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From Disconnected to Superagers: Perceived Quality of an Intergenerational Digital and Health Literacy Program for Central-Italy Older Adults

Maurizio Esposito[a], Sara Petroccia[a], Fabiola Balestrieri[a]

Abstract

This article examines the perceived quality of an intergenerational digital and health literacy program for Italian older adults, developed within the PRIN PNRR 2022 project *Ageing, Health Literacy and Digital Skills through the Pandemics*. Drawing on qualitative and quantitative data from semi-structured interviews (N = 21) and pre- and post-course questionnaires (N = 60), the study explores how older participants experienced learning processes, relational exchanges, and transformations in self-efficacy throughout the training. Adopting a grounded and interpretive approach, the analysis reconstructs participants' trajectories from digital disconnection to varying forms of empowerment, identifying persistent barriers, enabling conditions and symbolic shifts in the perception of technology. Findings reveal that the program's perceived quality depends less on technical proficiency than on relational and communicative dynamics that foster trust, recognition and continuity. Digital and health literacy emerge as intertwined dimensions of empowerment, extending beyond instrumental learning to encompass cultural adaptation and social participation.

The study proposes the metaphor of the *digital spore* to describe the latent yet resilient nature of older adults' competences, which can reactivate under supportive social and communicative conditions. Overall, the findings highlight how intergenerational communication functions as a generative engine of empowerment, transforming digital inclusion into a shared cultural practice that redefines ageing, care, and citizenship in the digital era.

Keywords: intergenerational communication; digital inclusion; health literacy; ageing; empowerment.

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1. From exclusion to intergenerational empowerment

Across Europe, ageing has evolved from a biological condition into a complex social phenomenon that demands renewed analytical frameworks. Extended life expectancy and the lengthening of late adulthood have reshaped the demographic composition of contemporary societies generating profound implications for welfare regimes, healthcare systems, and cultural understandings of later life. Italy, the second-oldest country globally after Japan (ISTAT, 2024), epitomizes this transformation: more than one quarter of its population is now aged 65 or older, a proportion that continues to rise. Yet this demographic achievement - rooted in advances in medicine, improved living conditions and declining fertility - reveals a paradox. The longer we live, the more we risk inhabiting societies that remain structurally and culturally unprepared for longevity: highly digitized, fast-paced, and often inattentive to the slowness, vulnerability and embodied experience of ageing.

The Covid-19 pandemic exposed this paradox with unprecedented clarity (Esposito, 2022). During lockdowns, digital technologies became essential infrastructures for accessing healthcare, sustaining social connections and performing everyday civic practices. For many older adults, however, the abrupt migration of services to online platforms entailed exclusion rather than inclusion. The "digital imperative" imposed by remote medical consultations, telemonitoring systems, and QR-code health certificates highlighted the fragility of an order that presupposes universal technological literacy. What was presented as a neutral process of modernization functioned instead as a cultural and symbolic filter, differentiating those who could remain connected from those left outside digital participation.

Technological engagement is interwoven with social meanings, relational configurations and affective orientations. For older adults, such mediation acquires specific cultural and emotional resonance, as it intersects with generational memories of analogue media, embodied routines, and moral economies of care. The act of "going online" thus becomes emblematic of wider social tensions between autonomy and dependency, innovation and continuity, inclusion and marginalization.

Within this context, the concept of *health literacy* provides a crucial analytical bridge. Defined as the capacity to obtain, comprehend and use information to make informed decisions regarding health (Norman & Skinner, 2006), it increasingly unfolds in digital environments where information and infrastructure coincide. The rapid expansion of e-health platforms, patient portals and telemedicine has reconfigured the modalities of healthcare access, demanding digital competences that are unevenly distributed across populations.

This cognitive dimension reveals that digital exclusion is as much symbolic as material. Many older individuals internalize cultural scripts that associate technology with youth, speed, and productivity attributes from which they perceive themselves as distanced. Ageism, both structural and internalized, reinforces such detachment by casting older adults as technologically incapable or resistant to innovation (Ayalon, 2020; Rosales & Fernández-Ardèvol, 2020). Accordingly, educational interventions focused on digital and health literacy must address not only the acquisition of operational skills but also the symbolic and relational conditions that render those skills meaningful. The goal is not simply to teach *how* to use technologies, but to reconstruct *why* and *for whom* their use matters.

At the same time, emerging evidence calls into question deficit-based narratives that depict older adults as passive or incapable in digital contexts. Empirical research shows that many seniors integrate technologies into their everyday lives with creativity and autonomy. In cognitive neuroscience, the category of "superagers" individuals over 80 who preserve levels of cognitive and functional efficiency comparable to much younger cohorts (Park et al., 2025) has prompted a broader reflection on resilience and adaptability in ageing. From a sociological standpoint, this figure shifts attention from decline to capacity, from loss to reconfiguration. In the digital sphere, it illustrates how later life can become a site of innovation, where experiential knowledge and curiosity converge to generate new forms of technological engagement. Between disconnection and superageing lies a wide continuum of practices that defy binary classifications of inclusion and exclusion. Understanding this heterogeneity requires conceiving ageing as a dynamic process of negotiation both with technology and with the social meanings that accompany it.

Italy offers a particularly instructive terrain for examining these dynamics. The country combines one of Europe's most aged populations with persistent territorial inequalities in digital infrastructure and limited investment in lifelong learning. These structural conditions make digital inclusion in later life not only a social necessity but also a privileged object of sociological inquiry. The initiative examined in this article an intergenerational digital and health literacy course conducted between December 2024 and May 2025 represents a concrete application of this approach. Conceived as a dialogical and participatory learning environment, the program paired young *digital animators* with older participants, fostering horizontal exchanges in which knowledge was co-constructed rather than transmitted.

This intergenerational framework resonates with enduring sociological debates on the transmission of knowledge across age cohorts. Margaret Mead (1970) famously distinguished between postfigurative societies, where the young learn from older adults, and prefigurative societies, in which the direction

of learning is reversed. In such contexts, older generations acquire knowledge from the young, producing what Mead described as a "cultural inversion" that destabilizes established hierarchies of authority. Intergenerational education thus emerges as a space of reflexivity, where teaching and learning are mutually constitutive and where age relations are redefined through communication. Subsequent scholarship has framed these interactions in terms of "generational intelligence" (Biggs & Lowenstein, 2011) the capacity to interpret one's position within the broader intergenerational field and to engage others empathetically. Applied to digital contexts, this form of intelligence extends beyond technical proficiency to encompass recognition, self-efficacy, and the collective construction of meaning.

From a systemic standpoint (Luhmann & Schorr, 1999), such exchanges can be interpreted as recursive communicative sequences that sustain learning over time. Each interaction a question posed, a demonstration offered generates a shared code that facilitates future understanding. Through repetition, feedback, and trust, these micro-sequences build semantic stability, transforming competence from a transient achievement into a durable social process. In this sense, digital literacy in later life is not a fixed attribute but a communicative accomplishment sustained by relational continuity. The intergenerational course analyzed here may therefore be viewed as an *enabling environment* (Sen, 1999), where cognitive learning intersects with moral, affective, and symbolic dimensions of inclusion, allowing older adults to re-enter digital spaces as recognized and competent actors.

2. The interplay between age, technology and health: context and theoretical framework

European societies are experiencing significant demographic changes, fueled by longer life spans and ongoing low fertility rates (UNECE, 2023). Italy stands out in this pattern, ranking as Europe's oldest nation and the second oldest globally, following Japan (ISTAT, 2024). These shifts broaden the range of requirements among older individuals while heightening the need for digital tools that promote independence, personal oversight and involvement in everyday activities.

Studies in sociology highlight that embracing these technologies goes beyond basic operational abilities; it involves a multifaceted interplay of cultural elements, relational dynamics and interpretive frameworks influenced by social connections and confidence levels (van Dijk, 2005, Neves et al., 2013; Lupton, 2014; König et al., 2018; Rosales & Fernández-Ardèvol, 2023).

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Over the past few years, health literacy has established itself as a demanding factor in facilitating fair and knowledgeable entry into healthcare systems. Population aging introduces intricate obstacles, necessitating sufficient skills to maneuver through a detailed network of services, entitlements, and choices. Yet, many people aged 65 and older face notable hurdles in obtaining and making sense of health-related details, with important consequences for personal well-being and the activity of social support structures. At the same time, the shift toward digital healthcare - sped up by the Covid-19 crisis - has reshaped how people reach medical care, bringing in features like remote consultations, digital medical files, virtual scheduling, and personal tracking systems. While these innovations hold promise for broader inclusion, they demand digital proficiencies that older adults frequently lack, illustrating how unchecked digitization can widen disparities instead of narrowing them (Petroccia, 2024; Esposito & Petroccia, 2025).

In this context, the concept of e-health literacy - defined by Norman and Skinner (2006) as the ability to seek, comprehend, and apply health information from digital environments and online information ecosystems - assumes a central role, as its deficiency contributes to widening the grey digital divide and restricting equitable access to digital health services, particularly among the elderly population. This form of literacy integrates computer, media, scientific, and health skills, proving essential for autonomous and informed health management within the contemporary digital ecosystem. Recent literature (Shi et al., 2023; Yang et al., 2024) has further emphasized the significance of the cognitive gap - that is, perceived confidence in one's digital capabilities - as a key barrier to participation, often more salient than the actual technical skills possessed. This cognitive divide, interwoven with cultural and generational factors, can diminish the inclination to utilize digital tools in healthcare settings, highlighting the role of trust-based relationships and intergenerational mediation as mechanisms to enhance perceived self-efficacy and foster mindful adoption of e-health technologies.

These newer studies stress the importance of the perceptual divide - the self-assessed assurance in digital abilities - as a major obstacle to involvement, frequently outweighing real technical know-how. This perceptual barrier, linked to cultural and age-based influences, may reduce the desire to engage with digital health applications, emphasizing the value of reliable interactions and cross-generational guidance in boosting self-perceived competence and encouraging thoughtful integration of e-health solutions (Esposito & Petroccia, 2025).

Recent contributions in the sociology of health and medicine highlight the cultural, social, and ethical aspects of ageing in relation to digital inclusion (Mol, 2008; Peine & Neven, 2021). While older adults are frequently depicted as digitally marginalized, empirical studies reveal a diverse array of competencies,

spanning from complete disengagement to sophisticated utilization. This spectrum occasionally encompasses superagers, those over 80 who exhibit cognitive and functional abilities akin to much younger individuals, often integrating digital tools in innovative ways (Park et al., 2025; Zhavoronkov et al., 2025). Such variability challenges stereotypical assumptions and emphasizes the importance of tailored interventions that recognize individual potentials, moving beyond uniform views of exclusion to foster inclusive pathways for technological engagement. Yet, a critical sociological lens cautions against uncritical celebration of these models, as they may perpetuate the biomedicalization of aging, emphasizing molecular and technological fixes while sidelining broader socio-cultural determinants like inequality, relational support, and ethical considerations in technology design (Clarke & Shim, 2009; Mol, 2008; Marshall & Katz, 2016; Ragnedda, 2017). Gender emerges as a significant dimension in shaping digital experiences among older adults. Research indicates that older women frequently report lower digital self-efficacy and higher technophobia compared to male peers, partly reflecting historical patterns of gendered labor divisions and differential exposure to technology in working life (Rosales & Fernández-Ardèvol, 2023).

Hence, there arises an urgent need to adopt an educational approach that extends beyond the mere transmission of technical skills, promoting processes of recognition, agency, and participation. From this viewpoint, intergenerational training emerges as an innovative and transformative strategy. As highlighted by Mead (1970), the inversion of educational roles enables forms of reciprocal learning capable of deconstructing symbolic hierarchies between generations. These insights are complemented by those of Bennett and Elman (2006), as well as Biggs and Lowenstein (2011), which underscore the value of intergenerational exchanges in bolstering a sense of belonging and social cohesion.

This intergenerational approach draws on systemic theories of communication (Luhmann & Schorr, 1999), in which repeated interactions build enduring patterns of shared meaning, ultimately supporting empowerment through common interpretive contexts.

The course under examination in this study, analyzed in the subsequent section, aligns with this theoretical framework. It constitutes an intergenerational training mechanism that, beyond disseminating tools for digital and health literacy, is characterized by the creation of a relational and dialogic space between young facilitators and elderly participants, thereby facilitating processes of mutual learning and the reinforcement of intergenerational trust.

Intergenerational education, as emphasized by Newman and Hatton-Yeo (2008), fosters empowerment through the acknowledgment of prior

competencies, the transcendence of technological ageism (Ayalon, 2020), and the reconfiguration of social roles ascribed to various age groups. Within this framework, the interplay between digital literacy and health literacy serves as a pivotal nexus for empowerment. Indeed, the course did not function merely as a technical instrument but configured itself as an enabling environment (Sen, 1999), wherein digital knowledge serves as a lever for accessing rights and reconstructing social affiliations. In this context, digital literacy encompasses not only the technical proficiency to operate tools but also the cultivation of an active and informed digital citizenship, wherein the management of personal data, privacy, and comprehension of digital logics become core elements. As noted by Isin and Ruppert (2015), digital citizens are not merely users but agents engaged in the production and regulation of data. In the healthcare domain, this awareness is particularly pertinent, as service access is increasingly mediated by digital interfaces entailing sensitive decisions. Consequently, the critical utilization of technologies represents a prerequisite for democratic participation and the safeguarding of digital rights. From this perspective, digital and health literacy can also be interpreted as a multilevel empowerment process, articulated across individual, organizational, and communal dimensions. As elucidated by Rappaport (1981) and Zimmerman (1995), empowerment transcends the subjective realm, manifesting through active engagement in relational contexts, the capacity to influence one's surroundings, and the establishment of mutual support networks. For individuals over 65, this manifests as an enhancement of self-efficacy, alongside the opportunity to act as proactive agents in co-constructing their engagement with digital and health domains.

3. Intergenerational learning design and mixed-method approach

The study explores the lived experiences of digital health literacy among Italian older adults participating in the training course conducted as part of the PRIN PNRR 2022 project *Ageing, health literacy and digital skills through the Pandemics*[1]. The course was structured across nine meetings, held between December 2024 and May 2025 in Italy, and the data analyzed here refer to the entire training cycle.

The didactic approach privileged the intergenerational dimension, involving the co-leadership of activities by young digital animators trained to support learning through a horizontal and dialogic relationship. The course promoted basic digital skills in health and everyday contexts, with particular

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attention to: use of smartphones and tablets, video calls and social networks, access to public and health digital services, data protection and autonomous management of technical problems.

This intergenerational approach aligns with similar initiatives across Europe and beyond. In Germany, the Digital Angel project operates mobile consulting buses offering face-to-face support and media-literacy workshops for older adults (Telekom, 2024), while the UK's Digital Champion Programme (2022-2026), coordinated by Age UK, recruits and trains volunteer Digital Champions to support approximately 120,000 older people across 40 local partnerships, providing one-to-one guidance and loaned devices to address barriers of skills, trust, and equipment access (Age UK, 2022). Spain's Fundación Grandes Amigos similarly deploys a volunteer network to deliver digital-partner sessions and community workshops where seniors learn to use smartphones and online services while sharing life experiences with younger mentors (Grandes Amigos, 2024). The EU-funded Digital Generations project (2022) adopts a structured train-the-trainer model in which university students deliver hands-on workshops to older citizens, linking digital skills to active-ageing objectives across multiple member states.

The methodological design adopted is based on an inductive mixed-methods approach, oriented toward theory construction from empirical data and aimed at avoiding the imposition of predefined theoretical categories. On the qualitative side, the study draws on Grounded Theory (Glaser & Strauss, 1967), widely recognized as methodologically appropriate for investigating emergent and complex phenomena, such as health and digital literacy in the older population. On the quantitative side, pre- and post-course questionnaires were used to obtain a descriptive baseline of participants' digital and health competences and to capture perceived changes over time. The two components were integrated in a convergent design, allowing qualitative insights and quantitative distributions to be read in a complementary way. This approach makes it possible to capture in depth the relational dynamics, subjective perceptions and intergenerational practices that develop in formative contexts, while situating them within an overarching profile of participants' competences and uses of technology. Building on these insights, this article reports findings from 60 questionnaires administered across two phases (30 before, 30 after) and 21 semi-structured interviews conducted at the end of the digital and health literacy course (15 with senior participants and 6 with young digital animators).

Triangulation was achieved by cross-referencing qualitative and quantitative sources prior to and during the analysis: 1) grey literature (project reports, policy briefs, and institutional documents on digital health initiatives for older adults) and scientific literature reviewed before the course implementation, which provided the contextual and theoretical baseline; 2)

qualitative data from the 21 semi-structured interviews conducted post-course; and 3) open-ended responses in the pre- and post-course questionnaires. This multi-source strategy allowed for the verification of emerging themes, the identification of convergences and divergences across data types, and the strengthening of interpretive validity (Corbetta, 2015; Corbin & Strauss, 2008).

To distinguish pre- and post-data, questionnaires were sequentially numbered, with the first 30 as pre-course and the latter as post-course.

Quantitative data from the pre- and post-course questionnaires were analyzed using descriptive statistics (frequencies and percentages), with a specific focus on daily device use, purposes of technology adoption and familiarity with digital health services. These results are presented in Figures 2 and 3, which visualize participants' baseline profiles and highlight the selective and uneven nature of their engagement with digital tools prior to the course.

The questionnaires, administered in paper format before and after the course, were structured across nine thematic sections to elicit participants' subjective experiences, perceptions, and evolving narratives of digital engagement. These encompassed: 1) personal and socio-demographic context; 2) everyday digital familiarity (e.g., device activation, video calls, messaging, web searches); 3) health-specific digital practices (e.g., online appointment booking, accessing medical reports, using monitoring apps); 4) security and crisis response awareness; 5) expectations and perceived barriers (open-ended); 6) habitual technology use and purposes; 7) foundational digital literacy (e.g., terminology, password creation); 8) past experiences and accessibility challenges (open-ended); and 9) forward-looking suggestions for course enhancement (open-ended). Handwritten responses enriched the qualitative depth, revealing nuanced anxieties, aspirations, and calls for inclusive design. These open-ended reflections, alongside categorical self-assessments, provided a rich narrative foundation for mapping pre-course technophobia, post-course empowerment, and emergent agency in health-related digital practices.

The semi-structured interviews aimed to explore: 1) the pre-existing relationship of over-65s with digital technologies; 2) the perceived impact of the course on the adoption of such technologies, especially in health contexts; 3) obstacles and facilitators encountered in the learning process. This data collection technique, flexible and oriented toward listening (Corbetta, 2015), proved effective in eliciting subjective experiences, latent difficulties, and unexpected resources, valorizing the voices of the interviewees. The conversations, averaging 45 minutes in duration, were audio-recorded with informed consent, fully transcribed and anonymized.

The sample was selected through purposive sampling, adopted to include subjects capable of providing pertinent and in-depth contributions related to the study object. The older adults came from seven senior centers in Italy; the

interviewed animators were among the active trainers in the project. Recruitment involved outreach to senior centers via project coordinators, targeting individuals over 65 with varying levels of digital familiarity to ensure diversity in experiences. The sample included 30 older adults (aged 65-85, with a balanced gender distribution: 16 women, 14 men; educational backgrounds ranging from primary school to university degrees and socioeconomic statuses reflecting local demographics, including retirees from working-class and professional sectors).

The transcripts from the 21 semi-structured interviews were analyzed through a coding process inspired by Grounded Theory, articulated in three phases: open coding (identification of 112 units of meaning, each associated with a minimal conceptual code); axial coding (grouping of codes into 24 descriptive categories and identification of relationships between them, from which six macro-thematic areas emerged); and selective coding (isolation of a central theoretical core, which highlighted digital competence as a heterogeneous process, conditioned by social and relational factors). These macro-themes (intergenerational support, digital health literacy, relational benefits, digital barriers, trust/autonomy, and motivations for learning) served as the foundation for deriving the usage and knowledge profiles presented in Section 5, ensuring they emerged inductively from patterns in the data rather than predefined categories.

The same iterative coding procedure was applied to the open-ended responses in the pre- and post-course questionnaires (sections on expectations, difficulties, past experiences, and suggestions), yielding 87 additional meaning units that were integrated into the shared coding framework to enrich thematic saturation and ensure consistency across data sources.

To ensure coherence and transparency, a shared coding protocol was prepared that encompassed both interview transcripts and the thematic content of the open-ended questionnaire responses, containing a definitional grid of categories, application examples, and inclusion/exclusion criteria. Intersubjective validation was conducted through comparison among coders on a subsample equal to 30% of the transcripts and 25% of the questionnaire open responses. Theoretical saturation was reached when the last three interviews and the final set of post-course open responses produced no new relevant categories.

However, it should be noted that the methodological design presents some limitations. These aspects do not invalidate the results but suggest caution in extending the data to other territorial and social contexts. In addition, the exploratory and descriptive nature of the quantitative component limits the possibility of inferring causal relationships, positioning the mixed-methods design as a primarily interpretive tool rather than a predictive one. Eventually,

to mitigate voluntary participation bias, we incorporated reflexive discussions in interviews to explore motivations and prior predispositions, though this does not eliminate the potential for overly positive narratives. Future studies could employ comparative sampling from non-voluntary contexts to test generalizability.

4. Persistent barriers, intermittent competences and learning trajectories: highlights from interviews

The qualitative analysis conducted on interviews with seniors and digital animators provides a detailed picture of the training experience, which goes beyond the simple acquisition of technical skills and is read in light of the quantitative baseline emerging from the pre-course questionnaires. The collected data narrate the learning processes, encountered resistances and subjective transformations experienced in the digital and health literacy course.

Consistent with the adopted grounded approach, the results are organized into three main thematic nuclei:

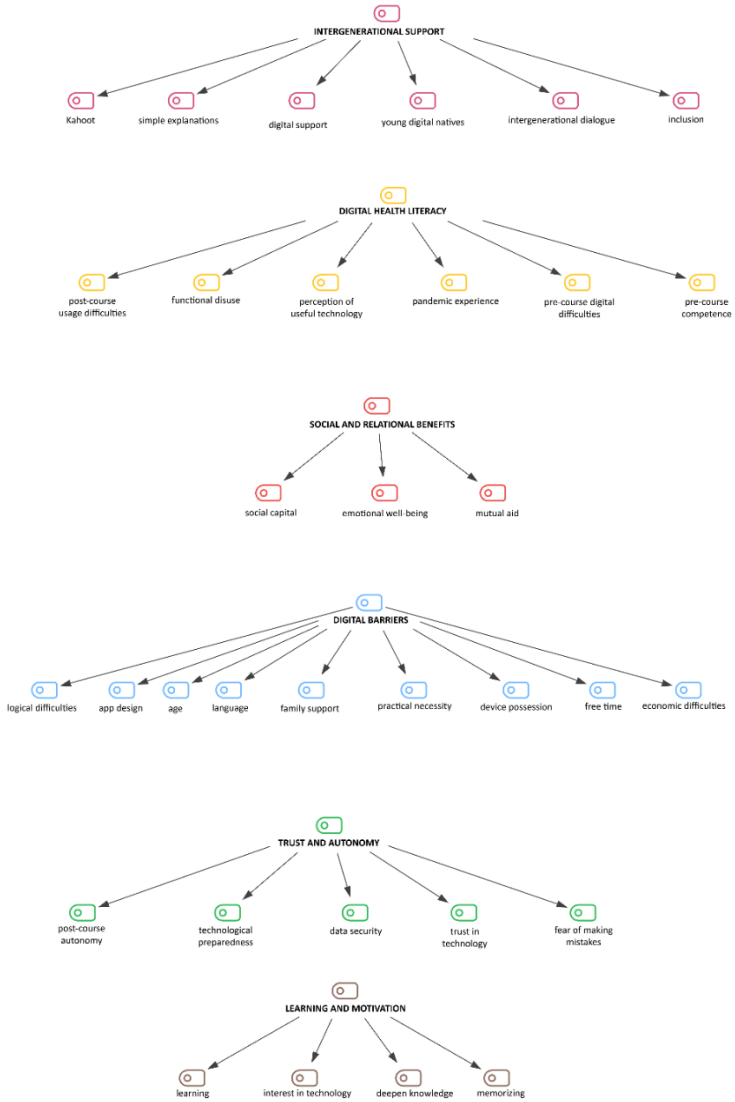
- the initial difficulties in using digital technologies, observed in the course's startup phase;
- the effectiveness of training activities in terms of empowerment, autonomy, and awareness;
- the barriers that continue to persist, even after the intervention, indicating the structural and cultural limits of digital inclusion processes in later life.

This articulation reflects the processual, discontinuous and non-linear nature of digital inclusion in the over-65 population. The digital divide does not express itself solely in terms of access or skills but configures as a multidimensional phenomenon, traversed by symbolic, relational, and cultural dynamics.

The analysis allowed for the identification of six recurrent macro-thematic areas, which structure the participants' training experience and orient their learning trajectories: intergenerational support, digital health literacy, relational benefits, digital barriers, trust/autonomy and motivations for learning (Figure 1).

For anonymity and analytical purposes, interview transcripts were coded with identifiers: S denotes senior participants (older adults), while DA refers to digital animators (young facilitators), each followed by a unique sequential number.

Figure 1. General map of thematic coding emerged from the analysis of interviews (N = 21)



Note. This figure outlines the primary thematic clusters derived from a qualitative examination of 21 interviews involving senior learners and young digital facilitators. Coding adhered to Grounded Theory guidelines, with data processing conducted via MAXQDA software (2024 version), capturing the analytical categories that appeared consistently across the empirical dataset. The diagram facilitated the detection and arrangement of key digital challenges highlighted in the qualitative evidence, providing a groundwork for the initial stage of categorization. Source: Authors' processing via MAXQDA, 2024.

During the course, numerous barriers related to the use of digital technologies emerged, particularly in navigating online health services. These obstacles are situated at various levels: material (absence of adequate devices, stable connection, essential peripherals); cognitive (difficulty understanding the logic of digital processes, mismatch with the reference analog culture); sensorial (visual, auditory, or motor deficits); symbolic (complex technical language, non-intuitive icons, foreign-language terminology, perception of exclusion).

During the practical workshops of the course, preceded by introductory theoretical moments, significant technical difficulties emerged. In fact, the qualitative analysis highlighted strong heterogeneity in participants' prior digital skills: although some participants had prior experiences (such as using SPID, consulting the electronic health record, or online booking of visits), for many of them, interaction with their device was limited. This heterogeneity required digital animators to constantly adapt contents and teaching methods.

Beyond technical obstacles, a cognitive resistance emerged, linked to the perception of a lack of logic in digital mechanisms. Technologies often appear alien to older adults' operational models, fueling disorientation and a sense of inadequacy.

> *"The difficulty was linked to logic: it seemed almost entirely absent. For them, everything had to be built, everything new. We take many things for granted: they give us a tool and we start using it. They, instead, found themselves disoriented. They couldn't understand the underlying logic: for example, why do I need an electronic identity card to access a service?" (Interview DA_06)*

This resistance could be interpreted as an expression of a generational and symbolic mismatch between the analog culture in which the older population was formed and the implicit assumptions of digital technologies. To these cognitive barriers are added difficulties of a sensorial and physical nature. Visual, auditory, or motor problems hinder interaction with device interfaces, reducing accessibility; in some cases, sensorial limitations were mistakenly interpreted as technical malfunctions.

At the end of the course, older adults seem capable of autonomously accessing the Electronic Health Record, booking medical visits online, or consulting digital reports, overcoming difficulties that previously entailed total dependence on family or external operators. In this way, knowing how to use a smartphone or a health application becomes an expression of independence, mastery of one's health, and the possibility of choice among different care options.

Beyond the strictly health sphere, the effects of the training path extended to various areas of daily life. Numerous interviewees report having acquired

new skills in using digital tools for managing banking operations, making online purchases, and maintaining social relationships through messaging platforms and video calls.

The relational dimension also assumed a central role in the training experience, perceived not as a mere space for individual learning but as a context of sociality and mutual support. In numerous cases, a cooperative dynamic developed among participants, which contributed to generating a climate of reciprocal support, strengthening the sense of belonging and countering the risk of social isolation. Furthermore, the role of intergenerational relationships should be highlighted; the acquisition of autonomy in operations previously delegated to children or grandchildren reduced asymmetries and favored more paritarian interaction:

> *"I was afraid to touch buttons. Before, I always asked my son for help. Then I saw that nothing happens and now I do things alone." (Interview S_09)*

The qualitative analysis has shed light on how the effectiveness of digital and health literacy activities for the older population does not completely eliminate difficulties in autonomous and continuous use of technologies. Alongside positive outcomes in terms of learning and strengthening autonomy, barriers emerge that persist or reactivate once the training path is concluded. These obstacles, situated between subjective conditions and structural factors, contribute to maintaining a form of age-related digital exclusion (grey digital divide).

The three dimensions that appear to be the persistent difficulties in using digital devices by older adults are: availability of free time, the need for practice, and the role of family support. These elements not only influence the ability to use digital technologies continuously but connect to other variables already analyzed previously - age, technical difficulties, app design, and language complexity, which provides a representation of the conceptual relationships emerged from empirical material. These barriers, rooted in material, cognitive, sensorial, symbolic, motivational, and relational dimensions, not only influence the stability of acquired skills but condition their integration into daily life.

It is from this observation that the metaphor of the *digital spore* is proposed, useful for interpreting the intermittent and situated nature of literacy in later life and for deepening the dynamics that fuel persistent barriers.

It can be interpreted as an analytical tool to describe an intermediate condition between full inclusion and total exclusion. It involves competences that, analogously to spores in biology, can remain in a latent state for prolonged periods, reactivating only in the presence of enabling conditions: accessible

environments, stable relational support, extended times for practice, and social recognition of learning value.

5. From the pre-course baseline data to empowerment: the digital starting points of older learners

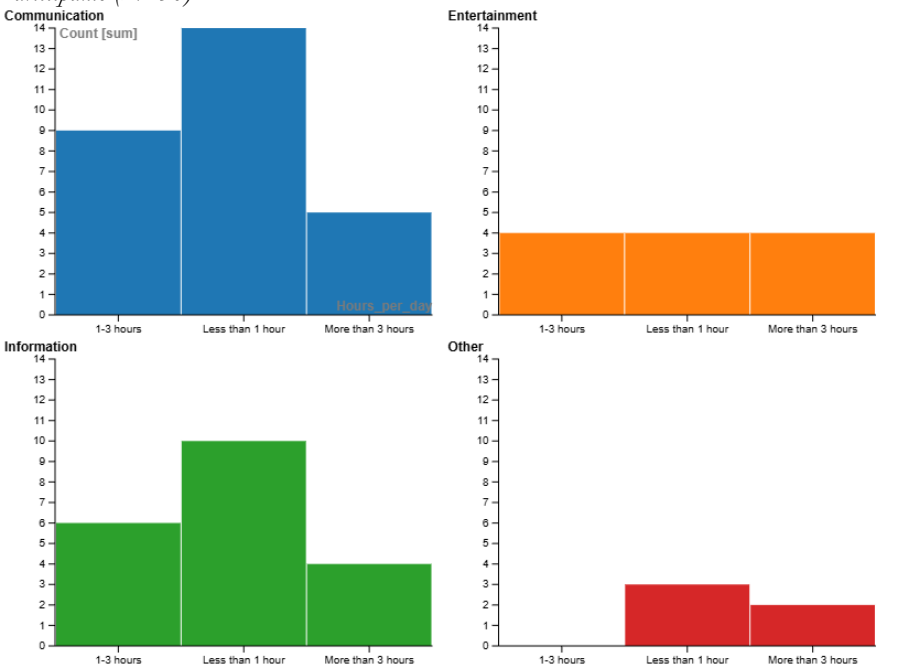
The pre-course questionnaires offered an initial snapshot of participants' everyday relationship with technology. Before entering the training, most older adults reported a limited and functional engagement with digital devices. As illustrated in Figure 2, over half used their smartphone or tablet for less than one hour per day, while only a minority declared more than three hours of daily use. The frequency of use was closely related to purpose: communication clearly dominated, followed by information search and entertainment, whereas administrative and health-related tasks remained marginal.

The grouped bar chart draws from responses to Question 13 on hours of daily device use and Question 14 on main purposes (multiple selections allowed: Communication, Entertainment, Information, Other).

Multiple responses to *Q14 For which purposes do you mainly use technology*? confirm that digital tools were perceived primarily as channels for maintaining contact with relatives and friends – through phone calls, messaging or occasional video calls – rather than as instruments for managing everyday services or personal health. Only a few participants reported using online booking systems, email, or access to the Electronic Health Record, indicating a selective and need-oriented use rather than an integrated digital routine.

This baseline picture highlights the starting asymmetries that shaped the subsequent learning trajectories. Limited exposure, restricted purposes and minimal confidence defined the digital profile of many learners at entry. As part of the quantitative component of the mixed-methods design, these descriptive distributions provide an essential backdrop for interpreting the qualitative narratives presented in the subsequent sections.

Figure 2. Pre-Course Distribution of Daily Digital Device Usage and Primary Purposes Among Participants (N=30)



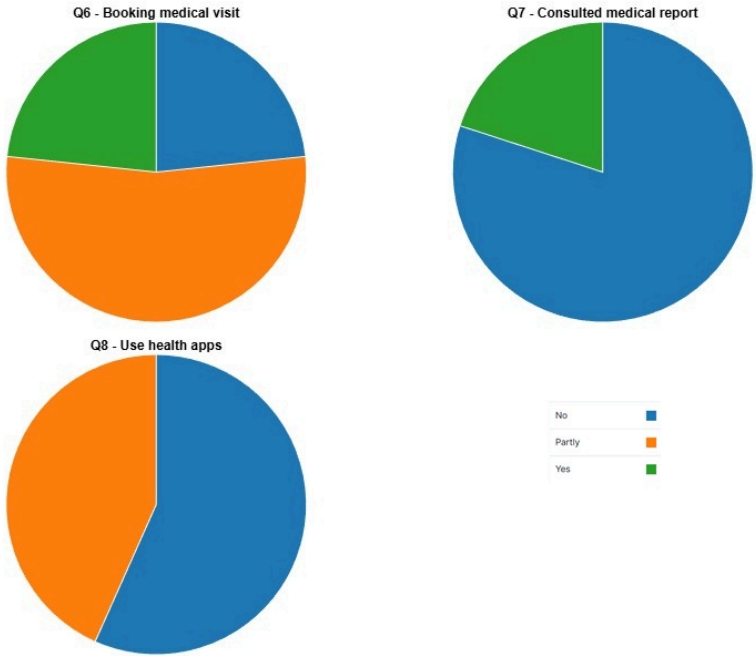
Complementing the general overview, Figure 3 focuses specifically on the section of the questionnaire devoted to digital health competences, capturing the participants' pre-course familiarity with online health services. The three pie charts illustrate responses to questions on the ability to book medical visits online (Q6), consult one's electronic medical record (Q7), and use mobile health applications (Q8).

The results delineate a landscape of partial and uneven engagement with e-health tools. A limited number of participants reported being able to complete online bookings autonomously, while the majority declared either relying on family members or avoiding the procedure altogether. Access to the Electronic Health Record appeared even more marginal, suggesting that the interface and procedural complexity of such platforms often act as symbolic as well as cognitive barriers. Health-related applications, finally, emerged as the least used resource – often perceived as unnecessary or confusing, and associated with distrust toward self-monitoring technologies.

Taken together, these data indicate that before the training course, older adults' digital engagement was predominantly confined to communicative and recreational uses, with health management remaining peripheral. The picture

conveys what may be described as a "latent literacy": a form of potential competence not yet consolidated into practice. In methodological terms, these findings illustrate how the quantitative strand of the study captures not only levels of use but also the gap between perceived usefulness and actual adoption, which is then unpacked qualitatively through interviews and usage and knowledge profiles. Participants generally recognized the usefulness of digital health tools but lacked the experiential confidence, continuity, and enabling environment necessary to translate awareness into routine action.

Figure 3. Pre-course distribution of digital health competences among participants (N = 30)



Building on these insights into barriers and latent potentials, the following section maps participant usage and knowledge profiles, illustrating the heterogeneous perceived quality of the program.

6. Mapping perceived quality: digital and health competences through usage and knowledge profiles in later life

Drawing upon the multifaceted insights gleaned from the qualitative analysis of interviews and questionnaires, which illuminate the discontinuous

trajectories of digital health literacy acquisition among older adults - marked by persistent barriers, relational facilitators and the latent potential encapsulated in the digital spore metaphor - this study distills emergent patterns into a typology of usage and knowledge profiles that maps the perceived quality of the intergenerational program, thereby categorizing participants' competences, attitudinal dispositions and perceived transformations in later-life digital engagement from disconnection to empowerment and beyond.

The typology delineates four profiles:

- *digitally disconnected*, older adults with minimal or no experience using digital devices, expressing technophobia and dependency on others for accessing online health services.
- *Pragmatic users*, learners who use digital tools selectively and instrumentally, mainly for practical health-related purposes (e.g., booking appointments, downloading prescriptions), but who often require external support.
- *Empowered adopters*, participants who developed confidence in using digital technologies for managing health and everyday tasks, reporting increased autonomy and critical awareness.
- *Superagers*, highly competent and cognitively resilient older adults who integrate digital tools creatively into their routines, often serving as informal mentors within peer groups.

The typology serves as analytical anchors for interpreting the perceived quality of the digital health literacy course and its heterogeneous impact on learning trajectories.

This analytical integration allows the typological model to be reframed as a continuum of perceived quality of the learning experience, reflecting not only differences in competences but also in the affective, relational and symbolic dimensions of digital inclusion in later life.

Overall, the perceived quality of the course emerged as highly differentiated, spanning from experiences of frustration and dependency to those of autonomy and empowerment. Qualitative data reveal that older learners' trajectories are discontinuous and situated: they oscillate between moments of progress and relapse, empowerment and uncertainty, reflecting the processual nature of learning in later life.

By synthesizing quantitative and qualitative insights, the following Table 1 illustrates how the four usage and knowledge profiles also correspond to different perceptions of training quality, relational engagement and persistent barriers.

From Disconnected to Superagers: Perceived Quality of an Intergenerational Digital and Health Literacy Program for Central-Italy Older Adults

Maurizio Esposito, Sara Petroccia, Fabiola Balestrieri

Table 1. Usage and knowledge profiles of digital and health literacy among older adults

Profiles	Digital Literacy	Health Literacy	Perceived Quality of the Course	Learning and Social Dimension	Persistent Barriers and Risks	Resources and Potentials	Communicative Dimension
Digitally disconnected	Minimal or no device use; unable to navigate independently.	Limited understanding and application of health information; difficulties accessing online health services.	Course perceived as useful but difficult; feelings of frustration and inadequacy prevail.	Fragmented participation, frequent need for assistance, limited confidence.	Lack of devices and connectivity; cognitive and symbolic resistance; dependency on relatives.	Community-based or intergenerational support may enhance motivation.	Communication mainly unidirectional and dependency-oriented; exchanges limited to instruction and reassurance.
Pragmatic users	Basic skills (messaging, videocalls); difficulties with complex apps and forms.	Partial ability to manage digital health tasks; often reliant on external help.	Appreciate the course for its practical utility, but engagement remains instrumental.	Active participation only for perceived useful tasks (e.g., prescriptions, bookings).	Lack of time and regular practice; interface design and language barriers.	High motivation to learn; potential for consolidation through repetition and guidance.	Communication becomes functional and problem-solving oriented; trust begins to build through dialogic support.
Empowered adopters	Confident in using smartphones, portals, and health apps.	Able to interpret and apply medical information autonomously.	High perceived quality: course viewed as transformative and empowering.	Strong self-efficacy and engagement; development of digital habits and critical awareness.	Occasional digital fatigue; need for continuous support or updates.	Autonomy, peer support, and willingness to act as tutors for others.	Communication is dialogic, trust-based, and reflexive; enables mutual learning and reinforcement of self-efficacy.
Superagers	Advanced adaptability; creative integration of digital tools in everyday life.	Exceptional cognitive and interpretive skills; critical use of complex health platforms.	Course perceived as socially enriching and affirming of personal resilience.	High involvement; act as informal mentors or role models; foster peer collaboration.	Possible physical or sensory limitations; risk of overexposure to misinformation.	Resilience, adaptability, and potential role in intergenerational knowledge transfer.	Communication becomes generative and bidirectional; older adults act as mediators and co-creators of shared meanings.

Note: Authors' elaboration. The typology offers an interpretive synthesis of the heterogeneous learning trajectories observed, emphasizing the communicative and intergenerational dimensions underlying digital and health empowerment in later life.

During the early stages of the course, several participants reported a sense of cognitive resistance and disorientation in approaching the *illogical* digital world, especially when confronted with complex procedures such as accessing the Electronic Health Record or using online booking systems. Others, however, described a gradual process of familiarization that reshaped their sense of competence and self-efficacy. For some participants, digital literacy became a symbolic gateway to renewed autonomy, social participation, and even critical awareness toward digital risks and privacy.

The perceived quality of the course follows a progression from functional engagement to transformative participation. While *digitally disconnected* and *pragmatic users* express initial resistance and instrumental use, *empowered adopters* and *superagers* represent trajectories of autonomy, critical awareness, and relational enrichment.

However, the persistence of structural and symbolic barriers - limited access to adequate devices, lack of constant practice, and dependence on family support - reveals that digital inclusion in later life remains a fragile and reversible process. The course's perceived quality thus depends less on technological mastery than on relational scaffolding, iterative practice, and the cultural redefinition of ageing itself.

7. Generative communication as a recursive engine of empowerment

These findings suggest that digital and health literacy training for older adults should be conceptualized as relational care practices, where learning is enabled through empathy, continuity, and the co-construction of meaning. In this perspective, the quality of a training experience cannot be reduced to technical outcomes but must include dimensions of belonging, recognition, and symbolic empowerment. Beyond the typological differentiation, the qualitative evidence highlights a set of enabling factors that sustain perceived quality and learning continuity among older adults. Across the four profiles, these resources operate as relational and motivational drivers that mitigate the fragility of acquired competences. Community-based and intergenerational support proved particularly significant for those initially excluded or *digitally disconnected*, as it fostered a sense of belonging and reduced feelings of inadequacy. Among *pragmatic users*, intrinsic motivation and the willingness to learn - often triggered by health-related needs - emerged as decisive in maintaining engagement and consolidating basic skills. For *empowered adopters*, self-efficacy, peer support, and the internalization of digital practices as part of daily routines reinforced autonomy and critical awareness. Finally, *superagers* demonstrated a remarkable

capacity for resilience and adaptability, positioning themselves as informal mentors and intergenerational bridges within the learning community.

Taken together, these findings suggest that the sustainability of digital competences in later life depends not solely on technological proficiency but on the activation of relational and symbolic resources that transform learning into a shared and meaningful social experience. This relational dimension is particularly evident in the *generative role of communication*, which acts as a recursive engine of empowerment, fostering ongoing cycles of knowledge creation and stabilization. Drawing from a systemic perspective (Luhmann e Schorr, 1999), intergenerational communication in these contexts transcends mere information transfer, instead generating self-sustaining processes where initial interactions - such as questions about digital tools or shared problem-solving - spawn subsequent dialogues that build semantic stability and collective meaning. The generative nature of this communication is underscored by its ability to produce emergent outcomes: for instance, recurring themes like trust, security, simplicity, and availability not only reinforce individual learning but also create inclusive codes that bridge generational asymmetries, allowing older adults to contribute their experiential wisdom while young animators provide technical facilitation. This circularity renders the boundary between teacher and learner porous, enabling mutual legitimation and the co-creation of adaptive strategies for digital engagement. Furthermore, the generative aspect manifests in the extension of learning beyond formal sessions, as participants initiate informal exchanges, micro-communities of practice and collaborative initiatives that perpetuate skill consolidation. In this way, communication operates as a dynamic social device, not just for cohesion but for the ongoing regeneration of competences, aligning with the digital spore metaphor by providing the relational soil necessary for latent potentials to germinate, evolve and resiliently adapt to persistent barriers in later-life digital inclusion.

8. Communication and the relational foundations of digital inclusion

This study underscores the transformative potential of intergenerational digital and health literacy programs in bridging the grey digital divide among Italian older adults, charting a progression from disconnection to empowerment as evidenced by the emergent typology of participant profiles - from the digitally disconnected to pragmatic users, empowered adopters, and superagers. Methodologically, the mixed-methods design – combining descriptive questionnaire data with in-depth qualitative interviews – made it possible to map not only the distribution of competences and uses, but also the meanings, ambivalences and relational dynamics that structure older adults'

trajectories of digital inclusion. The qualitative insights reveal that perceived program quality hinges not merely on skill acquisition but on the interplay of relational dynamics, motivational factors, and contextual enablers, which collectively mitigate persistent barriers such as cognitive resistance, limited practice opportunities and substitutive family support. By framing digital competences as intermittent and situated, akin to the latent vitality of a *digital spore*, the analysis highlights how these competences germinate within supportive communicative environments, where recursive intergenerational exchanges foster semantic stability, mutual legitimation, and sustained agency.

Yet, the findings also caution against overly optimistic narratives of inclusion, emphasizing that structural inequalities - rooted in socioeconomic disparities, ageist representations, and inaccessible digital infrastructures - render such progress fragile and reversible. The program's heterogeneous impact, as mapped through usage and knowledge profiles, illustrates that true empowerment extends beyond technical proficiency to encompass symbolic recognition, self-efficacy, and social cohesion, transforming literacy into a vehicle for active citizenship in later life.

Moving from divide to possibility, these results advocate for inclusive training models that prioritize adaptability, continuity and cultural sensitivity. Policymakers and educators should reorient interventions toward longitudinal accompaniment rather than episodic instruction, integrating community networks, peer mentoring, and user-centered design to accommodate diverse ageing trajectories. In doing so, digital health literacy can evolve from a remedial tool into a generative practice, promoting equitable access, resilience, and intergenerational justice in an increasingly digitized society. Future research might extend this framework to comparative contexts, exploring how such models adapt across cultural and socioeconomic variances to further dismantle entrenched exclusions.

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