ICT-Mediated Learning as a Form of Socio-Emotional Support for Older Adults

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Abstract. The adverse effects of the pandemic on the emotional state of older adults have fuelled the debate regarding their digital exclusion and the need to promote their genuine inclusion. During this period, technology and technology-mediated learning have improved the quality of life of older adults in many ways. The purpose of this research is to identify the socio-emotional role of technology-assisted learning programmes for seniors ever since the onset of the pandemic. The results reveal a positive impact on the emotional well-being of older adults from these forms of learning. Participants highlight the value of intergenerational socialisation enabled by these learning formats in the process of self-learning and reciprocal learning that takes place on platforms such as YouTube and WhatsApp. However, a preference among seniors for in-person learning has also been observed, which is sometimes linked to a certain level of technological anxiety.

Keywords: Older adults, active ageing, ICT-based learning, socio-emotional support, e-learning, blended learning.

1 Introduction

The negative impact of the pandemic on the emotional state of older adults has intensified the debate on their digital exclusion, prompting reflection on alternatives that will allow their true technological inclusion. Information and Communication Technology (ICT) enables new forms of socialisation for seniors that can mitigate the adverse effects of loneliness and social isolation on their emotional and mental health [1, 2, 3]. This ICT capability has been evident in the most difficult moments of the pandemic by enabling closer communication for older adults, softening spatial-temporal barriers with their family and friends [2, 4], and providing socio-emotional support that has boosted their self-confidence [1, 5]. Nevertheless, these tools are not always adapted to every senior to the same extent, due to the varying degrees of accessibility and digital literacy of this population [6]. Beyond the digital generation gap, there are intra-generational divides that explain the existence of diverse categories of the so-called *silver surfers* [7, 8]. Older users with low levels of digital

literacy are reluctant to use ICT, yet the number of seniors willing to it is increasing, as they see an obvious benefit in its diversified use [9].

On the other hand, the increasing desire of older adults for learning [10] has boosted the offering by universities for seniors, which have become relatively important spaces for learning and social interaction among this group [11]. The health crisis has changed these systems to technology-dependent, distance learning formats, which has created difficulties for many users [12]. E-learning has always offered older adults with mobility problems the opportunity to learn, yet seniors have traditionally shown a negative attitude toward this type of educational model [13]. However, the pandemic and the possibilities of technological accessibility in today's societies have fostered digital learning modes for older adults [13, 14]. In addition, social networks have offered informal and collaborative learning through the co-creation of content and intergenerational relationships [15, 16, 17].

Such contributions, which delve into the theoretical background of this situation, show the relevance of ICT and education for the social and digital inclusion of seniors. However, this is a topic that has only been partially addressed, and deserves a scientific-academic approach from other perspectives as well. Thus, the purpose of this research is to determine the socio-emotional role of technology-based learning programmes aimed at older adults since the start of the pandemic, which implies answering the following three research questions (RQ):

RQ1. What role has ICT played in seniors' learning since the beginning of the pandemic, and what impact has this learning had on their state of mind?

RQ2. How does technological dependency affect older adults and what effect has it had on their motivation for online learning and digital literacy?

RQ3. What has been the experience of senior educational organisations and how has the health crisis affected the way they have adapted their offerings?

This research provides a qualitative approach to the experiences of older adults with different levels of digital capital, and the contributions of those responsible for educational programmes aimed at this audience. Consequently, it could provide valuable knowledge regarding the learning needs of a social group at risk of digital exclusion. This will allow us to advance in finding the key to motivating the less technologically-qualified seniors so they can improve their digital capital and achieve greater operational autonomy, as well as alternatives for socio-emotional support.

2 Theoretical Background

2.1 Digital Capital of Seniors and the Digital Divide they Confront

Digital capital is "the accumulation of digital skills related to information, communication, safety, content-creation and problem-solving, as well as digital technology" [18, p. 2367]. As such, this concept combines a series of internal aptitudes and skills belonging to each individual (digital competence), with a set of material or technical resources that are external, to which that person has access (digital technology) [19]. Ragnedda [18] defines digital capital in terms of the three levels of the digital divide. Consequently, a person's level of digital capital

determines their degree of digital inclusion or exclusion. In general, differences in technical access to the Internet (first-level digital divide) lead to inequalities in both the level of digital skill and the ways ICT is used (second-level digital divide), and in the degree of achievement of tangible results associated with those uses (third-level digital divide) [20]. A person's digital capital determines the quality of their Internet experience, and it can either induce or aggravate inequities related to the second and third-level digital divides [18].

This digital capital depends on diverse socio-demographic variables. Moreover, a significantly adverse correlation has been observed between the level of digital skill and age [19]. Among the different population segments, older adults have a smaller variety of digital devices (first-level digital divide) [20] and a lower level of digital skills. Moreover, their range of uses on the Internet is less diverse (second-level digital divide) [21], and they obtain less benefits in the social areas of their lives from using online media (third-level digital divide) [18, 22, 23]. In this regard, Nimrod [24] has found that only 17.7% of seniors use social media and engage in other new media activities, which shows that there is a second-level digital divide that clearly affects this group. To some extent, the digital inequities that older adults must face are a result of the fact that the level of digital literacy decreases with age [25, 26]. Along these lines, Van-Deursen and Van-Dijk [27] point out that age has a detrimental impact on the level of operational and formal internet skills, yet they also reveal that this is not a key factor in the level of informational and strategic internet skills. In fact, using the Internet on a daily basis to perform online tasks may have a greater impact than age on both the digital behaviour [28] and browsing patterns of seniors [29, 30, 31]. Thus, older adults with previous experience using ICT find it very useful, and they are more willing to learn how to use it to carry out digital tasks that allow them to achieve independence and social engagement [32]. Furthermore, other factors that influence their use of technology include their stage of life, functional limitations linked to ageing, and the ways that each senior socialises [33].

At the beginning of the 21st century, the limited use of ICT by older adults was linked to this group's perception of digital tools as useless [34]. Today, however, many seniors find online activities more interesting than other daily pursuits [35]. Specifically, older adults place exceptional value on using the Internet to contact their families, especially children and grandchildren [36]. This intergenerational connection enabled by ICT [37], which allows families to feel connected despite being separated by distance [4, 36], could be used as an incentive to encourage reluctant seniors to use the Internet [35].

2.2 The Value of Digital Literacy and Online Learning for Older Adults

The exponential ageing of the population has coincided with the challenge posed by the strong advance of digitisation for seniors [5]. This challenge has meant that digital literacy for older adults has gone from being an option to an obligation. This requires strategies that help them develop flexible technical skills that will allow them to react in a self-sufficient way to constant technological changes [38]. In this context, ICT training has emerged as an opportunity for lifelong learning that can improve the quality of life for many seniors [39]. Recent studies indicate that technological

training for older adults should have a modular design, integrating self-regulated learning formats into guided learning modules that take into account the diversity of skills and knowledge of seniors, so they can choose the option that best suits their needs [40]. To help people over 80 years of age in their digital inclusion and technological use, it is advisable to design organised, non-formal learning programmes that allow this group to socialise, acquire knowledge, increase their self-confidence, and avoid isolation and anxiety [5]. Serious games seem to be a method that can work for older users in improving their digital capital by offering them pleasant learning experiences that facilitate the understanding of complex and unappealing technical concepts [41, 42].

The participation of seniors in educational programmes contributes to their well-being and quality of life by improving their cognitive functions, enhancing their independence, and motivating their sense of belonging to a group [43]. Although the stereotypical view persists that older adults are not interested in using technology, and even less in using it for educational purposes, more and more seniors are participating in digitisation [11]. Fernández-Ardèvol and Rosales [44] have revealed an attitude among this group that defies these stereotypes and is linked to their desire to learn and their willingness to create intergenerational relationships.

The pandemic has led to an understanding of the benefits of technology for older adults, which has enabled their learning in times of forced isolation [14], thereby helping to improve their state of mind [1]. Older audiences are increasingly using ICT to learn, as they consider that neither knowledge nor learning is limited by age, and they find it rewarding as well [41]. The number of older adults interested in participating in lifelong learning programmes is steadily growing, yet this offer must be adapted to the needs of each profile of senior learners [11, 38]. University offerings for older adults have been implementing diverse Technology-Mediated Learning programmes (TML), which have made knowledge more accessible to seniors [13]. Alavi and Leidner [45, p. 2] define technology-mediated learning [TML] as “an environment in which the learner’s interactions with learning materials (readings, assignments, exercises, etc.), peers, and/or instructors are mediated through advanced information technologies”. The effective pedagogical use of technology-mediated learning methodologies requires an adaptation of traditional teaching methods [46]. These alternatives to in-person learning have become the only way of accessing education for seniors in the last two years as a result of the pandemic, leading to a digital dependency that has excluded some users [12].

Older adults generally have a negative attitude toward the use of e-learning [13], yet Lipphardt et al. [47] have shown that many seniors are well-adapted to this type of training and can benefit from its advantages. However, there are differences in their level of motivation for using it, depending on their age, health, gender, and nationality. Along the same lines, it has been noted that older adults are open to acquiring technological skills through blended learning if they are motivated and aware of the functional benefits that ICT can offer them [38]. Younger seniors participate in e-learning programmes, motivated by the acquisition of competence, development of instrumental skills, and membership in a social group, while older seniors engage in e-learning courses for personal growth [47]. Younger seniors (55-65 years old) who use digital media with confidence display an especially positive attitude toward ICT use and a greater willingness to participate in e-learning [11].

2.3 The Learning Opportunities Offered to Older Adults by Social Networks

In the context of collaborative learning, social networks have provided an open space for self-learning on a wide range of topics of interest to older adults. Many of them are curious to explore social networks, which act as an incentive to acquire the digital skills to use them [17, 48]. Social networks offer various learning paths for older adults, ranging from open-source video tutorials that help them acquire instrumental skills [49], to options using the smartphone that provide them with a private social space for digital education that they can share with their grandchildren [50]. Harley and Fitzpatrick [17] have identified the opportunities offered by YouTube as a tool for reciprocal learning, a channel for intergenerational contact, and a space for the co-creation of content. WhatsApp has opened up new ways of relating and learning [51] on a more private, personal level. Seniors combine the interactions they carry out through their smartphones with forms of digital entertainment that might involve the creation, publication, and dissemination of content [44], which are actions that expand their learning options. Thus, the mobile phone and some digital platforms have helped democratise access to knowledge, yet what is needed is to design applications that break down accessibility barriers encountered by certain social groups [51]. Through their smartphones, older users can create spaces for reciprocal digital education that they share with their grandchildren [50]. These and other intergenerational interactions, which are driven by social networks, have a strong appeal for seniors and promote a better quality of life through entertainment and mutual learning [15, 16, 17].

Among the initiatives developed specifically for older adults, Senior Network and MiOne stand out. Senior Network is a pilot project based on the idiosyncrasies of social networks, which has provided older adults with access to knowledge on current affairs, health, and culture. This has fostered their intellectual stimulation and social participation, and has mitigated the adverse effects of loneliness as well [52]. MiOne is an online community where seniors are assisted in actively using diverse digital contexts [9]. Through these and other Digital Social Networks (DSN), older adults can be integrated into the knowledge society, which can improve their quality of life [15, 16]. Thus, despite the stereotyping of seniors by social networks, the latter offer older adults the opportunity to exchange ideas and thoughts in a digital community [53, 54].

3 Methodology

In order to answer the research questions (RQ) proposed in this article, a methodological triangulation has been designed based on two qualitative techniques of an exploratory nature: Focus groups and personal interviews. Focus groups allow access to the learning experiences that seniors have had since the beginning of the pandemic, mediated by ICT, as well as the effects of these experiences on their emotional state and interest in improving their technological skills. This technique makes it possible to explore the experiences, attitudes, and perceptions of a small group of subjects who discuss, reflect, and explore a topic in depth [55, 56, 57], by

using dynamic participation [58] in which a sense of belonging to a group has emerged [57, 59]. Interviews with the heads of organisations dedicated to the education of older adults offer the opportunity to learn about their e-learning programmes and the evolution of their offering since the outbreak of the pandemic. It also allows us to discover what role these organisations have played in accompanying and entertaining seniors. Interviews offer a comprehensive, contextualised approach to a specific topic through direct interaction with experts who can clarify concepts related to the object of study [60, 61].

3.1 Sample Design

Four focus groups were conducted, which consisted of a small number of participants over 60 years of age. The small size was chosen in order to achieve greater emotional and interactive engagement [62]. The sample consisted of a total of 27 people over 60 years of age (Table 1), based on the principle of convenience and access to participants through collaborating organisations, which implied a lack of balance between men (M) and women (W). Each group was organised according to a criterion of experiential bonding between subjects in the same group in order to foster emotional empathy and the expression of shared feelings based on similar experiences [56, 59]. All of the subjects who participated in this study reside in different parts of Spain.

Table 1. Sample of the focus groups. Source: Developed by the authors.

Items	Group I	Group II	Group III	Group IV
Age	60-77 years	61-77 years	61-73 years	60-67 years
Gender	3 W & 3 M	6 W & 1 M	4 W & 2 M	5 W & 3 M
Occupation	4 W & 2 R	1 W & 6 R	2 W & 4 R	5 W & 3 R
Residence	5 C & 1 R	7 Large C	6 Small C	8 R
Education level	Very high	High	Medium	Low
Digital competence	Very high	High	Medium-low	Medium-low & low

Table 1 summarises the sample design, which was divided into four focus groups: Group I, selected with the support of Complutense University of Madrid (UCM), is composed of six subjects with a high level of education who live mainly in cities (C); Group II, selected with the support of Complutense University for Seniors (UCM for Seniors), is composed of seven participants, nearly all of them retired (R), with a high educational level and interest in lifelong learning; Group III, organised with the help of the Centro de Educación de Personas Adultas (CEPA) Rio Sorbe de Guadalajara, is made up of six people with a low-medium level of education; Group IV, designed with the help of the town council of the municipality where the participants live, is composed of eight individuals living in a rural area (R), most of them working (W), with low educational and digital levels, and diverse but low-skilled occupations.

The interviews, which comprise the final part of the methodology, were conducted with four people in charge of various Spanish institutions, organisations, and administrative departments involved in lifelong learning for older adults. The purpose of these interviews was to identify their commitment to promoting the participation and autonomy of this social group, while taking into account its impact on their well-being [1, 43, 47]. Table 2 provides a brief description of the profiles interviewed, who hold positions of authority in the following organisations: The Deputy Directorate of Seniors for the City of Madrid [63], a local administrative body that designs and implements programmes and services that enhance the autonomy of the entire population of older adults in Madrid and their social inclusion; Complutense University for Seniors (UCM for Seniors) [64], a public institution that offers some 2,500 older users the opportunity to be intellectually active, thereby contributing to their personal growth and social integration; Canal Senior [65], a non-profit organisation that offers the most prominent digital platform in Spain for informal e-learning in both synchronous and asynchronous modes, in order to enhance older adults' access to knowledge; and Universitas Senioribus CEU (Senioribus CEU) [66], a private educational centre based on the concept of lifelong learning, which offers its nearly 1,400 senior students educational programmes to help them remain intellectually active during the ageing process.

Table 2. Sample of interviews conducted. Source: Developed by the authors.

Interviewees	Code	Institution, organization, or administration	Position
Interviewee 1 [63]	I1	Deputy Directorate of Seniors in Madrid	Subdirector
Interviewee 2 [64]	I2	Complutense University for Seniors	Coordinator
Interviewee 3 [65]	I3	Canal Senior	President
Interviewee 4 [66]	I4	Universitas Senioribus CEU	Director

3.2 Procedure and Data Analysis

Prior to conducting the focus groups, a discussion guide was prepared for two reasons: Firstly, to orient the discourse of the participants and make it dynamic; and secondly, to standardise the recording of data and enable the qualitative analysis of the content [57]. The guide's design was agreed upon by the research team in order to provide answers to the research questions, especially RQ1 and RQ2. Additionally, the most relevant aspects of the scientific literature review were considered in its preparation. Thus, the topics chosen for moderating the focus groups were the following:

1. Participants' views on the role of ICT as a mediator of informal learning since the beginning of the pandemic.
2. Perceptions and/or experiences of the older adults' regarding the impact of technology-mediated learning on their state of mind.
3. Seniors' perception of the impact of technological dependence on their motivation for e-learning and improving their level of digital skill since the pandemic.

Along the same lines, before conducting the interviews, a semi-structured guide was also prepared in order to assist the interviewer in carrying out the work. To design the guide, the research team considered some of the key results obtained from the focus groups, as well as aspects of the theoretical background related to the research questions. However, regarding the interviews, even though the three research questions were the foundation of the methodological design, the interview discussion focused more on answering the last question, or RQ3. For that reason, three blocks of questions were defined, which were sufficiently open-ended to guarantee fluidity, spontaneity and flexibility in each interviewee's response, and they are as follows:

1. Considerations and experiences of your institution or company related to the role that ICT has played in encouraging older adults to learn and improve their state of mind since the beginning of the pandemic.

2. Perceptions of the influence that technology dependency has had on seniors' motivation for online learning and digital literacy, especially from the start of the first confinement.

3. Changes in the educational offering of your institution or company in order to adapt to the new digital scenario as a result of the pandemic.

Due to the nature of the research itself, the fieldwork began with focus groups in January of 2021. Afterward, the interviews were conducted in February of the same year. The nature of these techniques and the conversational dynamics that arose determined the time duration, which was variable in each case. Thus, the focus groups lasted longer (approximately 90-140 minutes), compared to the interviews (approximately 40-60 minutes).

Both the focus groups and interviews were conducted by using Blackboard Collaborate. This online platform allowed the discourse to be recorded and transcribed, thereby allowing for in-depth exploration of the topics addressed in each case and the relationships between them [58]. A qualitative-inductive study of the discursive content [67] was carried out using Atlas.ti 9, in order to systemise a thematic analysis that allowed us to categorise the results [68] according to the research questions. Atlas.ti is a software package that draws from the methodological processes of grounded theory [69, 70], although its own methodological conceptualisation and functionality allow for qualitative content analysis and thematic analysis [71].

To carry out this analysis, a rigorous coding process was previously implemented for the main topics that guided the focus groups and interviews, as well as for the sub-topics, which were derived from the priority themes and identified through inferential and inductive procedures [68]. This coding was developed by combining the three strategies identified by Glaser and Strauss [70] for text analysis framed within Grounded Theory: Open, axial, and selective coding [71]. Open coding was carried out based on exploring the text, using in-vivo coding close to the discourse content to determine preliminary thematic categories. Axial coding identified the most relevant thematic categories from which the coding was initiated, thereby allowing for the definition of sub-categories according to the evolution of the discourse itself. Selective coding made it possible to choose the main categories of codes and their relationship with the others based on several tests carried out by means of open and axial coding [70, 71]. Coding procedures that are open, axial, and selective involve cyclical and evolutionary analyses in which the researcher repeatedly examines the

material, applying techniques of data consolidation and reduction, which enable the investigator to identify, code, and interpret the most relevant themes for her or his research [72]. Once the axial and selective codes have been established, Atlas.ti enables an analysis of the relationship between them, linking them to text passages, referred to as *quotes* [70].

Table 3 lists the coded topics that have been categorised into families or groups of codes according to their conceptual similarity. In addition, this table includes both the abbreviated codes and the grounded (Gr) rate of each code, or in other words, its rootedness or grounding according to its iteration or frequency of occurrence in the discourses analysed [73].

Table 3. Topic coding. Source: Developed by the authors using Atlas.ti.

Topic description by category	Code	Grounded (Gr)
1. Positive role of ICT-based learning for seniors	PREL	300
1.1. Motivator of emotional well-being	MEW	280
1.1.1. Personal autonomy and self-confidence	ASC	108
1.1.2. Socialisation	SOC	132
1.1.2.1. Intra-generational	SIA	54
1.1.2.2. Inter-generational	SIE	103
1.1.3. Digital inclusion	DIN	123
1.1.4. Curiosity for learning and staying up-to-date	CLU	68
1.1.5. Entertainment	ENT	96
1.2. Motivator of quality of life	MQL	160
1.2.1. Intellectual and mental activity	IMA	71
1.2.2. Instrumental skills and competence	ISC	103
2. Negative role of ICT-based learning for older adults	NREL	71
2.1. Deterrent by cognitive load and technology indifference	DCD	66
2.2. Deterrent by a lack of adaptation to the senior profile	DAP	29
3. Adaptation of the training	AOT	207
3.1. Adapting to circumstances (the digital drive)	ATC	77
3.2. Adapting to profiles (diversification of offerings)	ATP	39
3.3. Adaptation to topic interests	ATI	168
3.3.1. Culture, leisure, sport, and current affairs	CLA	89
3.3.2. Technology and digital skills	TDS	85
4. Formats of ICT-based learning for older adults	FEL	269
4.1. Self-learning	SEL	98
4.1.1. Video tutorials for self-learning	VID	24
4.1.2. Self-learning without technical assistance	SWT	32
4.1.3. Self-learning assisted by a loved one	SAB	39
4.2. Guided learning	GUL	98
4.3. Reciprocal learning	REL	93
4.4. Preference for in-person learning	PIP	80

Once the code tree was defined, two types of relational analysis were carried out:

1. Studies of co-occurrences among codes, which make it possible to identify, observe and understand the synergies or confluences that occur among the coded topics and their overall intensity in the combined analysis of focus groups and interviews.

2. Analysis of a table-document containing occurrences, which reveals the rootedness (Gr) of a coded topic in each interview and/or focus group, according to its iteration or frequency of appearance in each discourse.

Atlas.ti allows the results of these analyses to be compiled into tables and Sankey diagrams. These diagrams allow visualisation of the interaction detected in the two types of analysis described above, highlighting the dominant factors of each relationship according to the magnitudes of each coded topic, which is shown by the band width that links them, thereby reflecting the contribution of each code in relation to others with which it converges [73]. Also, verbatim has been included in the results in order to clarify ideas linked to the thematic categories related to each research question.

4 Results

4.1 The Role of ICT and its Motivational Value in the Learning Process of Older Adults (RQ1, RQ2)

From a beneficial point of view, ICT has provided learning opportunities that have fostered a positive state of mind among people over 60 years of age and improved their quality of life. Up to 300 occurrences have been counted in focus group discussions and interviews that identify positive aspects of technology-mediated learning since the outbreak of the pandemic (PREL Gr=300, Table 3). The results of the co-occurrence analysis shown in Table 4 reflect up to 216 connections between types of technology-assisted learning for older adults (FEL) and its positive role for seniors (PREL). However, this study shows a stronger connection of this type of learning to the motivators of emotional well-being (MEW-FEL, 202 co-occurrences) than to the motivators of quality of life for older adults (MQL-FEL, 108 co-occurrences). Of the types of ICT-assisted learning most highly regarded by the participants, self-learning (SEL-PREL, 87 co-occurrences), reciprocal learning (REL-PREL, 82 co-occurrences), and guided learning (GUL-PREL, 78 co-occurrences) stand out.

Table 4. Types of ICT learning used by older adults and their impact on emotional well-being and quality of life. Source: Developed by the authors using Atlas.ti.

	FEL	SEL	VID	SWT	SAB	GUL	REL	PIP
PREL	216	87	21	33	31	78	82	46
MEW	202	76	18	27	28	76	79	38
MQL	108	59	16	25	17	54	19	12

The Sankey diagram shown in Fig. 1 represents the intensity and contribution of each motivator of emotional well-being (MEW) and motivator of quality of life (MQL) of seniors in specific ICT-mediated learning processes. It shows that socialisation (SOC) and digital inclusion (DIN) are the MEWs that contribute most to the positive role of ICT-mediated learning for older adults.

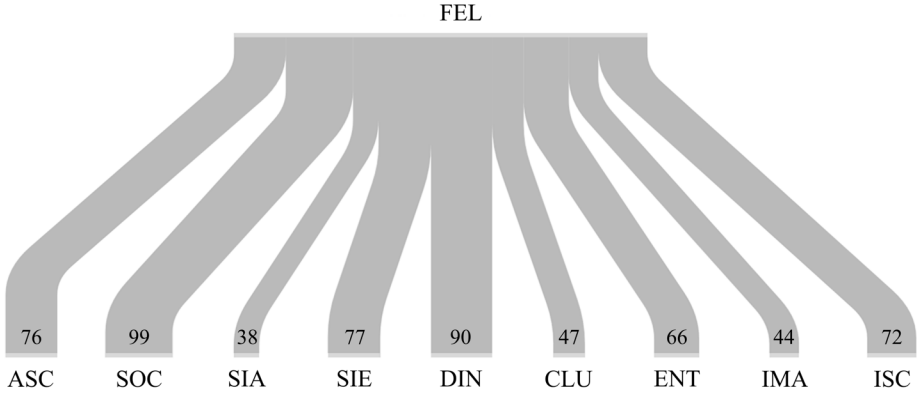

Fig. 1. Motivators of emotional well-being of older adults related to ICT-mediated learning. Source: Developed by the authors using Atlas.ti.

According to Fig. 1, the motivational value of intergenerational socialisation (SIE) with family and friends stands out, as it enables these learning opportunities for older adults, as stated by participants in the focus groups. Here are some examples:

Group I: *"I'm part of a very large WhatsApp group, which is Icono 14, and it stands out for the convergence of opinions between people who are very diverse generationally, politically, and geographically. It is a learning space that highlights the value of community confluence. Community is life"*.

Group IV: *"During the most difficult times, connection with the family through these tools was essential. It was not just about talking and seeing each other; it was about learning to cope better with what was happening; to understand it with the help of our children and grandchildren"*.

On the other hand, Fig. 1 identifies instrumental skills and competence (ISC) as the most relevant motivator of MQLs in the positive role of this learning mode for seniors, as stated by some participants in the focus groups:

Group II: *"My digital skills were crucial. They've empowered me to take care of myself all this time. Every day I looked for an online tutorial. I did exercise and meditation. You might say it has allowed me to maintain my life quality at all levels"*.

Table 5 shows the confluences detected between the different codes that define motivators of emotional well-being of older adults (MEW, Gr=280) and quality of life (MQL, Gr=160) related to senior learning. Thus, the emotional well-being (MEW) provided by learning is related to quality of life (MQL) on 146 occasions. The most prominent confluences among the motivators of emotional well-being (MEW) observed are those produced by socialisation (MEW-SOC, 126 co-occurrences), digital inclusion (MEW-DIN, 121 co-occurrences), as well as personal autonomy and

self-confidence (MEW-ASC, 104 occurrences), confirming that these factors are catalysts of the emotional well-being provided by ICT-mediated learning for older adults. The importance of the socialising role of learning in digital environments highlights the support it has offered to seniors, according to the interviewees:

I4: *"We're finding very encouraging surprises, because somehow we're seeing that more human closeness is being generated online than in person, because when older adult students come face-to-face with each other, they only know their friend and a few others, but they don't know the other students' names or who they are. Whereas in the online environment, students and teachers usually connect 10 minutes before class and interact with each other. This online socialisation is proving to be extremely interesting"* [66].

I1: *"We have promoted the design and development of Apps so that administrations, families, and older adult users can exchange information and make use of digital tools. We've realised the importance of the socialisation generated through video calls and online groups. This is why we have promoted these tools and training in digital skills for seniors; we have taught them how to use these other forms of social connection to share knowledge"* [63].

Table 5. Synergy between topics associated with the positive impact of ICT-mediated learning on seniors' emotional well-being (MEW) and quality of life (MQL). Source: Developed by the authors using Atlas.ti.

	MEW (Gr=280) ◄				146			► MQL (Gr=160)	
	ASC	SOC	SIA	SIE	DIN	CLU	ENT	IMA	ISC
MEW	104	126	53	97	121	68	91	66	96
ASC	0	6	2	5	87	25	9	26	80
SOC	6	0	56	104	17	10	62	21	8
SIA	2	56	0	31	8	7	25	16	2
SIE	5	104	31	0	15	9	49	16	7
DIN	87	17	8	15	0	30	15	34	81
CLU	25	10	7	9	30	0	27	34	17
ENT	9	62	25	49	15	27	0	33	7
MQL	96	26	16	21	103	47	37	72	104
IMA	26	21	16	16	34	34	33	0	16
ISC	80	8	2	7	81	17	7	16	0

Table 5 also reflects the strong relationship between MEW and entertainment (ENT) in ICT learning (MEW-ENT, 91 co-occurrences), which demonstrates the value of fun for seniors' emotional satisfaction:

Group II: *"During the most difficult moments of the confinement, my grandson called me every day, and we did some physical exercise in a fun way using YouTube video tutorials; it was a learning experience that was mutually fun and enriching"*.

As they are aware of the power of YouTube as a tool for learning, socialisation, and entertainment, some institutions ventured into using such channels to reach a larger number of older adults:

I2: *"The experience with YouTube is so wonderful that it's going to stay. We have five clubs: Literature, Art, Music, Computer Science, and Film. On Fridays, what the professors do is use the YouTube channel of Complutense University for Seniors, and they bring in a guest speaker who gives a lecture; then they interview him or her live, and it's accessible to everyone. It's not associated with any course, neither the first nor the second cycle; it's open to everyone"* [64].

According to the data in Table 5, it can be interpreted that on the one hand, digital inclusion enables personal autonomy and self-confidence for older adults (DIN-ASC, 87 co-occurrences). Digital inclusion repeatedly converges with the quality of life (DIN-MQL, 103 co-occurrences) of seniors, showing the impact that the first parameter can have on the second. Instrumental skills and competence (ISC) is the most salient of the MQLs, with 104 connections between the two codes. Thus, some focus group participants with less digital skills recognise their progress in technological inclusion during the pandemic and its importance for their life quality:

Group IV: *"The most beautiful and gratifying thing about this whole pandemic is that we've made some progress with technology –before, we didn't do half of what we do now. You were connected to the computer, videoconferencing, the tablet, and the mobile phone. Actually, all of that has been very positive, but also very difficult, because we weren't used to it; we haven't lived with technology like young people do now; they're born with technology"*.

From a negative point of view, connections have been detected between the different forms of ICT-assisted learning and factors that deter the use of these learning modalities among people over 60 years of age. However, the negative role of ICT-mediated learning for older adults is less firmly rooted (NREL Gr=71, Table 3), which indicates its positive prevalence according to the perception of the participants in this research. Table 6 gives a detailed itemisation of the co-occurrences between the negative aspects associated with these learning approaches, highlighting 49 unfavourable associations with this type of learning for seniors (NREL-FEL). Specifically, the negative role of this learning mode is linked mainly to a preference for in-person contact (NREL-PIP, 44 occurrences). This reveals a certain nostalgia for physical presence, which even the participants with the highest level of digital capital recognise, despite acknowledging the remarkable potential of e-learning:

Group I: *"I work as an associate professor of Journalism at Pompeu Fabra University, and during the confinement I coordinated a subject-workshop consisting of the launch of a digital version of an old newspaper, Diario de Barcelona, in April 2020. This university newspaper was created during the confinement and we had to do everything from home by videoconferencing. It was really fun and interesting, but we all missed getting together at the university in person. So, the technology was very good for us, but there's really no substitute for being in person"*.

Table 6. Reluctance among older adults to use digital learning. Source: Developed by the authors using Atlas.ti.

	FEL	SEL	VID	SWT	SAB	GUL	REL	PIP
NREL	49	12	1	2	9	8	11	44
DCD	47	12	0	1	10	8	12	42
DAP	23	7	1	1	5	3	5	20

According to the data in Table 6, the cognitive load of this type of learning and the indifference that older adults perceive with regard to technology, and therefore with learning in digital environments (DCD-FEL, 47 co-occurrences), have been identified together as the strongest barrier. Meanwhile, the deterrent due to a lack of adaptation to the different profiles of seniors (DAP) is a lesser obstacle. The aforementioned cognitive load, which is linked to technological distress or indifference toward the devices, may reduce the interest of some older adults for this type of education:

Group III: *"I find technology very cold. I prefer to see and touch people... Videoconferencing lets you see and learn many things, but you don't touch anything, and you miss things. I'm all about being with people.. I don't like technology at all"*.

Interest in the learning content and its effect on emotional motivation (MEW) and quality of life (MQL) of seniors varies from item to item. As outlined in Table 7, content on culture, leisure, sport, and current affairs activate, above all, entertainment (CLA-ENT, 59 co-occurrences) and socialisation (CLA-SOC, 43 co-occurrences), acting as emotional motivators for participants with stronger digital skills, as they acknowledge in their statements as follows:

Group II: *"I've taken a couple of art courses, one on cubism. I also started to get into watercolour demonstrations from Buenos Aires because I like painting. I still do it nearly once a week, and it allows me to meet interesting people"*.

Table 7. Interest among older adults in the content of ICT-mediated learning processes. Source: Developed by the authors using Atlas.ti.

	MEW							MQL	
	ASC	SOC	SIA	SIE	DIN	CLU	ENT	IMA	ISC
ATI	53	57	22	46	63	39	66	38	49
CLA	11	43	20	33	15	28	59	34	6
TDS	47	14	2	13	52	12	8	6	48

As shown in Table 7, content related to technology and digital skills connect, on the one hand, with digital inclusion (TDS-DIN, 52 co-occurrences) as well as personal autonomy and self-confidence (TDS-ASC, 47 co-occurrences), thereby activating emotional motivators. On the other hand, these topics converge with instrumental skills and competence (TDS-ISC, 48 co-occurrences), encouraging the quality of life of seniors, which is especially appreciated by those with the lowest digital skills, who reflect on the need to learn more:

Group III: *"I use technology, more or less [...] but I think I should use it more. I need to take more classes because I feel a bit awkward, and I'd like to be more autonomous. Of course, I also do it for myself personally, and for everything, because you can be left behind, you know, because this thing is advancing a lot"*.

Technological dependence has had a variable impact on older adults' interest in improving their digital skills, depending on the dominant profile in each focus group. Fig. 2 shows a priority for content related to culture, leisure, sport, and current affairs (CLA) among the most digitally-competent groups (Groups I and II), while it reveals a preference for topics related to technology and digital skills (TDS) among groups with a lower level of technological competence (Groups III and IV).

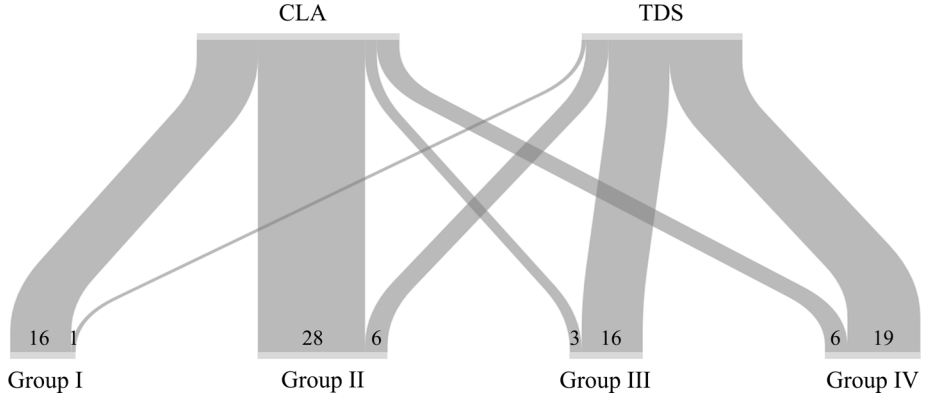

Fig. 2. Adaptation of the topic interests of older adults' learning according to the profile of the focus group in which they participated. Source: Developed by the authors using Atlas.ti.

Moreover, the results shown in Fig. 2 are consistent with the reflections of participants with lower levels of digital capital on preferences linked to their needs which, in some cases, generate a certain amount of anxiety or embarrassment for them, as acknowledged by the learning experience of one of the interviewees:

I3: *"Many seniors feel anxiety, distress, and unease. Unease because you have to rely on someone else to solve things that you should be able to do yourself, without having to depend on others. There's a lot of work to be done by everybody"* [**65**].

4.2 The Adaptation of Training Organisations for Older Adults (RQ3)

As explained by the heads of training organisations directed at seniors who took part in this research, the pandemic was a catharsis for all three organisations that had offered in-person courses (I1, I2, I4) [63, 64, 66], as they had to adapt to distance learning methods they had not used before March of 2020. This requirement explains the synergy between the adaptation of the training and the adaptation to circumstances, which is reflected in the 70 co-occurrences between AOT and ATC (Table 8), and is evident in some of the interviewees' statements:

I4: *"We had to virtualise everything and use our ingenuity. We have about 50 subjects. [...] We even virtualised one subject called 'Getting to know Madrid',*

which is an art class that involved visits to the city [...] So, with the help of Google Earth and Google View, and a lot of imagination and effort, we managed to virtualise the subject. Now, most of the subjects are being taught by live streaming through Blackboard Collaborate, and then recorded, so you can watch them during the week [...] Naturally, it took a huge effort to make this happen" [66].

I2: *"We had to learn all of this new technology the hard way. We've all learned together how to get over this hurdle, and to launch, re-start, and transform all the classroom-based subjects into virtual ones so as not to lose the course, so that the senior students would be accompanied and have their classes available, as far as possible. And that's what we continue to do [...] hoping our students will keep staying active and continue to learn new things, which is what they want"* [64].

Table 8. Synergy between the adaptation of training for older adults and ICT-mediated learning methods. Source: Developed by the authors using Atlas.ti.

	AOT	ATC	ATP	ATI	CLA	TDS	SEL	GUL	REL	PIP
AOT	0	70	36	153	81	77	52	60	40	22
ATC	70	0	28	29	6	24	11	32	7	10
ATP	36	28	0	9	5	6	2	12	2	6
ATI	153	29	9	0	88	83	50	44	36	14
CLA	81	6	5	88	0	4	17	23	25	6
TDS	77	24	6	83	4	0	36	23	11	8

According to the analysis of co-occurrences shown in Table 8, the adaptation of the training (AOT) by these organisations has mainly focused on adapting to the topic interests (ATI) of older adults, resulting in an increase in their offering (I3) [65] and/or in the digitisation of the content that was previously taught in-person (I2, I4) [64, 66]. This is reflected in the high number of confluences between the two codes (AOT-ATI, 153 co-occurrences), and this synergy is stated often by the interviewees as follows:

I3: *"We multiplied the range of activities we had by three. So, the idea was for seniors to have an additional learning and entertainment environment [...] And this expansion of the offering led us to touch on all kinds of subjects, ranging from a series of courses we did on the Spanish copla, which was a big success, to courses on authors and history"* [65].

Table 8 also shows that a need for balance has been identified between content on culture, leisure, sport, and current affairs (CLA-ATI, 88 co-occurrences), and content on technology and digital skills (TDS-ATI, 88 co-occurrences). This balance probably reflects a coexisting need to improve technological skills, especially among groups with less digital capital (Groups III and IV), along with an incentive to escape the situation and seek entertainment with interesting topics on culture and current affairs. Despite this overall balance between the adaptation of topic interests (CLA and TDS), the interviews revealed a different response by the diverse training organisations.

Fig. 3 outlines the content offering of each institution since the start of the pandemic. It has been found that organisations specialising in education for older adults (I2, I3, I4) [64, 65, 66] have chosen either balance in topic content or

prioritisation of topics on culture, leisure, sport, and current affairs (CLA). On the other hand, the Deputy Directorate of Seniors in Madrid (I1) [63], committed to the social inclusion of older adults, has shown special concern for their digital literacy, and is implementing courses focused on technology and digital skills (TDS), thereby allowing seniors to access spaces for citizen participation:

I1: *"One of the goals of the Deputy Directorate of Seniors is to design and implement a digital access plan for older adults. It was approved in July 2020, and since then we've been working on this strategy [...] We believe emphasis must be placed on training older adults, not only in technology, but also in its possible uses [...] We have 91 municipal senior centres in the City of Madrid. Each centre has a technology room equipped with computers, and from there we organise workshops for seniors on awareness-raising and training in the use of these new tools"* [63].

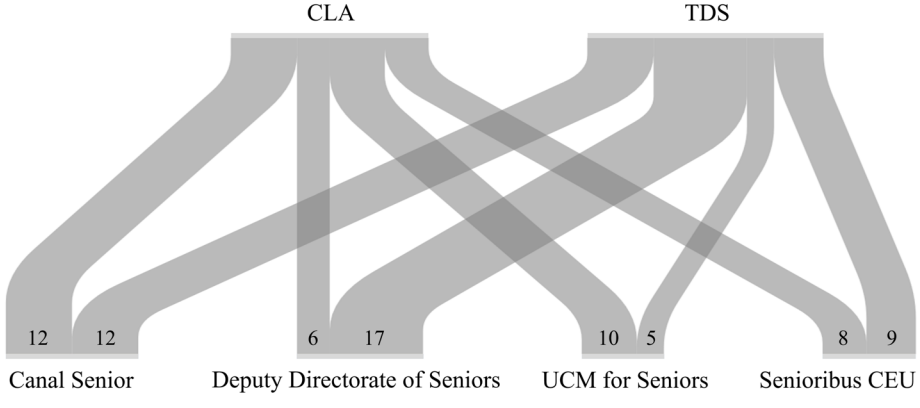

Fig. 3. Adaptation of the educational offering according to the organisation or institution that focuses on training older adults. Source: Developed by the authors using Atlas.ti.

With regard to the learning methods shown in Table 8, and as stated by the interviewees, the most well adapted mode since the pandemic has been the guided approach by specialised organisations (AOT-GUL, 60 co-occurrences). However, in addition to this datum, which was foreseen due to the responsibility of these institutions toward their target audience, the focus group participants acknowledged having felt the need to enhance their self-learning since the pandemic, yet not in the same way nor same direction.

Fig. 4 shows greater dependence by older adults with less digital capital (Groups III and IV) on self-learning with the help of a loved one:

Group IV: *"Look, about me and technology, apart from being a fairly untidy person, I'm a coward about using these tools. But I'm really lucky, because I gave all the tasks to Gerardo [his son], and poor Gerardo is the one who comes over and fixes the problems, and with his saintly patience, he even explains it to us all over again"*.

Group III: *"We constantly have problems with technology. Usually, my son and daughter-in-law help us, but during the confinement, they had to explain everything by using technology. With the telephone and videoconferencing, we*

tried to solve the problems, and I would say we learned more by doing it on our own than just having them come over and solve it for us right away".

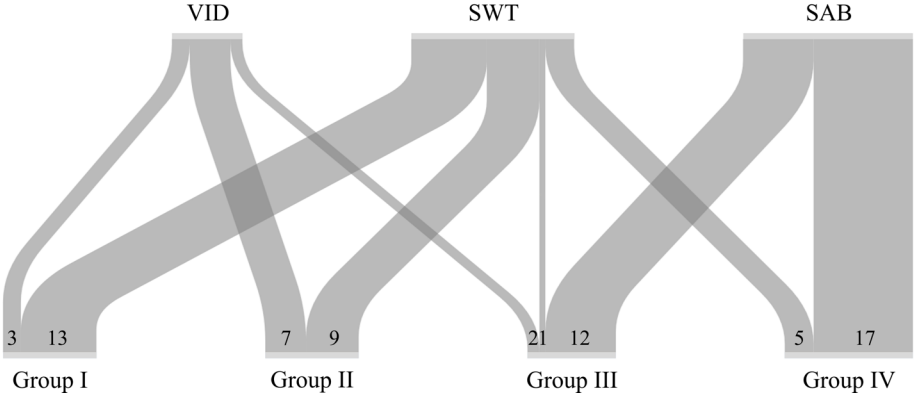

Fig. 4. Prevalent self-learning methods among older adults according to the profile of the focus group in which they participated. Source: Developed by the authors using Atlas.ti.

By contrast, as shown in Fig. 4, the participants of the focus groups with a high technological level (Groups I and II) are self-taught without technical assistance:

Group I: *"I've been a professor of Communication at university, and I still am, although I'm now an emeritus professor. I believe I've gained a good digital level with this experience. I haven't had much trouble with the applications I need. I shop and do banking online. When I have to learn a new programme, I usually succeed".*

Group II: *"I've recently retired, and I worked in banking. At that time, I had to get up to speed with e-banking and digital certificates. But fortunately, today, I don't have to bother anyone about these things. I'm fairly confident".*

5 Conclusions and Discussion

The findings of this research explore the role played by ICT-mediated learning in seniors' attitudes and motivation to improve their technological skills, especially since the pandemic, based on the adaptation of learning by various educational institutions. The results point to conclusions that reinforce or complement previous studies.

Firstly, online education aimed at older adults has had a mostly positive effect on their lives, as it provides them with emotional well-being, which may encourage this group to participate more in this type of learning. The results emphasise the socialising potential of ICT-mediated learning for seniors, especially in terms of intergenerational connection with loved ones. The spaces prepared specifically for this type of learning, or that arise spontaneously in social networks, motivate older adults' sense of belonging to a social group [43]. Moreover, these spaces provide them with a place for social interaction [11, 39], which is especially appealing due to a pre-existing emotional bond, or to the allure of youth for seniors [15, 16, 17, 39, 44, 50]. Furthermore, this learning allows intra-generational socialisation among older

adults [5], which is particularly relevant for those without family who find genuine loved ones among their cohorts. Sharing their experiences through e-learning or blended learning [14] allows seniors to share their knowledge with others in society and feel useful, which gives them personal satisfaction [17, 41, 44, 51, 54]. Another important motivating factor for emotional well-being that seems associated with digital learning by older adults is that it enhances their digital inclusion. This is a due to the underlying technology used in e-learning, which helps seniors strengthen their digital skills [5, 38, 47] and improve civic participation, the latter of which is one of the great challenges that public administrations must face, according to the results of this study. Therefore, public administrations must make a greater effort in their transition to e-government that leaves no one behind [8, 62, 74]. Entertainment is also seen as a motivator of emotional well-being that can foster the use of e-learning among older adults and their interest in improving digital literacy [15, 16, 17, 39]. Thus, it would be advisable to design courses for seniors that rely on gamification such as serious games, allowing complex and uninteresting concepts to be learned in a fun way [41, 42].

Secondly, despite the positive effects of ICT-mediated learning for older adults, a preference for in-person training has been detected, sometimes nostalgic, even among seniors with high-level digital skills. Sometimes, this predilection is a reaction to the cognitive load, which leads to technological anxiety and is linked to age-related physical-cognitive decline [13].

Thirdly, technological dependence has been highly decisive for older users with less digital skills. Repeated confinements have forced them to contemplate the need to advance in this area to be more autonomous. Now, they value digital literacy, as it lets them function without depending on loved ones. This requires a much-needed social debate to include an offering that does not leave out those with less technological skills [7, 12], which is flexible according to the characteristics of each group [10, 13, 47].

Fourthly, adaptation of the training by the organisations that collaborated in this study has been prompted by the pandemic and the specific vulnerability of the senior citizens. These formerly in-person institutions have had to adapt in record time to distance and technological education that has been difficult for all of those involved, especially for users with less digital skills [12]. On the positive side, institutions and users have had to respond collaboratively to this need, which has allowed an increase in the digital competence of less qualified older adults, contributing to their digital inclusion and autonomy. Adapting the offering to the circumstances has resulted in the virtualisation of courses of traditionally in-person universities. This has allowed access for seniors who reside in geographical areas far from the cities where these institutions are located, thereby increasing access to knowledge by this group [5, 51]. Adapting to the profiles has been more complex, due to the wide diversity of digital skills among this audience [6], which was acknowledged by the heads of the training institutions interviewed. For this reason, it is important to start designing strategies that consider education to be a key pillar of active ageing, as stated by the General Subdirector of Seniors (I1) [63], and something that can only be achieved by seeing it as lifelong learning [39, 47].

Fifthly, this study has revealed the value of self-learning and reciprocal learning for older adults since the first confinement resulting from COVID-19. YouTube and

WhatsApp have emerged as platforms for unguided, informal learning among strangers, friends, and loved ones. The video tutorials hosted by YouTube enable seniors to acquire knowledge and instrumental skills [17, 49], which they might need at any given moment. Therefore, YouTube is an open space for self-regulated learning [40], which an older user can potentially take advantage of as needed. WhatsApp, on the other hand, is a private network in which seniors can create digital spaces for reciprocal education of an intergenerational nature [50]. According to the results of this research, among these ways of learning, entertainment is a key emotional motivator for older adults, especially when it involves grandchildren.

Additionally, the findings of this research have clearly shown that the factors that influence older adults' online learning have important implications that need to be addressed. From a personal point of view, families could take advantage of grandchildren's ability to encourage grandparents to participate in virtual environments. In this way, seniors themselves, together with their loved ones, could benefit from collaborative and mutual learning, which they would find enjoyable and entertaining. Likewise, administrations and public institutions aimed at protecting older adults should take advantage of the socialising potential of ICT-mediated learning as an incentive to promote digital literacy programmes. The pandemic has highlighted and increased the dependence on technology for performing everyday tasks that were previously done in-person. In this regard, as some of the results of this work point out, many older adults with less digital capital have experienced great difficulties in carrying out some activities online. Thus, it is important to address the limitations of seniors with lower levels of digital capital. Moreover, this need requires the commitment of professionals in the training sector that targets older adults, as they must design and implement specific programmes to foster digital skills, especially for seniors at risk of digital exclusion. Although lifelong learning centres have made a tremendous effort to adapt their offerings to the circumstances imposed by confinements, they must propose courses that are accessible for all profiles of older adults. Only by labouring in the digital inclusion of this group by helping them improve their literacy can we attain their full social and civic participation. Along this path, the involvement of researchers who specialise in active ageing and/or lifelong learning is essential, as they are the ones who can find new opportunities for achieving the full inclusion of the senior population. Other findings of this research point to the self-learning options provided by digital platforms such as YouTube, as well as reciprocal learning through applications such as WhatsApp. Consequently, future lines of research could explore the possibility of using these types of tools to encourage informal learning based on the benefits of intergenerational and intra-generational interaction achieved by older adults when using them. Similarly, another line of experimental research could also be conducted to assess the effectiveness of pilot programmes in lifelong learning centres that incorporate intergenerational digital activities, thereby taking advantage of existing platforms that seniors already use.

Overall, this study represents a step forward in furthering the knowledge of learning formats aimed at older adults by having identified opportunities for improving such methods. We have also highlighted new paths to explore in order to promote the digital inclusion of all seniors, based on support that goes beyond instrumental provisions to the socio-emotional factors involved in online learning. The limitations of this research should also be mentioned, which are typical of

exploratory studies that work with small samples within a given geographical area. Nevertheless, the results herein could be complemented by future studies that explore the importance of ICT-mediated learning for older adults in other countries, or that focus on reciprocal and unguided learning through social networks.

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References

1. Llorente-Barroso, C., Kolotouchkina, O., Mañas-Viniegra, L.: The enabling role of ICT to mitigate the negative effects of emotional and social loneliness of the elderly during COVID-19 pandemic, International Journal of Environmental Research and Public Health, 18(8), pp. 3923:1--3923:19, (2021) https://doi.org/10.3390/ijerph18083923
2. Nakagomi, A., Shiba, K., Kondo, K., Kawachi, I.: Can online communication prevent depression among older people? A longitudinal analysis, Journal of Applied Gerontology, 41(1), pp. 167--175, (2022) https://doi.org/10.1177/0733464820982147
3. Newman, M.G., Zainal, N.H.: The value of maintaining social connections for mental health in older people, Lancet Public Health, 5(1), e12--e13, (2020) https://doi.org/10.1016/S2468-2667(19)30253-1
4. Taipale, S.: Intergenerational connections in digital families, Springer, Cham, (2019) https://doi.org/10.1007/978-3-030-11947-8
5. Hošnjak, A.M., Pavlović, A.: Older adults knowledge about using smart technology during the covid-19 crisis-a qualitative pilot study, Ifac Papersonline, 54(13), pp. 675--679, (2021) https://doi.org/10.1016/j.ifacol.2021.10.529
6. Hargittai, E., Dobransky, K.: Old dogs, new clicks: Digital inequality in skills and uses among older adults', Canadian Journal of Communication., 42(2), pp. 195--212, (2017) https://doi.org/10.22230/cjc.2017v42n2a3176
7. Vulpe, S., Crăciun, A.: Silver surfers from a European perspective: Technology communication usage among European seniors, European Journal of Ageing, 17(1), pp. 125--134, (2020) https://doi.org/10.1007/s10433-019-00520-2
8. Sánchez-Valle, M., Llorente-Barroso, C., Alcalá-Abad, L. (2022): Perceptions and attitudes of Spanish "Digital Seniors" towards e-Government, International Journal of Electronic Government Research, 18(1), pp. 1--19, (2022) https://doi.org/10.4018/IJEGR.297228
9. Ferreira, S., Veloso, A.I.: Older adults in ICT contexts: Recommendations for developing tutorials, in Human Aspects of IT for the Aged Population. Design for the elderly and technology acceptance. HCII 2019. Lecture Notes in Computer Science, vol 11592, pp. 376--387. Springer, Cham, (2019) https://doi.org/10.1007/978-3-030-22012-9_27
10. Czaja S.J, Sharit J.: Designing training and instructional programs for older adults. CRC Press, Boca Raton, (2012) https://doi.org/10.1201/b13018

11. Martín-García, A.V., Muñoz-Rodríguez, J.M., Serrate-González, S., Murciano-Hueso, A.: Intention of participating in e-learning university programs for senior citizens. Profile indentificaion using segmentation analysis, Pedagogia Social, (39), 105--122, (2021) https://doi.org/10.7179/PSRI_2021.39.07
12. Tsai, C.H., Romera-Rodriguez, G., Li, N., Robert, J., Serpi, A., Carroll, J.M.: Experiencing the transition to remote teaching and learning during the COVID-19 pandemic, Interaction Design and Architecture(s) Journal - IxD&A, 46, pp. 70--87, (2020) https://doi.org/10.55612/s-5002-046-004
13. Bai, X., He, Y., Kohlbacher, F. Older people's adoption of e-learning services: A qualitative study of facilitators and barriers, Gerontology & Geriatrics Education, 41(3), pp. 291--307, (2020) https://doi.org/10.1080/02701960.2018.1469488
14. Cerna, K., Paluch, R., Bäumer, F. Ertl, T., Müller, C.: Transformation of HCI co-research with older adults: Researchers' positionality in the COVID-19 pandemic, Interaction Design and Architecture(s) Journal - IxD&A, 50, pp. 27--47, (2021) https://doi.org/10.55612/s-5002-050-002
15. Casanova, G., Rolandi, E., Vaccaro, R., Pettinato, L., Colombo, M., Guaita, A.: New older users' attitudes toward social networking sites and loneliness: The case of the oldest-old residents in a small Italian city, Social Media + Society, 7(4), pp. 1--13, (2021) https://doi.org/10.1177/20563051211052905
16. Carenzio, A., Ferrari, S., Rasi, P.: Older people's media repertoires, digital competences and media literacies: A case study from Italy, Education Sciences, 11, 584, pp. 1--15, (2021) https://doi.org/10.3390/educsci11100584
17. Harley, D., Fitzpatrick, G.: Youtube and intergenerational communication: The case of Geriatric1927, Universal Access in the Information Society, 8(1), pp. 5--20, (2009) https://doi.org/10.1007/s10209-008-0127-y
18. Ragnedda, M.: Conceptualizing digital capital, Telematics and Informatics, 35(8), pp. 2366--2375, (2018) https://doi.org/10.1016/j.tele.2018.10.006
19. Ragnedda, M., Ruiu, M.L., Addeo, F.: Measuring digital capital: An empirical investigation, New Media & Society, 22(5), pp. 793--816, (2020) https://doi.org/10.1177/1461444819869604
20. Van-Deursen, A.J.A.M., Van-Dijk, J.A.G.M.: The first-level digital divide shifts from inequalities in physical access to inequalities in material access, New Media & Society, 21(2), pp. 354-375, (2019) https://doi.org/10.1177/1461444818797082
21. Hargittai, E.: Second-level digital divide: Differences in people's online skills, First Monday, 7(4), (2002) https://doi.org/10.5210/fm.v7i4.942
22. Van-Deursen, A.J.A.M., Helsper, E.J.: The third-level digital divide: Who benefits most from being online?, in Communication and information technologies annual, Vol. 10, pp 29--52, Emerald Group Publishing Limited, Bingley, (2015) https://doi.org/10.1108/S2050-206020150000010002
23. Van-Deursen, A.J.A.M, Helsper, E.J.: Collateral benefits of Internet use: Explaining the diverse outcomes of engaging with the Internet, New Media & Society, 20(7), pp. 2333--2351, (2018) https://doi.org/10.1177/1461444817715282
24. Nimrod, G.: Older audiences in the digital media environment, Information, Communication & Society, 20(2), pp. 233--249, (2017) https://doi.org/10.1080/1369118X.2016.1164740

25. Hunsaker, A., Hargittai, E.: A review of Internet use among older adults, New Media & Society, 20(10), pp. 3937--3954, (2018) https://doi.org/10.1177/1461444818787348
26. Olsson, T., Samuelsson, U., Viscovi, D.: At risk of exclusion? Degrees of ICT access and literacy among senior citizens, Information, Communication & Society, 22(1), pp. 55--72, (2019) https://doi.org/10.1080/1369118X.2017.1355007
27. Van-Deursen, A.J.A.M., Van-Dijk, J.A.G.M.: Internet skills and the digital divide, New Media & Society, 13(6), pp. 893--911, (2011) https://doi.org/10.1177/1461444810386774
28. Hill, R.L., Dickinson, A., Arnott, J.L., Gregor, P., McIver, L.: Older web users' eye movements: Experience counts. In: Proceedings of the 18th ACM SIGCHI Conference on Human Factors in Computing Systems (CHI'11), pp. 1151--1160. ACM (2011) https://doi.org/10.1145/1978942.1979115
29. Ivan, L., Loos, E., Bird, I.: The impact of technology generations on older adults' media use: Review of previous empirical research and a seven-country comparison, Gerontechnology, 19(4), pp. 1--19, (2020) https://doi.org/10.4017/gt.2020.19.04.387
30. Loos, E.: In search of information on websites: A question of age?, in Universal access in human-computer interaction. Users diversity. UAHCI 2011. Lecture Notes in Computer Science, vol 6766, pp. 196--204. Springer, Berlin, Heidelberg, (2011) https://doi.org/10.1007/978-3-642-21663-3_21
31. Loos, E., Ivan, L.: Not only people are getting old, the new media are too: Technology generations and the changes in new media use, New Media & Society, 0(0), (2022) https://doi.org/10.1177/14614448221101783
32. Baker, S., Warburton, J., Hodgkin, S., Pascal, J.: The supportive network: Rural disadvantaged older people and ICT, Ageing & Society, 37(6), pp. 1291--1309, (2017) https://doi.org/10.1017/S0144686X16000350
33. Loos, E.: Senior citizens: Digital immigrants in their own country?, Observatorio (OBS*), 6(1), pp. 1--23, (2012) https://doi.org/10.15847/obsOBS612012513
34. Selwyn, N., Gorard, S., Furlong, J., Madden, L.: Older adults' use of information and communications technology in everyday life, Ageing & Society, 23(5), pp. 561--582, (2003) https://doi.org/10.1017/S0144686X03001302
35. Jones, R.B., Ashurst, E.J., Atkey, J., Duffy, B.: Older people going online: Its value and before-after evaluation of volunteer support, Journal of Medical Internet Research, 17(5), e122, (2015) https://doi.org/10.2196/jmir.3943
36. Ivan, L., Fernández-Ardèvol, M.: Older people and the use of ICTs to communicate with children and grandchildren, Transnational Social Review, 7(1), pp. 41--55, (2017) https://doi.org/10.1080/21931674.2016.1277861
37. Freeman, S., Marston, H.R., Olynick, J., Musselwhite, C., Kulczycki, C., Genoe, R., Xiong, B.: Intergenerational effects on the impacts of technology use in later life: Insights from an international, multi-site study, International Journal of Environmental Research and Public Health, 17(16), pp. 5711:1--5711:14, (2020) https://doi.org/10.3390/ijerph17165711
38. Martínez-Alcalá, C.I., Rosales-Lagarde, A., Alonso-Lavernia, M.A., Ramírez-Salvador, J.A., Jiménez-Rodríguez, B., Cepeda-Rebollar, R.M., López-Noguerola, J.S., Bautista-Díaz, M.L., Agis-Juárez, R.A.: Digital inclusion in older adults: A comparison between face-to-face and blended digital literacy workshops, Frontiers in ICT, 5, 21, (2018) https://doi.org/10.3389/fict.2018.00021

39. González, A., Viadel, V., Ramírez, M.P.: ICT learning by older adults and their attitudes toward computer use, Current Gerontology and Geriatrics Research, 2015, 849308, (2015) https://doi.org/10.1155/2015/849308
40. Schlomann, A., Even, C., Hammann, T.: How older adults learn ICT - Guided and self-regulated learning in individuals with and without disabilities, Frontiers in Computer Science, 3, 803740, (2022) https://doi.org/10.3389/fcomp.2021.803740
41. Bernardino, I., Baptista, R.J., Bidarra, J., Mamede, P.: Serious games for seniors: Learning safe behaviors on the web. In: Proccedings of the 16th Iberian Conference on Information Systems and Technologies, pp. 1--4. IEEE Xplore (2021) http://hdl.handle.net/10400.2/11237
42. Fua, K.C., Gupta, S., Pautler, D., Farber, I.: Designing serious games for elders. In: Proceedings of the International Conference on the Foundations of Digital Games, pp. 291--297. Foundations of Digital Games (2013) https://bit.ly/3BKrUc6
43. Noble, C., Medin, D., Quail, Z., Young, C., Carter, M.: How does participation in formal education or learning for older people affect wellbeing and cognition? A systematic literature review and meta-analysis, Gerontology and Geriatric Medicine, 7, pp. 1--15, (2021) https://doi.org/10.1177/2333721420986027
44. Fernández-Ardèvol, M., Rosales, A. (2017): Older people, smartphones and WhatsApp, in Smartphone Cultures, vol. 1, pp. 55--68, Routledge, Abingdon, (2017) https://doi.org/10.4324/9781315307077
45. Alavi, M., Leidner, D.E.: Research commentary: Technology-mediated learning. A call for greater depth and breadth of research, Information Systems Research, 12(1), pp. 1--10, (2001) https://www.jstor.org/stable/23011097
46. Alavi, M.: Computer-mediated collaborative learning: An empirical evaluation, MIS Quarterly, 18(2), pp. 159--174, (1994) https://doi.org/10.2307/249763
47. Lipphardt, A.M., Held, P., Leen-Thomele, E., Hain, L.: ICT enhanced learning for older adults: Influencing factors on satisfaction and the role of learning motivation, Gerontechnology, 17(suppl), p. 59s, (2018) https://doi.org/10.4017/gt.2018.17.s.059.00
48. Wieczorkowski, J., Fundowicz, K., Popiołek, M.: Use of social media by older adults. In: Proceedings of the 7th European Conference on Social Media, pp. 330--338. Academic Conferences and Publishing International Limited (2020) https://bit.ly/3VeGT56
49. Digmayer, C., Jakobs, E.M.: Help features in community-based open innovation contests. Multimodal video tutorials for the elderly. In: Proceedings of 30th ACM International Conference on Design of Communication, pp. 79--88. SIGDOC'12 (2012) https://doi.org/10.1145/2379057.2379073
50. Caliandro, A., Garavaglia, E., Sturiale, V., Di-Leva, A.: Older people and smartphone practices in everyday life: An inquire on digital sociality of Italian older users, The Communication Review, 24(1), pp. 47--78, (2021) https://doi.org/10.1080/10714421.2021.1904771
51. Dias-De-Oliveira, C., Fioravanti, M.L., Pontin-De-Mattos-Fortes, R., Barbosa, E.F.: Accessibility in mobile applications for elderly users: A systematic mapping. In: Proceedings of the 48th Annual Frontiers in Education Conference, pp. 1--9. IEEE (2008) https://doi.org/10.1109/FIE.2018.8659017

52. Sugarman, D.: Networked seniors, in Handbook of smart homes, health care and well-being, pp. 521--528, Springer, Cham, (2017)
https://doi.org/10.1007/978-3-319-01583-5_46
53. Monroy-Trujillo, A., Padilla-Castillo, G., Cabezuelo-Lorenzo, F.: Sports and hate speech messages on Instagram: The case of Seville FC in the Spanish league, in Hate speech and polarization in participatory society, pp. 237-250, Routledge, London, (2021)
https://doi.org/10.4324/9781003109891-19
54. Xu, W.: (Non-)stereotypical representations of older people in Swedish authority-managed social media, Ageing and Society, 42(3), pp. 719--740, (2022)
https://doi.org/10.1017/S0144686X20001075
55. Grønkjær, M., Curtis, T., De-Crespigny, C., Delmar, C.: Analysing group interaction in focus group research: Impact on content and the role of the moderator, Qualitative Research, 1(2), pp. 16--30, (2011)
https://doi.org/10.7146/qs.v2i1.4273
56. Krueger, R.A.: Focus groups: A practical guide for applied research, Sage, Newbury Park, (1988)
57. Morgan, D.L.: Focus groups, Annual Review of Sociology, 22, pp. 129--152, (1996)
https://doi.org/10.1146/annurev.soc.22.1.129
58. Tonkiss, F.: Focus groups, in Researching society and culture, pp. 237--255, Sage, London, (2018)
59. Gibbs, A.: Focus groups, Social Research Update, 19, (1997)
https://bit.ly/3v0eh4Q
60. Benney, M., Hughes, E.C.: Of sociology and the interview, in Sociological methods, pp. 190--198, Aldine, Chicago, (1970)
https://doi.org/10.4324/9781315129945
61. Taylor, S.J., Bogdan, R., DeVault, M.L.: Introduction to qualitative research methods: A guidebook and resource, John Wiley & Sons, Hoboken, (2016)
62. Abad-Alcalá, L., Llorente-Barroso, C., Sánchez-Valle, M., Viñarás-Abad, M., Pretel-Jiménez, M.: Electronic government and online tasks: Towards the autonomy and empowerment of senior citizens, Profesional de la Información, 26(1), pp. 34--42, (2017).
https://doi.org/10.3145/epi.2017.ene.04
63. Interviewee 1 (I1) (General Subdirector of Seniors, Madrid City Hall: Personal communication, 11 March (2022)
64. Interviewee 2 (I2) (Academic Coordinator of Complutense University for Seniors): Personal communication, 17 December (2020)
65. Interviewee 3 (I3) (Executive Chairman of Canal Senior, Madrid, Spain): Personal communication, 3 December (2020)
66. Interviewee 4 (I4) (Director of Universitas Senioribus CEU): Personal communication, 10 December (2020)
67. Patton, M.Q.: Qualitative evaluation and research methods, Sage, Newbury Park, (1990)
68. Nowell, L.S., Norris, J.M., White, D.E., Moules, N.J.: Thematic analysis: Striving to meet the trustworthiness criteria, International Journal of Qualitative Methods, 16, pp. 1--13, (2017)
https://doi.org/10.1177/1609406917733847
69. Corbin, J., Strauss, A.: Grounded theory research: Procedures, canons and evaluative criteria, Qualitative Sociology, 13, pp. 3--21, (1990)
https://doi.org/10.1007/BF00988593
70. Glaser, B.G., Strauss, A.L.: The discovery of grounded theory: Strategies for qualitative research, Aldine, Chicago, (1967)
https://doi.org/10.4324/9780203793206

71. Muhr, T.: Atlas.ti. A prototype for the support of text interpretation, Qualitative Sociology, 14(4), pp. 349--371, (1991)
https://doi.org/10.1007/BF00989645
72. Williams, M., Moser, T.: The art of coding and thematic exploration in qualitative research, International Management Review, 15(1), pp.45--55, (2019)
https://bit.ly/3uWHP31
73. Friese, S.: ATLAS.ti 9 Windows. User Manual, https://bit.ly/3vLXPVh, (2021, 23 de julio)
74. Kolotouchkina, O., Llorente-Barroso, C., & Manfredi-Sánchez, J.L.: Smart cities, the digital divide, and people with disabilities, Cities, 123, 103613, (2022)
https://doi.org/10.1016/j.cities.2022.103613