Advancing Digital Empowerment: The Next Phase of the Capacid@de Digital Initiative

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Abstract. This paper details the strategic modifications implemented in the latest phase of the Capacid@de Digital initiative. Building upon an analysis of earlier actions—presented in a previous publication—this article focuses on the iterative changes designed to enhance the initiative's impact on digital inclusion among seniors. The initiative harnesses the skills and enthusiasm of higher education institution student volunteers, who deliver tailored digital training to an elderly population. We describe the process of refining the training methodologies to better meet the needs of seniors and volunteers. This study contributes to the growing body of literature on volunteer-led digital training and offers a replicable model for similar community-based programs aimed at reducing the digital divide.

Keywords: Digital Literacy, Senior Digital Inclusion, Volunteer-Led Training, DigComp Framework, Community-Based Education.

1 Introduction

The Capacid@de Digital initiative [1] addresses the digital divide affecting seniors in the Tâmega e Sousa region of northern Portugal, where limited digital proficiency contributes to social isolation and restricted access to online services. Recognizing these barriers, the program fosters digital inclusion by providing structured training in fundamental digital skills, thereby promoting autonomy and participation in the digital society.

A distinctive feature of Capacid@de Digital is its volunteer-driven approach, leveraging students from the Escola Superior de Tecnologia e Gestão do Politécnico do Porto (ESTG|IPP). Under the supervision of academic staff, who also volunteer their time, these students facilitate training sessions in municipal venues, ensuring accessibility and local engagement. This model benefits all parties involved: seniors acquire essential digital skills, students develop transferable competencies, and both students and academic staff enhance their community engagement—an aspect increasingly emphasized in higher education.

The initiative is structured around the DigComp-based INCoDe.2030 framework [2], offering 38 modular training units across foundation and intermediate levels. These modules encompass basic computing, internet navigation, online services, digital communication, content creation, cybersecurity, and data protection, equipping participants with the competencies necessary to engage in digital environments. The curriculum integrates a diagnostic assessment to personalize learning trajectories, ensuring that training is tailored to individual needs. By aligning with national digital inclusion strategies, the initiative benefits from institutional support from the

Secretary of State for Digital Transition and Portugal Digital, reinforcing its impact and scalability.

Following an initial implementation phase [3], a prior study [4] analysed key outcomes, highlighting measurable improvements in digital competencies among senior participants while also identifying challenges they encountered in engaging with digital tools. Building on these findings, this study shifts focus to the organizational challenges faced by the initiative, particularly those related to the structuring and coordination of a volunteer-based model within a higher education institution (HEI). Given the unique dynamics of HEI-led volunteer programs, specific factors—such as volunteer availability, training standardization, and long-term sustainability—must be considered to enhance program effectiveness. This research presents the modifications implemented and how they address these challenges while ensuring the program remains effective and adaptable to the specific needs of both volunteers and senior participants.

This paper is structured as follows. Section 2 reviews related work on digital literacy programs for seniors, student-led volunteer training, and the DigComp framework [5] and its implementation the INCoDe.2030 initiative. Section 3 introduces the Capacid@de Digital initiative, its goals, and challenges from the first phase. Section 4 outlines the improvements made and how these changes align with the DigComp framework. Finally, Section 5 presents conclusions, key insights, and recommendations for future digital inclusion efforts.

2   Related Work

Digital literacy is a crucial skill for full participation in contemporary society, influencing access to information, social interactions, public services, and economic opportunities. As daily activities become increasingly digitalized, older adults remain one of the most digitally excluded demographics, facing distinct technological, cognitive, and socio-economic barriers [6].

Older adults face multiple barriers that hinder their engagement with digital technologies, limiting their access to essential services and opportunities for social participation. A significant challenge is the lack of prior exposure, as many seniors did not grow up using digital tools, leading to unfamiliarity and low confidence in navigating computers, smartphones, and the internet. This often results in anxiety and fear of making mistakes, further discouraging their willingness to engage with digital platforms [7]. Cognitive and physical limitations associated with aging also pose challenges, as declines in working memory, processing speed, and sensory abilities can make it difficult to adapt to digital environments. Many digital interfaces are not designed with older users in mind, with small fonts, complex navigation, and fast-paced interactions creating accessibility barriers. Additionally, dexterity issues, such as arthritis, can further complicate tasks like typing or using touchscreens [6, 8].

Despite the challenges associated with digital literacy, acquiring these skills offers significant benefits for older adults. Digital proficiency fosters social inclusion by enabling seniors to stay connected with family and friends through video calls, messaging apps, and social media, reducing loneliness and depression [9]. Additionally, as essential services such as banking, healthcare, and government resources increasingly move online, digital literacy helps prevent exclusion and reduces dependence on others [10]. Access to digital tools also supports lifelong learning and cognitive stimulation, providing opportunities to engage with educational content, news, and online courses, which contribute to cognitive health and may delay the onset of dementia. Furthermore, digital literacy enhances cybersecurity awareness, equipping older adults with the skills to recognize phishing

attempts, securely manage passwords, and identify misinformation, reducing their vulnerability to online fraud and scams [11–13].

Beyond these cognitive and physical constraints, motivational factors also play a crucial role in digital exclusion. Many older adults question the practical benefits of digital literacy, particularly if they have managed most of their lives without digital tools. Research suggests that perceived usefulness is a stronger predictor of technology adoption among seniors than technical complexity, meaning that when digital tools are not seen as relevant to daily life, seniors are less likely to engage with them [14, 15]. Socio-economic factors further exacerbate digital disparities, particularly among low-income and less-educated seniors who may lack access to affordable devices and internet connections. Additionally, social isolation and limited support networks can reduce opportunities for learning, making it more difficult for older adults to develop digital skills [12]. Addressing these barriers requires targeted strategies to enhance accessibility, motivation, and support, ensuring that seniors can fully participate in an increasingly digital society.

To bridge the digital divide among seniors, various strategies have been proposed to enhance digital literacy and promote engagement. Intergenerational learning models, where younger volunteers mentor older adults, have proven effective in creating a supportive learning environment and reducing generational stereotypes [16]. Additionally, simplified and accessible learning materials help accommodate different learning paces [8]. Personalized learning pathways, tailored to individual needs and interests, improve engagement and retention by focusing on practical applications such as video calls for social interaction or online banking for financial management [10]. Community-based digital training initiatives, offered through libraries, community centers, and HEI-led volunteer programs, have also proven successful in reaching digitally excluded seniors [17, 18].

Several initiatives have been developed to bridge the digital divide, ranging from governmental programs to community-based interventions [19]. These efforts encompass various formats, including dedicated Digital Literacy Workshops delivered face-to-face [20]. Research also evaluates the effectiveness of Blended Digital Literacy Workshops, which integrate online learning components like Learning Management Systems (LMS) [20]. Intergenerational projects serve as another significant approach, exemplified by the "Digital Partners" project where teenagers provided instruction to older adults on using smartphones and tablets [21]. Similarly, the Australian "Grandparents and grandsons" project facilitated older adults' use of the internet and email with the assistance of students [20]. These initiatives underscore the commitment to equipping older adults with essential digital skills and confidence [20].

These initiatives often draw upon existing frameworks that clarify digital competencies and their levels, such as the European Digital Competence Framework for Citizens (DigComp) [22].

The DigComp framework has been widely adopted to standardize digital literacy training, particularly in initiatives targeting older adults [23]. DigComp is a reference framework that provides a common understanding of what digital competence is and serves as a basis for the development of digital skills policies and initiatives across Europe [5]. The framework is designed to be technology-neutral and is intended to help citizens engage confidently, critically, and safely with digital technologies. DigComp is structured around five key areas of digital competence [5] (see Table 1).

Table 1. DigComp Conceptual Reference Model (based on [5]).

Area	Competences
1. Information and data literacy This area focuses on the ability to articulate information needs, to locate and retrieve digital data, information, and content, to judge the relevance of sources, and to manage and organize digital information.	1.1. Browsing, searching and filtering data, information and digital content 1.2. Evaluating data, information and digital content 1.3. Managing data, information and digital content
2. Communication and collaboration This area covers interacting, communicating, and collaborating through digital technologies while being aware of cultural and generational diversity. It also includes participating in society through digital public and private services and managing digital identity.	2.1. Interacting through digital technologies 2.2. Sharing through digital technologies 2.3. Engaging in citizenship through digital technologies 2.4. Collaborating through digital technologies 2.5. Netiquette 2.6. Managing digital identity
3. Digital content creation This area focuses on creating and editing digital content, integrating and re-elaborating digital content, understanding copyright and licenses, and programming.	3.1. Developing digital content 3.2. Integrating and re-elaborating digital content 3.3. Copyright and licences 3.4. Programming
4. Safety This area pertains to protecting devices, personal data and privacy, health and well-being, and the environment in digital contexts.	4.1. Protecting devices 4.2. Protecting personal data and privacy 4.3. Protecting health and well-being 4.4. Protecting the environment
5. Problem-solving This area covers resolving technical problems, identifying needs and technological responses, using technology creatively, and identifying gaps in digital competence.	5.1. Solving technical problems 5.2. Identifying needs and technological responses 5.3. Creatively using digital technologies 5.4. Identifying digital competence gaps

The DigComp framework has been updated several times since its initial publication in 2013. The most recent version is DigComp 2.2, which updates the examples of knowledge, skills, and attitudes that are applicable to each competence within the framework. These examples aim to illustrate how individuals can interact with both common and emerging technologies, like Artificial Intelligence.

The framework also outlines different levels of proficiency, illustrating the progression in the acquisition of digital competence. These levels range from foundation to highly specialized, allowing for a structured approach to learning and assessment. DigComp can be used by individuals to assess their digital competence, by educators to develop curricula, and by policy makers to design digital inclusion initiatives [5].

The framework has also been used to construct the Digital Skills Indicator (DSI), which is used to set policy targets and monitor the Digital Economy and Society Index (DESI) [24]. DigComp is also used in the Europass CV, allowing job seekers to

evaluate and include their digital competence in their CVs [5]. The DigComp framework has been translated and adapted for use in different countries.

By structuring training content into progressive levels of competence, DigComp-based programs allow for personalized learning pathways that address key areas such as data literacy, communication, and cybersecurity. The integration of DigComp in programs like INCoDe.2030 demonstrates its effectiveness in shaping national digital literacy policies [25].

INCoDe.2030 is a Portuguese national initiative that aims to enhance digital skills among the population, promoting a more equitable, competitive, and sustainable society. It is strongly based on the DigComp framework, adapting it to the specific context of Portugal. INCoDe.2030 uses the DigComp framework as a foundation for its digital competence initiatives. The initiative recognises the DigComp framework as a key European reference for understanding and developing digital skills. To make the DigComp framework more relevant to the Portuguese context, INCoDe.2030 developed the Quadro Dinâmico de Referência de Competência Digital (QDRCD) [2]. The QDRCD is a national framework based on DigComp, adapting its concepts to the Portuguese reality. The QDRCD maintains most of the competences defined in DigComp 2.1 but with some modifications in the naming of the areas and the descriptions, and it excludes the Programming competence (3.4. on Table 1) since it is covered by other competences. By basing its framework on DigComp, INCoDe.2030 ensures that its initiatives are aligned with European standards, and it supports the development of digital skills that are relevant for both individual and societal progress within Portugal. Under the umbrella of INCoDe.2030, more than 1,200 initiatives[1] have been implemented across Portugal, aiming to enhance digital literacy and inclusion at various levels.

3 The Capacid@de Digital Initiative: Scope and Initial Implementation

Higher education institutions (HEIs) play a critical role in digital inclusion by leveraging student volunteers to support community-based training programs [16]. Research suggests that HEI-led digital literacy initiatives benefit both seniors and students, fostering intergenerational learning and providing students with real-world problem-solving skills [26]. However, organizational challenges exists, such as volunteer turnover, pedagogical consistency, and program scalability, which must be addressed to ensure long-term success

The Capacid@de Digital initiative [1, 3], developed by the HEI Escola Superior de Tecnologia e Gestão do Politécnico do Porto (ESTG|IPP), addresses the growing digital divide in the Tâmega e Sousa region by fostering digital literacy among adults through a structured, volunteer-led training program. The initiative emerged in response to the increasing technological demands of contemporary society, where limited digital skills contribute to social exclusion, reduced access to essential services, and diminished civic participation. Recognizing these challenges, the project leverages student volunteers to deliver training sessions, equipping participants with the necessary competencies to navigate digital environments effectively.

Digital transformation has reshaped access to information, social interaction, and economic opportunities, yet many adults—particularly those from socioeconomically disadvantaged backgrounds—struggle with fundamental digital tasks. The initiative aligns with Portugal's INCoDe.2030 program. It aims to provide participants with a structured learning pathway tailored to their individual needs. The training curriculum consists of 38 modules categorized into foundational and intermediate levels,

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[1] www.pontodigital.pt

covering key digital competencies such as basic computer operation, internet navigation, digital communication, cybersecurity, and online services usage. A diagnostic questionnaire is employed to assess initial skill levels and create personalized learning paths, ensuring that each participant receives instruction relevant to their existing knowledge and digital needs.

The pedagogical model relies on student volunteers, who are responsible for delivering training sessions under the supervision of academic staff. This approach fosters intergenerational learning, benefiting both participants and volunteers by encouraging knowledge exchange and promoting civic engagement among students [27, 28]. Academic staff gain closer community proximity, enhancing their understanding of local needs and strengthening their role as active contributors to societal development. The training sessions are conducted in municipal spaces across different municipalities, allowing greater accessibility and minimizing logistical barriers for participants. The initiative's methodology underscores the importance of localized, face-to-face learning experiences, particularly for populations with limited prior exposure to digital technologies. The initiative not only contributes to reducing digital exclusion within Tâmega e Sousa but also serves as a case study for how HEIs can effectively engage with local communities.

To comprehensively address the competencies outlined in the reference framework for the designated proficiency levels—foundation and intermediate—a total of 38 training modules were developed (see

Table **2**). Each module is categorized by a unique code, title, number of training sessions, and total instructional hours, presented in the format *number_of_sessions/number_of_hours*. Additionally, the table specifies the competence area (see Table 1), incorporating an Area 0 dedicated to basic computer skills, and indicates the proficiency level, denoted as F for foundation and I for intermediate. As can be observed from

Table **2**, some of the training modules were defined to cover different areas of competencies (e.g., 6 in Information Literacy and Communication and Citizenship) or both levels of proficiency (e.g., 31 in Solution Development).

Table 2. Capacid@de Digital Reference Model.

Code	Name	s/h	Area	Proficiency
0.1	First Contact with a Computer	1/3	0	F
0.2	First Steps in Windows	2/6	0	F
0.3	Basic Use of IT Tools	1/2	0	F
1	Surfing the Internet	1/3	1	F
2	Advanced Internet Searches	1/2	1	I
3	Digitization of Information	1/2	1	F
4	Digital Transition	1/2	1	I
5	Digital Storage	1/2	1	F
6	Digital Information Management	1/3	1, 2	I
7	Electronic Mail	1/3	2	F
8	Curriculum Vitae Online	1/3	2	F
9	Online Calling and Videoconferencing Services	1/2	2	I
10	Online Presence Creation - Youtube	1/3	2	I
11	Online Presence Creation - Blogs and Websites	1/3	2	I
12	Social Networks	1/4	2	F
13	Use of Public Services Online	2/6	2	F
14	Homebanking	1/3	2	I
15	Text Processing	2/8	2, 3	F

16	Spreadsheet	2/8	2, 3	F
17	Basic Image Treatment	1/3	2, 3	F
18	Digital Presentations	1/3	2, 3	I
19	Spreadsheet - Data Analysis	1/3	2, 3	I
20	Basic Video Editing	1/3	2, 3	I
21	Cyberbullying and Virtual Harassment	1/2	2	F, I
22	Credentials Management	1/2	2	F
23	Digital Mobile Key	1/3	2	I
24	Digital Information	1/2	3	F
25	Digital Writing	1/2	3	I
26	Data and Equipment Protection	1/2	4	F, I
27	Cybersecurity	1/3	4	F, I
28	General Regulation on Data Protection	1/3	4	F, I
29	e-Health	1/2	4	F, I
30	e-Environment	1/2	4	F, I
31	Use of Digital Equipment	1/3	5	F, I
32	Time and Task Management Tools	1/2	5	F
33	Online Forms	1/2	5	I
34	Collaborative Project Management Tools	1/3	5	I
35	Digital Evolution	1/2	5	F, I

The study presented in [4] examines the role of digital literacy in promoting active aging, focusing on the Capaci@de Digital initiative. Active aging emphasizes continuous engagement in social, educational, and civic activities, which is increasingly dependent on digital competencies. However, older adults often face barriers to digital inclusion, including lack of prior exposure, cognitive limitations, and motivation issues. The study employs questionnaires, interviews, and focus groups with 20 participants aged 60 to 90 years to evaluate the impact of digital training on social inclusion, digital empowerment, and quality of life. Findings indicate that participants acquired essential digital skills, improving their ability to navigate online services, communicate digitally, and engage with technology. Moreover, the program fostered relationship-building among participants, promoting social inclusion and reducing isolation. Despite the positive outcomes, challenges such as session frequency, need for continued support, and accessibility were identified. The study underscores the importance of lifelong learning in enabling older adults to remain active members of society. By aligning with national digital strategies like INCoDe.2030, initiatives such as Capaci@de Digital can enhance digital literacy, foster social inclusion, and contribute to healthier aging. Future work should explore scalability, long-term impact, and expanded access to maximize the benefits of digital literacy for older populations.

Although the positive impact of the Capaci@de Digital initiative has been evident in promoting digital inclusion among seniors, its expansion has also brought organizational challenges that affect its efficiency, sustainability, and overall impact. These challenges primarily concern scheduling logistics, participant engagement, volunteer retention and management, and curriculum structure, all of which influence the effectiveness of training sessions and the learning experience of participants.

One significant challenge was scheduling and session frequency. Initially, training sessions were spread over an extended period, often spanning more than one semester. While this structure aimed to offer in-depth learning opportunities, it unintentionally led to low retention rates among participants. The long intervals between sessions made it difficult for seniors to maintain motivation and retain acquired skills, requiring constant reinforcement and review. Furthermore, inconsistencies in scheduling—resulting from venue availability, volunteer

coordination, and participant constraints—further complicated the process, making it challenging to ensure a structured and continuous learning path. In addition to scheduling difficulties, resource constraints also impacted program efficiency. The initiative relied on municipal venues, which were not always adequately equipped with updated computers, stable internet connections, or accessible facilities, occasionally causing delays or limitations in training delivery.

Volunteer availability and turnover posed another significant obstacle. The Capaci@de Digital initiative initially aimed to retain a stable volunteer-participant relationship throughout a semester, ensuring continuity in learning and fostering stronger connections between seniors and student trainers. The goal was to have volunteers remain with the same group of participants for an entire semester, allowing for personalized instruction, trust-building, and a structured progression in digital skill acquisition. However, this proved difficult due to the extensive number of training modules, which often extended beyond the timeframe of a single semester. With 38 modules covering a wide range of digital competencies—from basic computer skills to cybersecurity—the curriculum outlasted the availability of volunteers, leading to disruptions in instruction and inconsistencies in teaching approaches. Table 3 presents the number of student volunteers and academic staff involved in the last four actions of the initiative. The initiative has performed a total of four actions across different locations. Action 1 was delivered in the Municipality of Baião, covering five civil parishes: Ancede, Frende, Gove, Tresouras, and Viariz. During this phase, we successfully completed the first four modules. Actions 2, 3, and 4 were carried out at the Centro Intergeracional da Lixa in the Municipality of Felgueiras. Action 2 consisted of 9 modules, Action 3 also involved 9 modules, and Action 4 included 8 modules. These three actions allowed us to complete the entire foundation level of the program.

Table 3. Number of student volunteers and academic staff involved in the initiative.

	Action 1	Action 2	Action 3	Action 4
Volunteers	5	6	6	4
Academic Staff	5	5	5	5

As student volunteers had to rotate due to academic obligations, exams, or internships, participants frequently experienced instructor changes, which disrupted the learning flow and sometimes led to repetition of topics or gaps in instruction. This mismatch between the intended duration of volunteer engagement and the length of the training program also contributed to participant disengagement. Seniors particularly benefited from consistent guidance, but when volunteers changed, they often had to adjust to different teaching styles, which occasionally hindered learning progression. Additionally, some participants who required more time to grasp digital concepts found it challenging to adapt to new volunteers, as previous trainers had already developed tailored teaching approaches to address their specific needs.

Addressing these organizational challenges requires a reassessment of the program structure to better align training duration with volunteer availability.

4   Modifications and Strategic Enhancements

To overcome the organizational challenges identified in the Capaci@de Digital initiative, a series of strategic improvements will be implemented to enhance

efficiency, sustainability, and learning continuity. Participant observation was employed as a qualitative research technique during the different stages of the project, with a special focus in sessions of the latest phase of the Capacid@de Digital initiative. Participant observation includes the researcher's participation in a variety of activities over a period, the main goal is to observe the participants and to engage in their activities to facilitate a better understanding of behaviors and activities [29]. In our case, researchers actively engaged in the training environments, interacting with both senior participants and student volunteers while simultaneously observing behaviors, practices, and social dynamics related to digital learning and empowerment. By engaging themselves in the process, the researchers were able to capture insights into how the training methodologies were received, how digital skills were being internalized by the elderly participants, and how volunteers adapted their approaches. This hands-on approach [30] allowed for a more empathetic and in-depth understanding of the evolving interactions and challenges faced during the digital inclusion process. It brough informal discussions about technology, behavioral changes in digital engagement, adaptation of teaching strategies by volunteers, and evolving perceptions of digital autonomy among the elderly. This approach contributed to a richer, contextually grounded understanding of the program's impact.

First, by introducing the following non-curricular adjustments, the initiative aims to increase engagement, improve knowledge retention, and build a more sustainable volunteer structure, all while ensuring the continued delivery of comprehensive digital literacy training for seniors.

Scheduling will be enhanced by establishing fixed training cycles throughout the semester, ensuring regular and predictable sessions. Instead of ad hoc scheduling that depends on venue availability, securing predefined time slots and spaces in collaboration with municipal partners would enhance consistency. Additionally, structuring sessions into shorter but more frequent sessions could help maintain participant engagement and reduce knowledge loss between sessions.

To address volunteer turnover, a team-based volunteer system will be introduced, where each participant group is assigned two or more volunteers who rotate responsibilities, ensuring that at least one familiar volunteer is always present. This approach will provide continuity in learning, minimizing disruptions caused by volunteer availability fluctuations. Additionally, having multiple volunteers per group will allow for greater flexibility and more personalized support, ensuring that participants receive consistent guidance while also fostering a more engaging and supportive learning environment. Furthermore, developing a more structured onboarding program for new volunteers—including training in digital pedagogy and a repository of instructional materials—could help standardize teaching approaches and minimize inconsistencies when transitions occur.

To enhance instructional continuity, a participant progress tracking system will be implemented. This could include digital or physical learning logs, where volunteers record participant progress, challenges, and areas requiring reinforcement. By maintaining these records, new volunteers can quickly adapt their teaching strategies to meet the specific needs of each participant, preventing repetitive instruction and reducing learning gaps.

Additionally, providing convenient resources remains a key priority. Ensuring that municipal venues are consistently equipped with standardized hardware, reliable internet access, and accessibility features is vital to preventing training delays and inconsistencies across locations. Efforts will continue to seek funding opportunities through project submissions, institutional grants, and strategic partnerships to support the initiative's long-term sustainability and scalability.

To optimize the curriculum structure and improve the sustainability and effectiveness of the Capaci@de Digital initiative, we will implement two key changes: focusing on the foundation level of proficiency and restructuring content

into a more suitable set of 10 modules (of two hours) instead of the 26 previously offered in the first phase.

The first major adjustment involves postponing the intermediate level to focus on the foundation level, ensuring that participants develop digital skills at a basic level with autonomy while receiving appropriate guidance when needed, as defined in DigComp. This approach allows for a more structured assessment of its impact on seniors' well-being and digital empowerment, reinforcing core competencies before advancing to more complex skills. No Intermediate sessions will be introduced at this stage, as we prioritize strengthening the core structure of the initiative and refining its pedagogical approach. By reinforcing the foundational digital competencies and improving participant engagement, we aim to establish a solid base for future program expansion, ensuring that when the Intermediate level is introduced, it builds upon a well-structured and effective learning model.

To ensure a clear understanding of the impact of the modifications introduced in this phase, we plan to implement a comprehensive evaluation in the next stage of the *Capacid@de Digital* initiative. This evaluation will build on the methodology established in the previous study, incorporating diagnostic questionnaires, participant feedback, and practical assessments based on the DigComp framework to measure improvements in digital competence among senior participants. By maintaining consistency with earlier evaluation methods, we aim to ensure comparability of results and transparently demonstrate the effectiveness of the revised training modules and organizational strategies. This approach will not only quantify learning outcomes and engagement but also support the ongoing refinement of the program, contributing valuable evidence to the broader discourse on digital inclusion and active aging.

The second adjustment focuses on grouping content to create a manageable set of 10 modules, ensuring that the training remains feasible within a single semester. This restructuring allows student volunteers to deliver the sessions effectively, while also providing adequate time for preparation and flexibility to accommodate unforeseen events. By aligning the number of modules with realistic time constraints, we enhance both the learning experience for participants and the teaching conditions for volunteers, reducing burnout and turnover. Additionally, reducing the number of modules benefits participant engagement, considering the particular profile of the senior learners. It is preferable to establish a clear timeline, as many participants face personal constraints that can hinder long-term or uncertain commitments. Factors such as health issues, medical treatments, and family responsibilities (e.g., caregiving for grandchildren) often affect their ability to consistently attend training over extended periods. By structuring the program within a defined timeframe, we provide a more accessible and predictable learning experience, increasing motivation, retention, and overall participation.

Table 4 to Table 13 present the new modules struture for the initiative. Each table includes the category and a description of the contents of the module, while the last column specifies the corresponding competence (see Table 1). The final row of each table outlines a praticl activity to be completed for the module.

Table 4. Module 1 – Introduction to Computers, Windows and Digital Storage.

01	Category	Description	Comp.
	Windows Environment and Navigation	Basic concepts: turning on the computer, using the mouse and keyboard, identifying the desktop, Start menu, and icons.	1.1
	Organization and Storage	Creating, renaming, and organizing folders and files (data storage and retrieval).	1.3
	Technical Problem-Solving	Identifying and resolving simple issues (e.g., difficulties saving or opening files).	5.1
	Device Protection	Basic guidelines for keeping the device secure and	4.1

		organized.	
	Practical Activity		
	Exploring the Desktop: Each participant, guided by the instructor, will create a folder named "My Documents", save a simple text file, and, if any difficulties arise (e.g., an error while saving), discuss possible solutions in a group.		

Table 5. Module 2 – Internet Navigation, Research, and Source Evaluation.

02	Category	Description	Comp.
	Basic Internet Use	Opening and using a web browser (e.g., Chrome or Firefox), entering website addresses, and using search engines to find information.	1.1
	Source Evaluation	Tips for identifying secure, reliable, and relevant websites.	1.2
	Research on Cross-Cutting Themes	Guidance on searching for information related to E-health, E-environment, GDPR, and Digital Evolution on government or institutional websites for use in future activities.	1.1, 4.[1-4]
	Practical Activity		
	Simple Research: Each participant will select a topic of interest and conduct a basic Internet search, noting key information, such as how websites address data protection or environmental issues. These notes will be stored on a storage device (e.g., USB drive) and will be used in Module 10.		

Table 6. Module 3 – Email, Sharing, and Netiquette.

03	Category	Description	Comp.
	Basic Email Use	Creating, sending, replying to, and archiving messages, with an emphasis on proper and secure usage.	2.1
	Content Sharing	Guidelines for sharing information (e.g., sending documents and photos) with a simple indication of authorship.	2.2
	Netiquette	Basic online behavior norms and appropriate communication.	2.5
	Personal Data Protection	Simple security practices, such as creating and properly using passwords.	4.2
	Practical Activity		
	Safe and Polite Email: With guidance, participants will create an email account and send a message to a colleague or the instructor. The exercise will emphasize clear writing, adherence to netiquette, and data protection (e.g., avoiding the sharing of sensitive personal information). The email content and key takeaways from the activity will be saved on a storage device (e.g., USB drive or cloud storage) for future reference.		

Table 7. Module 4 – Word Processing: Document Creation and Expression of Digital Identity.

04	Category	Description	Comp.
	Basic Use of Word Processor	Opening, typing, formatting (using bold, italics, underline), and saving documents.	3.1
	Expression of Digital Identity	Creating a personal document (e.g., a simple CV or cover letter) that reflects the participant's identity.	2.6
	Content Integration	Combining information and visual elements (e.g., inserting an image or icon) to enhance the presentation of the document.	3.2
	Practical Activity		

My First Document: Each participant will create a document containing their basic information, applying simple formatting and, if possible, inserting a visual element to help express their digital identity. The document will be saved on a storage device (e.g., USB drive or cloud storage) for future use.		

Table 8. Module 5 – Introduction to Spreadsheets, Identifying Needs and Creative Use.

05	Category	Description	Comp.
	Basic Use of Spreadsheets	Introduction to Excel or LibreOffice Calc: Learn how to enter data, perform simple calculations and use formulas, format cells, and organize information in tables. Practical examples include creating a "Shopping List" or an "Appointment Agenda" to effectively manage and present data	1.3
	Identifying Needs and Technological Responses	Demonstrating how a spreadsheet can address a simple daily need.	5.2
	Creative Use of Digital Technologies	Encouraging creativity in organizing and presenting data in the spreadsheet.	5.3
Practical Activity			
My List or Agenda: Participants will create a simple spreadsheet to record appointments or purchases, using colors and basic formatting to make it more visual and appealing. The completed spreadsheet will be saved on a storage device (e.g., USB drive or cloud storage) for future use.			

Table 9. Module 6 – Social Networks, Credential Management, Sharing, and Digital Collaboration.

06	Category	Description	Comp.
	Basic Use of Social Networks	Introduction to basic concepts and guidelines for accessing networks such as Facebook or WhatsApp, and managing profiles with a focus on digital identity.	2.1, 2.6
	Credential Management	Concepts on creating and maintaining secure passwords and taking care of privacy.	4.2
	Sharing and Digital Collaboration	Guidance on how to share content (images, messages, documents) and collaborate with other users, emphasizing proper attribution of credits when necessary.	2.2, 2.4
Practical Activity			
Secure and Collaborative Profile: In pairs or small groups, participants will access or create (or simulate the creation of) a social network profile, review privacy settings, and then carry out a sharing activity—sending a message or sharing a photo with co-creation guidance and attribution of authorship. The shared content will be saved on a storage device (e.g., USB drive or cloud storage) for future use.			

Table 10. Module 7 – Time and Task Management, Introduction to Programming (Sequence of Instructions).

07	Category	Description	Comp.
	Time and Task Management	Using simple applications (e.g., Google Calendar or digital notepad) to record appointments and tasks.	5.2
	Introduction to Programming	Defining programming as a sequence of simple instructions (e.g., "how to save a file" or "how to send an email"), encouraging logical thinking.	3.4

	Problem Solving	Identifying and resolving difficulties in using the tools introduced.	5.1
	Practical Activity		
	My Calendar and My Action Recipe: Each participant will record an appointment in a digital calendar (or simulated) and create, in writing, a step-by-step list of instructions for completing a common digital task, demonstrating the logic of the "action recipe." The completed task entry will be saved on a storage device (e.g., USB drive or cloud storage) for future reference.		

Table 11. Module 8 – Access to Digital Public Services and Research on Cross-Cutting Themes.

08	Category	Description	Comp.
	Access to Public Services	Navigate public service portals (e.g., healthcare and municipal information) in a simple way, demonstrating digital citizenship participation.	2.3
	Research on Cross-Cutting Themes	Guide participants in identifying and evaluating information about GDPR, E-health, E-environment, and Digital Evolution on reliable websites, observing how these issues are presented and ensuring data protection.	1.2, 4.[1-4]
	Practical Activity		
	Guided Navigation and Thematic Research: With the instructor's help, participants will access a public service website and search for information related to data protection (GDPR) and environmental issues. The findings will be recorded for use in the final activity (Module 10). The information will be saved on a storage device (e.g., USB drive or cloud storage) for future reference.		

Table 12. Module 9 – Digital Security, Cybersecurity, and Cyberbullying Prevention.

09	Category	Description	Comp.
	Digital Security	Tips for creating secure passwords, keeping the computer up to date, and recognizing suspicious messages.	4.1, 4.2
	Protection of Well-Being	Understanding what cyberbullying is, its risks, and how to act to protect physical and psychological well-being.	4.3
	Problem Solving for Technical and Behavioral Issues	Discussing and identifying solutions for technical and behavioral problems related to digital security.	5.1
	Practical Activity		
	Checking Security: Participants, with support, will review their security settings (e.g., passwords) and engage in a guided debate with practical examples of cyberbullying situations, discussing how to act and ask for help. The security settings and discussion outcomes will be saved on a storage device (e.g., USB drive or cloud storage) for future reference.		

Table 13. Module 10 – Basic Image Editing, Creation of an Integrative Poster, and Reflection on Gaps.

10	Category	Description	Comp.
	Basic Image Editing	Use simple tools (e.g., MS Paint or Canva) to edit images: crop, resize, insert text, and combine graphic elements.	3.1
	Integration and Reworking of Content	Integrate researched information (on E-health, E-environment, GDPR, and Digital Evolution) to create a digital poster, observing basic copyright	3.2, 3.3

		concepts (attributing credits when necessary).	
	Collaboration	Work in groups or individually, but with collaborative guidance to define layout and messages.	2.4
	Creative Use	Stimulate creativity in designing the poster.	5.3
	Reflection and Identification of Gaps	Reflect on acquired knowledge, identify strengths and gaps in one's digital skills, and outline paths for self-development.	5.4
Practical Activity			
Integrative Poster and Reflection: Participants will use an image editing tool to create a poster that summarizes the themes researched in previous modules (including information on GDPR, E-health, E-environment, and Digital Evolution). During the process, they should select images and texts applying guidelines on copyright (credits when necessary) and work collaboratively (or individually with support) to define the layout and message. Participants will write a brief reflection on what they have learned and identify areas they would like to develop further. The completed poster and reflection will be saved on a storage device for future reference.			

Additionally, unlike the current model, where seniors attend only selected modules based on their individual skill gaps, we will transition to a class-based system that fosters peer-assisted learning, offering multiple benefits for participants [31]. By maintaining stable learning groups, more experienced seniors can support beginners in navigating digital tools, reducing reliance on volunteers while promoting a collaborative and interactive learning environment. This approach not only enhances knowledge retention through mutual reinforcement but also strengthens social engagement, builds confidence, and fosters a sense of community among participants, ultimately amplifying the long-term impact of the initiative.

Table 14. Challenges and Corresponding Improvement Measures.

Challenge	Improvement Measure
Long intervals between sessions led to low retention rates, knowledge loss, and participant disengagement. Inconsistent scheduling due to venue availability further disrupted the learning process.	Fixed training cycles within the semester to ensure regular and predictable sessions. Shorter, more frequent meetings to maintain participant engagement and reduce knowledge loss between sessions.
Student volunteers faced academic constraints, leading to frequent rotations. This caused inconsistencies in instruction and disruptions in learning flow.	Implementation of a team-based volunteer system, where each participant group has multiple volunteers, ensuring at least one familiar instructor remains throughout the program. This reduces disruptions and ensures continuity.
The extensive number of modules exceeded the duration of a semester, making it difficult for volunteers to complete the program with the same group.	Restructuring the curriculum to 10 core modules that can be delivered within a single semester, giving volunteers adequate time for preparation and allowing flexibility for unforeseen events.
Previously, seniors only attended specific modules based on individual skill gaps, limiting peer interaction and learning continuity.	Transition to a class-based system to foster peer-assisted learning, where more experienced seniors support beginners, reinforcing knowledge retention and enhancing social engagement.

Volunteer rotations led to inconsistent teaching approaches, requiring repeated content review and leading to gaps in instruction.	Implementation of a participant progress tracking system, where learning logs record progress, challenges, and reinforcement needs, ensuring smooth transitions between volunteers.
Some municipal venues lacked updated computers, stable internet access, and accessibility features, affecting the training experience.	Ongoing efforts to secure funding through project submissions and institutional partnerships to enhance infrastructure and equipment availability.

To provide a clear overview of the key organizational challenges identified in the Capaci@de Digital initiative and the corresponding strategic improvements, Table 14 summarizes the main issues encountered and the measures implemented to enhance program efficiency, sustainability, and learning continuity. These modifications aim to optimize scheduling, improve volunteer management, restructure the training approach, and ensure resource availability. By addressing these challenges systematically, the initiative is better positioned to deliver consistent, high-quality digital literacy training while fostering a more engaging and inclusive learning environment for seniors.

5   Conclusion

The Capaci@de Digital initiative has demonstrated its effectiveness in promoting digital inclusion among seniors by providing structured training delivered through a volunteer-based model. The modifications introduced in this phase aim to address organizational challenges, enhance program efficiency, and strengthen the learning experience for both participants and volunteers.

By focusing on the foundation level of digital proficiency, the initiative ensures that participants build strong fundamental skills before advancing to more complex competencies. This strategic decision not only improves knowledge retention and engagement but also allows for a more structured assessment of the program's impact on senior well-being. The restructuring of content into 10 core modules has further optimized the training process, making it more manageable for volunteers while ensuring that sessions remain comprehensive and impactful.

The shift from an individualized, skills-based approach to a class-based system has strengthened peer-assisted learning, fostering a collaborative environment where experienced seniors support beginners. This method enhances social interaction, reduces dependence on volunteers, and reinforces long-term learning. Additionally, new strategies for volunteer management and scheduling, including a team-based structure and improved session planning, contribute to the sustainability and scalability of the initiative.

While these improvements mark a significant step forward, further research is necessary to assess long-term learning retention, explore additional pedagogical refinements, and expand the initiative's reach to other regions. Future work should also investigate the feasibility of reintroducing intermediate-level modules once the program's foundation has been solidified.

The refinements introduced in this phase contribute to a more structured, adaptable, and effective digital literacy program, ensuring that seniors gain the skills necessary to actively participate in an increasingly digital society. The initiative serves as a replicable model for HEI-led volunteer programs, reinforcing the role of

higher education institutions in bridging the digital divide and fostering lifelong learning.

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