skills remained subpar compared to the EU standard (56%), with just 45% of individuals in the 16-to 74-year age group possessing at least basic digital capabilities. One quarter of the population (25%) demonstrated advanced digital skills, and 46% had basic software skills, compared to 31% and 58% in the EU (European Commission, 2021). The rapid digitization of services, including e-government, banking, telehealth, and online education, has intensified the necessity of inclusion for older adults: without specific support, the shift to "digital by default" may unintentionally marginalize those with limited skills, reduced confidence, or inadequate access (Selwyn, 2004; Broadband Commission for Sustainable Development, 2022).

National strategies-especially the Action Plan for Digital Skills within the Cyprus Tomorrow framework-aim to upgrade capabilities across the population and workforce, promote e-governance, expand secure digital identities, and build robust connectivity (Deputy Ministry of Research, Innovation, and Digital Policy, 2021). In these initiatives, the emphasis lies on inclusion and lifelong learning, with a focus on older adults, people with disabilities, residents of remote areas, and the unemployed. At the same time, a key policy question remains: to what extent do these efforts reach those most at risk of exclusion, particularly older adults in rural areas, individuals with lower educational attainment, and those with limited prior digital exposure?

Within this context, research on the digital competencies of older adults, in our case, Cypriots, remains limited (Ollevier et al., 2020). Prior work distinguishes basic from advanced skills but provides less evidence about how these dimensions cluster empirically in older cohorts, or how demographic factors such as age group (50-64, 65-74, 75+), gender, education, and place of residence (urban/rural) are associated with competencies in practice. Our study contributes new data by applying a questionnaire aligned with the Digital Skills Indicator (DSI) to a sample of adults aged 50 and above in Cyprus, enabling us to (a) identify latent dimensions of competence through factor analysis and (b) test associations between competencies and key demographic variables. Guided by Van Dijk's framework (2020), we operationalize competencies as basic (operational) and advanced (strategic/problem-oriented) skills. Following Helsper's perspective (2012), we interpret observed differences as potentially reflecting unequal opportunity structures-differences in exposure through work, availability of training, local infrastructure, and social support-rather than individual deficits alone. Specifically, we address two research questions:

A. What are the levels and latent structure of digital competencies among Cypriot adults aged 50 and above, distinguishing basic from advanced skills?

B. How are competencies associated with age group, gender, educational attainment, and place of residence?

By answering these questions, the study aims to inform targeted interventions-particularly those designed for rural areas, lower-education groups, and the oldest age cohorts-and to support ongoing policy efforts to translate high-level ambitions into outcomes that prevent the consolidation of a digital underclass in later life.

2. Methods

2.1 *Participants*

Our sample comprised two hundred and eighty-seven (287) Cypriot individuals above the age of 50 years. We combined online recruitment with in-person participation in a convenience sampling strategy. Specifically, we collected data by (a) distributing an online questionnaire via Google Forms in Social Media groups, and (b) by carrying out on-site sessions at adult day-care centers, where the researchers administered paper versions of the same instrument. Through this method, we included both digitally active older adults and those with limited access. Although not fully representative, the sample captures key demographic characteristics that are relevant to the study's aims. It is important to note that the sample leaned toward residents residing in cities (81%) and participants with higher education (64.5% university graduates). The results could have favored more digitally active demographic groups (Table 1).

Table 1 shows the demographic characteristics of the sample (N = 287). The gender distribution comprised of 53% women and 47% men. The majority's age (51.9%) was 50-64, 32.4% aged 65-74, and 15.4% aged 75 and above. Most participants resided in urban areas (81%), while 19% were from rural locations. Regarding education, 64.5% held a university degree, 25.1% had graduated from high school (Lyceum), and 9.8% had completed elementary school. Employment status varied by age, with 51.9% of participants aged 50-64 still employed, whereas 48.1% of those aged 65 and older were pensioners.

Table 1. Demographic characteristics of the study population

Variable name	Category	*n*	%
Gender	Women	152	53.0
	Men	135	47.0
Age group	50-64 years	149	51.9
	65-74 years	93	32.4
	75+ years	44	15.4
Residence	Urban	232	81.0
	Rural	54	19.0
Education	University	185	64.5
	High school (Lyceum)	72	25.1
	Elementary school	28	9.8
Employment status	Employed (50-64 years)	149	51.9
	Pensioners (65+ years)	137	48.1

2.2 *Instruments*

Our instrument for the study was a questionnaire comprised of twenty (20) items. Besides the Personal Information Form (PIF) gathering information about the demographic characteristics of our sample (Questions Q1-Q4: gender, age, place of residence, educational level), Questions Q5-Q10 explored the participants' preferences and purposes for digital devices (Q5-Q6), the degree of comfort that digitalization has added to their lives (Q7, Q9), the extent to which they need assistance in accessing the digital world (Q8), and the extent to which they believed that digital transactions are safe (Q10). Items Q11-Q20 evaluated digital competencies using the standardized Digital Skills Indicator (DSI), a self-report tool based on the European Digital Competence Framework for Citizens (DigComp).

In the current study we applied a specific adaptation of the DSI's core self-assessment component, translated into Greek, namely a 10-item questionnaire based on the five competence areas of the DigComp. Large-scale surveys such as the European Commission's Digital Economy and Society Index (DESI) and Eurostat's Community Survey on ICT usage in households and by individuals do not use the full, multi-modal DSI. They also utilize a carefully selected collection of questions associated with DigComp to assess the "Basic Digital Skills" indicator for the EU population (Vuorikari et al., 2022). In their assessment of students' digital skills, Mieg et al., (2024) also applied only the 10-item questionnaire, derived from the DigComp framework, (which underpins the DSI) to assess digital competence, omitting the simulations and multiple-choice questions of the entire instrument. Importantly, we did not adapt or alter the DSI; our questionnaire employed the ten original items of the instrument, translated into Greek and standardized for our context. The DSI delivers a thorough assessment of the digital skills of the general public (ages 16 to 65) evaluating competencies across essential domains, such as Information and Data Literacy (Q11-Q13), Communication and Collaboration (Q14-Q15), Safety (Q16) Digital Content Creation (Q19-Q20), and Problem-Solving (Q17-Q18). Each domain has specific competencies: searching for and managing information, online communication and collaboration, creating and sharing digital content, understanding digital safety and privacy, and identifying and solving technical issues. The DSI's first pilot study was in 2014. Today, the instrument monitors the EU's policy objective of empowering at least, 80% of the European population with basic digital skills by 2030 (Vuorikari et al., 2022).

The DSI uses various answering modes to assess digital competence effectively. Apart from the self-assessed competencies, the items also depict behavioral patterns, actual abilities, and skills. Below are the primary answering

modes used in DSI implementations:

- Self-Assessment: Respondents rated their proficiency on a five-point scale. Raters assign scores to responses that correspond with three proficiency levels, namely.

- Basic: Capable of performing essential online activities tasks (e.g., searching for/retrieving information).

- Intermediate: Capable of executing routine, structured duties (e.g., developing presentations, managing social media).

- Advanced: Can perform complex, innovative tasks (e.g., coding, managing cybersecurity risks).

The overall digital skills level is determined by aggregating the scores for each domain. As far as the instrument's reliability is concerned, existing studies using the DSI consistently report strong reliability (α = 0.70-0.92). For the current dataset Cronbach's α was 0.902, confirming excellent internal consistency.

2.3 *Procedure*

In November and December 2023, we collected our data by (a) developing our instrument (questionnaire) on the Google Forms digital platform and (b) disseminating it online in various social media groups, specifically targeting adults 50 years and above. (c) We also held on-site meetings at adult day-care centers to include individuals unfamiliar with accessing and using the Internet. After providing clear instructions, participants at adult day-care centers completed paper versions of the questionnaire in the presence of the researchers.

2.4 *Data analysis*

We analyzed our data by applying descriptive statistics, such as average and standard deviation, to capture individual performance on digital competencies over the ten questionnaire items of the DSI questionnaire. To uncover hidden elements, we performed factor analysis using Principal Component Analysis with Varimax rotation and validated the dataset's appropriateness for factor analysis, as evidenced by a Kaiser-Meyer-Olkin (KMO) score of 0.913 and Bartlett's Test of Sphericity ($p < 0.001$). We retained two components collectively explaining 66.247% of the total variance.

Additionally, we applied chi-square tests of independence to examine possible links between digital literacy and demographic factors. These statistical analyses provided insight into the relationships between age, gender, education level, and place of residence and specific digital competencies. Here, we report only on significant findings ($p < 0.05$). Through Cronbach's alpha, we evaluated the internal consistency of the digital skills scale; the resulting coefficient of 0.902 safeguarded the high reliability of the scale. Through this meticulous approach, we gathered information on the structure of digital skills, demographic influences, and targeted domains for effective interventions.

3. Results

3.1 *Research question 1*

We began by surveying Cypriots aged 50 years and above on their online behaviors, communication abilities, information consumption, and technological usage. The DSI (ten items) evaluated the digital competencies of the participants, covering whether they: (a) used a digital device to search for information online, (b) downloaded and saved files from the internet, (c) looked for websites, (d) sent private messages via email or a digital communication platform, (e) posted comments and shared information online, (f) shopped online and installed digital apps, (g) solved problems with a device or service using online assistance, (h) verified the sources of information found online, (i) filled in online application forms including personal information, and (j) created something new from existing online images, music, or videos. We ranked responses from lowest to highest competence.

In order to categorize these items and identify underlying latent components, we performed factor analysis. The dataset demonstrated strong suitability, with a Kaiser-Meyer-Olkin (KMO) value of 0.913 and a Bartlett's Test of Sphericity p-value at $p < 0.001$, indicating sampling adequacy and correlation between items. Through the Principal Components Analysis with Varimax rotation, we preserved variables with loadings above the thresholds as indicated by Hair et al. (2014). This method resulted in an outcome that accounted for 66.2% of the total variance. Factor analysis

yielded a conclusive two-factor response, reflecting the distinction between basic/operational skills and advanced/strategic skills. Items that loaded strongly on the basic factor were online information searches, file downloads, looking for websites, post comments and private messaging. Troubleshooting, verifying information, completing online transactions, and creating new digital content loaded on the advanced factor. All loadings exceeded conventional thresholds, supporting the stability of the solution (Hair et al., 2014). Table 2 presents the factor structure.

Table 2. Factor loadings for digital competency items (principal component analysis with varimax rotation, $N = 268$)*

Item	Factor 1 (Advanced)	Factor 2 (Basic)
11. Use a digital device to search for information online	0.311	0.702
12. Download and save files from the internet	0.291	0.752
13. Looking for websites	0.167	0.800
14. Send private messages via email or messaging service	0.407	0.728
15. Post comments and share information online	0.302	0.816
16. Shop online and install digital apps	0.637	0.456
17. Solve a problem using online help	0.766	0.325
18. Verify the sources of information found online	0.746	0.311
19. Fill in online application forms with personal information	0.678	0.441
20. Create something new from online images, music, or videos	0.797	0.113

*The number preceding the item indicates the order of the question

The scree plot (Figure 1) confirms the two-factor structure. The curve exhibits a clear inflection point following the second component (eigenvalues bigger than 1). This signifies that subsequent components provided less explanatory value. The graphical evidence of Figure 1 reinforces the distinction between basic and advanced digital skills.

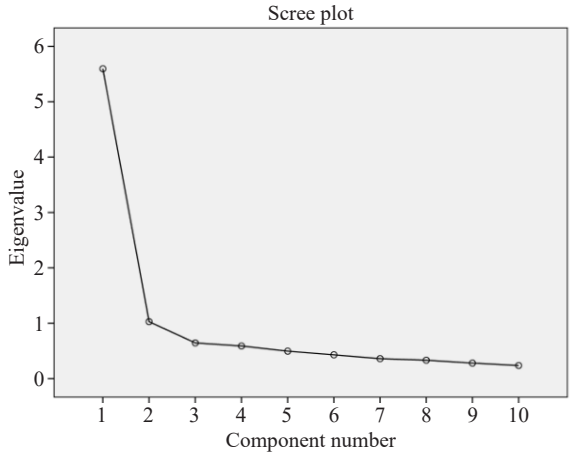

Figure 1. Spree plot of the analysis

3.2 *Research question 2*

To examine the association between digital literacy and demographic variables, we applied chi-square test of independence for age, gender, education, and place of residence. Table 3 shows only the results for significant associations.

Table 3. Chi-square test of association between age and digital competencies*

Item vs Age							
	Q8. Assistance with digital applications						
	Not at all	Little	Enough	A lot	Very much	χ^2 (*df*)	*p*-value
						67.82 (8)	0.001
50-64	63	58	17	2	8		
65-74	20	37	18	9	9		
75+	6	9	6	3	19		
	Q10. Perceptions of digital transaction safety						
	Not at all	Little	Enough	A lot	Very much	χ^2 (*df*)	*p*-value
						20.75 (8)	0.008
50-64	12	21	76	31	7		
65-74	6	22	45	19	1		
75+	9	13	14	4	3		
	Q17. Solving problems using online help						
	I have no idea on what you are referring to	I could not do it if I was asked	I could do it if I was asked			χ^2 (*df*)	*p*-value
						63.00 (4)	0.001
50-64	12	127	9				
65-74	6	65	21				
75+	19	15	9				
	Q20. Creating new digital content from online materials						
	I have no idea on what you are referring to	I could not do it if I was asked	I could do it if I was asked			χ^2 (*df*)	*p-value*
						49.88 (4)	0.001
50-64	18	113	15				
65-74	12	54	25				
75+	22	14	7				

*The number preceding the item indicates the order of the question

As shown in Table 3, our findings indicate the following tendencies regarding age groups and various digital

competencies:

Age showed a statistically significant association with several digital skills. Even though, when performing the chi-square test of association, we cannot know which factors are associated with which, only that there is an overall association, we can still derive the following comments from the descriptive statistics in Table 3. Participants aged 50-64 were the least likely to need assistance in using digital applications. On the contrary, the 75+ group demonstrated the highest dependence. Confidence in digital transaction safety also declined with age: younger participants reported greater trust in online transactions, while older participants expressed skepticism. Similarly, younger groups were more successful at problem-solving, provided they had online help and creating digital content, while older groups were less confident or unfamiliar with these skills.

Table 4 is a summary table that clearly shows which demographic variables are significantly associated with which digital competencies.

Table 4. Chi-square analysis of demographic variables and digital competencies*

Variable-item (Question)							
	Q9. Perception that digitization made life easier						
						χ^2 (*df*)	*p*-value
Gender						11.09 (4)	0.026
	Not at all	Little	Enough	A lot	Very much		
Female	1	8	36	52	53		
Male	5	14	31	28	56		
	Q10. Perceptions of digital transaction safety						
						χ^2 (*df*)	*p*-value
						17.92 (8)	0.022
Education	Not at all	Little	Enough	A lot	Very much		
Primary	7	8	5	5	1		
Secondary	5	16	37	11	3		
Higher	14	31	92	38	7		
	Q20. Creating digital content						
						χ^2 (*df*)	*p*-value
						10.07(2)	0.007
Residence	I have no idea on what you are referring to		I could not do it if I was asked		I could do it if I was asked		
Village	18		27		9		
City	34		154		38		

Gender also significantly influenced the participants' perceptions of whether digitization has made life easier (χ^2 = 11.09, p = 0.026). Women expressed more 'positive' views, with about 35% choosing the option "a lot" and another 35% choosing "very much." Men expressed more polarized views: 40% chose "very much," but fewer than

25% selected “a lot.”

The participants’ educational attainment had a significant impact on their trust and confidence in digital transactions ($\chi^2 = 17.92$, $p = 0.022$). Subjects with higher education demonstrated more confidence, as 75% rated transactions “enough” or “a lot” safe, whereas those with only primary education showed more skepticism, with the majority describing transactions as “not at all” or “little” safe.

Residence also affected digital content creation ($\chi^2 = 10.07$, $p = 0.007$). Urban participants demonstrated greater capability, with almost 20% reporting they could create new digital content. Individuals living in rural areas reported lower competencies; fewer than 10% could perform the task, and nearly one-third said they had “no idea” how to go about it.

4. Discussion

Our research addressed the effects of digital adaptation on the use of digital services by mid-to late-life citizens (50-75+ years). We examined the level of digital knowledge and the potential challenges that older adults encounter, while also assessing their media use in specific areas. Moreover, we investigated the relationship between demographic variables, including age, gender, educational level, and place of residence, and digital activities and skills.

Within this context, our first research question assessed our sample’s degree of digital literacy, online communication skills, information usage, and technological engagement. Factor analysis established a framework with two components, distinguishing between basic and advanced digital competencies. Searching for information online, downloading files from the internet, looking for websites, posting comments and sharing information online and sending private online messages are basic digital competencies, whereas problem-solving, verifying online information, completing digital transactions, and creating new content are part of advanced digital skills. This distinction underscores both the strengths and limitations of the over-50 demographic: although the majority of our participants performed fundamental tasks confidently, their proficiency in performing more complex, cognitively demanding activities varied. Helsper (2012; 2021) argues that digital disparities occur in terms of both access and the variety of skills acquired, often depending on life stage and social context. Our findings are consistent with this concept.

This pattern also aligns with Van Dijk’s (2005; 2020) resources and appropriation theory, which explains that differences in digital engagement arise not only from skills gaps but also from disparities in motivation, material access, and opportunities to apply digital technologies in meaningful ways. Our findings align with broader European research evidence, which shows that older adults frequently encounter challenges with digital engagement, often due to limited skills and insufficient institutional or social support (Schreurs & Quan-Haase, 2017). Köttl et al. (2021) report that in the European Union, 32% of adults aged 65-74 reported never using the Internet as recently as 2020, while a detailed study of Austrian older adults demonstrated that 46.1% of people over 65 did not use a computer or the Internet at all during an entire week (Cohn-Schwartz & Ayalon, 2021).

The second factor aligns with previous research, such as the distinction between basic operational skills and higher-order digital competencies, for example, problem-solving or creating digital content. Van Deursen and Van Dijk (2014) also identified a clear division between foundational digital tasks, such as browsing websites or sending emails, and advanced skills, including solving problems or creating digital content. Their studies in Europe and North America emphasized that people commonly master basic skills while advanced skills require specific training or experience. Moreover, the percentage of variance explained by the two components is also consistent with typical results in digital literacy research.

Eshet-Alkalai (2004) demonstrated that people feel more comfortable engaging in exploratory or familiar digital domains than in tasks requiring higher cognitive effort. Our findings support this notion: While the Cypriot participants demonstrated high competence in basic skills, such as information searches and online messaging, they showed lower proficiency in advanced skills, including information verification and content production. These elaborate tasks often necessitate problem-solving and critical thinking, corresponding with the elevated cognitive requirements identified in earlier studies (Eshet-Alkalai, 2004; Van Deursen & Van Dijk, 2014; Ng, 2012). Ng (2012), for example, asserts that advanced digital literacy implies analysis, assessment, and creation-directly connecting it to critical thinking skills.

Our findings reflect significant ramifications for digital inclusion initiatives. The strong performance in

fundamental competencies skills implies that older adults are not marginalized in daily digital activities. Yet, their poorer performance in advanced tasks highlights the necessity for targeted support. Programs and classes tailored for older adults could center on advanced areas, i.e., the vetting of information on the internet or the creation of digital content, thus enabling participants to advance beyond basic familiarity toward enhanced engagement and critical participation. Our findings directly impact Cyprus's digital inclusion policies and the EU's Digital Compass 2030, which targets 80% of the population to achieve at least basic digital skills by 2030 (Vuorikari et al., 2022).

Our second research question addressed a possible empirical association between specific demographic factors (age, gender, education, and place of residence) and aspects of digital competence by utilizing the chi-square test of independence. The findings reveal clear variations in digital competencies based on age, gender, educational attainment, and geographic location, highlighting the broader social and structural determinants influencing digital engagement.

Findings show significant relationships between age and digital competencies, especially those relating to advanced digital skills. Individuals aged 50-64 demonstrated higher proficiency in problem-solving using online assistance ($\chi^2 = 63.002$, $p < 0.001$) and creating digital content ($\chi^2 = 49.882$, $p < 0.001$) than those aged 65-74 and 75+. Likewise, reliance on support for troubleshooting prevailed significantly among older participants, especially those aged 75+ ($\chi^2 = 67.815$, $p < 0.001$). While older adults more often voiced skepticism about the safety of digital transactions and a greater need for help with basic applications ($\chi^2 = 67.815$, $p < 0.001$), younger participants (50-64) showed a stronger belief in matters of digital trust, such as online transactions ($\chi^2 = 20.752$, $p = 0.008$). These findings align with prior work, which shows that within older cohorts, relatively younger groups tend to perform more advanced digital tasks (Van Deursen & Van Dijk, 2014). Charness and Boot (2022) demonstrated that greater accessibility to the digital world may account for the superior digital performance among the younger subset of older adults (aged 50-64 years) who are still professionally and socially active. Moreover, Helsper and Reisdorf (2017) contend that older generations may regard digital technologies as challenging or unreliable due to limited exposure and unfamiliarity.

This study presents evidence that older adult men were less likely than women to believe technological advances have increased daily convenience ($\chi^2 = 11.093$, $df = 4$, $p = 0.026$) and were more likely to need help from a younger person for complex digital operations. Our findings differ from Kim et al. (2017), who reported older women lagging behind older men in Internet use and device adoption, and from the United Nations Economic Commissions for Europe report (2023) noting a persistent digital gender divide among adults 55-74, with fewer women online than men. Recent findings support this pattern, showing that women-particularly older women-tend to report lower competence in several digital skill areas, including content creation and security (Zhao et al., 2021). In EU countries, barely half as many women aged 55-74 have basic or above-basic digital abilities in comparison to younger demographics. Recent Eurostat (2024) data indicate that younger women are now utilizing the internet for essential services comparably or slightly more effectively than men; nonetheless, women in older age brackets continue to face a greater risk of digital exclusion than their older male counterparts. Analysts attribute this divide to lower incomes, reduced educational attainment, interrupted careers due to caregiving, employment in roles with minimal digital demands, barriers to training, lower financial literacy, poorer connectivity, and affordability constraints for devices and subscriptions (see United Nations Economic Commissions for Europe Report, 2023; Eurostat, 2024).

The educational level influenced significantly our subjects' confidence in digital transaction safety ($\chi^2 = 17.915$, $df = 8$, $p = 0.022$). Individuals with higher education demonstrated significantly more trust than those with primary education, a pattern that corresponds with previous studies showing correlations between higher education and elevated levels of digital competence (Van Deursen & Van Dijk, 2014). Education provides exposure to and access to advanced tools, fosters critical thinking, and cultivates effective learning habits. Ugwu's findings (Ugwu et al., 2021) reveal a positive association between education and digital security awareness, indicating a strong relationship between higher educational attainment and better cyber-hygiene knowledge and practices. Similarly, Luić et al. (2021) demonstrate that information security improves with increased understanding and awareness of identification and authentication concerns. These findings emphasize the importance of blending digital literacy into lifelong learning, particularly for people with limited formal education.

Residents in the cities displayed a noticeable advantage in creating digital content ($\chi^2 = 10.070$, $df = 2$, $p = 0.007$) and performed significantly better than rural residents. Our findings align with those of international research, which consistently detects residence-based differences in digital competencies. According to a Pew Research Center analysis (2021), the fact that adults in rural areas of the U.S. are less likely than their urban peers to own multiple gadgets or

have high-speed internet at home hinders the development of their digital competencies. When Feurich et al. (2024) recently compared urban-rural populations in Europe, they found a similar trend to the U.S.A. Charness and Boot (2009) also report urban-rural disparities due to unequal infrastructure and training opportunities, and Lee's research with older people (Lee et al., 2021) demonstrates that people in rural areas are less likely to use the Internet and engage in technological activities. Our results also suggest that increased exposure to digital tools and resources in urban settings leads to greater digital competency. Targeted measures are needed to bridge this gap, such as training initiatives and reliable broadband in remote areas.

4.1 *Implications for digital skill development*

Beneito-Montagut et al. (2022) attribute the disparate application of technology to conventional axes of inequality and sociodemographic variables, national policies, cultural influences, and life course considerations (Givskov & Deuze, 2018). It is crucial to highlight that digital technologies can be built explicitly for older individuals (Gonçalves et al., 2017; Sin et al., 2021). From our findings, it becomes clear that designers should create specific educational programs to improve advanced digital skills in older adults, since younger participants appear to have higher levels of digital skill proficiency. The strong positive correlation between age and advanced digital tasks (for instance, creating new digital content online or troubleshooting problems using the Internet) lends weight to the idea that such abilities are underdeveloped among elderly participants and need focused support efforts. Older participants may have deficiencies in basic skills and the confidence to use them, relying heavily on external help. Van Dijk (2020) noted the necessity of well-structured training programs that focus on gaps in digital competence, especially those that deal with the proper use of digital tools for critical evaluation and innovative application.

"Targeted workshops in the UK and Sweden have measurably improved older adults' digital engagement". They helped develop advanced skills, including identifying online misinformation and creating digital presentations (Helsper & Reisdorf, 2017). Community centers, universities, and public library initiatives facilitated workshops to improve digital literacy among older adults. We could obtain similar results for Cypriot adults over 50 by replicating such programs. Doing so for Cypriot adults over 50 could yield similar benefits, bridging the gap between basic and advanced digital competencies. These suggestions are in line with the EU's Digital Compass 2030 and Cyprus's National Digital Strategy, both aiming for at least 80% of EU citizens to have a basic understanding of digital technology by 2030 (Vuorikari et al., 2022). To achieve these goals and mitigate further disparities in digital engagement, addressing the advanced-skills gap among Cypriot adults over 50 is crucial for meeting these targets and preventing future inequalities in digital participation.

4.2 *Limitations*

This research has the following identifiable limitations: 1. While the DSI is widely used, it relies on self-reported data, which may introduce bias in the participants' evaluation of their digital skills. 2. Although the chi-square test does permit some knowledge into associations, it cannot tell us anything about cause and effect, thus limiting the interpretation of our findings. 3. Even though our sample size is representative of research in Cyprus, an expanded sample could include a broader range of demographics (e.g., socioeconomic status or occupational history), which could enhance the generalizability of the findings on digital literacy across older people, i.e., most of the participants lived in urban areas (80.5%), thus demonstrating an underrepresentation of third-age adults residing in rural areas. This urban overrepresentation may result in somewhat exaggerated assessments of digital competence, since rural populations generally have lower access to broadband and limited opportunities for digital training (Feurich et al., 2024). 4. The use of a five-point confidence scale for the DSI items provided a more nuanced measure of perceived ability than a simple binary or three-point scale would have allowed. While the instrument we applied differs from conventional Likert-type frequency scales, we deliberately selected it to capture participants' perceived ability rather than frequency of use. We recognize that this choice narrows the range of statistical techniques available, yet it remains appropriate for our chi-square analyses and reliability assessments (Cronbach's $\alpha = 0.902$).

Notwithstanding its constraints, our study provides significant insights into the digital competencies of Cypriot adults aged 50 and above, highlighting the need for future research in this field. A broader sample size and a more representative population in future studies would yield a clearer picture of digital literacy trends in Cyprus. Longitudinal

studies could evaluate if there are significant shifts in digital competencies over time, particularly after educational interventions and/or advances in technology. Furthermore, our data indicates that chronological age is the primary obstacle to digital literacy. Future research should explore other possible age definitions, including functional age, lifespan, subjective or psychosocial age, and performance-based age. Such a study potentially broadens the understanding of why many older people remain non-users.

Additionally, investigating the links between digital skills and such variables as education, employment, and access to digital tools will provide greater insight into the factors influencing digital literacy among older adults. Last, but not least, people over 50 often face issues that arise due to changes in their cognitive or physical functions. A study that also considers the factors contributing to health problems may present new data in the results.

5. Conclusion

Modern technologies have become indispensable for full and equal social participation in an increasingly digitalized world. However, disparities in access and skills—often referred to as the digital divide—persist, particularly among older adults. Worldwide, access to and use of digital technologies vary according to gender, age, education, region, and income. The digital gap may intensify existing inequalities and generate new ones within and between countries. Our study revealed significant age-related disparities in digital literacy ability among those aged 50 and over. Participants aged 50-64 consistently showed higher seniority, even in advanced digital skills, compared to older people, highlighting the need for courses tailored toward different age brackets. Once they address these deficiencies, policymakers and educators can promote digital technology more effectively as an ongoing force. This study's findings augment the existing body of research on digital skills and their role in promoting inclusivity and empowering older citizens in the digital era. Helsper and Reisdorf (2017) asserted that digital exclusion stems from inequalities in access and skills. Our study emphasizes the importance of the disparity between fundamental and advanced competencies to foster inclusivity; hence, targeted interventions could empower older adults to participate fully in an increasingly digital society. Policymakers should therefore integrate these findings into targeted national initiatives that bridge the gap between basic and advanced digital competencies, ensuring that older adults are not left behind as Cyprus advances toward its digital transformation goals.

Acknowledgment

This work is supported by the European Cooperation in Science and Technology (COST) Action CA21107-DIGI-net: Work Inequalities in Later Life Redefined by Digitalization, funded by the COST.

AI acknowledgment

During the preparation of this work the authors used ChatGPT to improve language and readability. After using this tool/service, the authors reviewed and edited the content as needed and they take full responsibility for the content of the publication.

Ethics statement

We informed all participants of the study's aims and their right not to participate or to withdraw from the study at any time. Signing a consent form marked their participation agreement. Only the research team members had access to raw data materials, thus ensuring the confidentiality of the participants' answers.

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Ethics Committee of the Resilience Research Unit of the Department of Psychology and

Social Sciences (Frederick University, ERRU220095, 20/10/2023).

Funding

The study did not receive any external funding.

Conflict of interest

The authors have disclosed no conflicts of interest.

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