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A SOCIAL NETWORK WITH LINEAR NAVIGATION AS A DIGITAL LITERACY METHOD FOR THE ELDERLY: A CASE STUDY ON RURAL AREA

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A SOCIAL NETWORK WITH LINEAR NAVIGATION AS A DIGITAL LITERACY METHOD FOR THE ELDERLY: A CASE STUDY IN A RURAL AREA

Abstract

Information and Communication Technologies (ICTs) have considerably increased the information and communication channels, favoring the emergence of new models for relations, such as social networks. However, for elderly users whose learning has traditionally been based on linear models of information such as textbooks, unfamiliarity with Internet can be a barrier. Moreover, elderly people living in rural communities face a lack of telecommunication infrastructures, which increases their difficulties in accessing ICTs. The aim of this study is to test a social network consisting of multiple applications with linear navigation as a digital literacy method for the elderly in rural areas. A sample of 46 participants between 60-76 years old with heterogeneous previous experience with ICTs participated in the study. They performed eight standardized sessions in an Elderly Leisure Center. Results showed differences in perceived usefulness between users with high and low ICT experience. After eight training sessions, the majority of the participants were able to independently use all the system applications, and positive results were obtained on the variables measured, i.e., learnability, sense of control over the system, ability to use the system, orientation, efficiency, accessible design, perceived ease, perceived usefulness, and intention to use. The participants with previous experience with other ICT methods preferred the linear navigation method because they thought it was easier than other ICTs. The results showed interaction differences when touch screens were used. Qualitative results showed that one of the most frequent emotions at the beginning of the ICT sessions was "fear" (related to breaking the computer or to making fools of themselves), but the continued use of the system improved the users' perceptions of their own capacity to handle ICTs and their interest in ICTs in general. The main contribution of this work consists of exploring the usefulness of linear navigation and social network systems in the context of digital literacy for elderly users in rural areas.

Keywords: Usability, digital literacy, navigation style, elderly users, rural areas.

CONTENTS

1. INTRODUCTION

1.1. Why elderly users in rural areas?

In recent years, special attention has been paid to the use of Information and Communication Technologies (ICTs) by elderly people. Social isolation has a negative impact on older people's wellbeing and health. ICTs can help to deal with social isolation and loneliness (Khosravi et al., 2016).We are facing an increasingly aging population (European Commission, 2006; United Nations, 2009), and the elderly make up the group with the least presence on the Internet (Van Volkom et al., 2014). A European study conducted in 2010 revealed that only 4% of elderly people used the Internet (European Commission, 2010). Although various e-inclusion policies have improved these data, the situation in the different member states is definitely uneven. In 2016 in the United Kingdom, only 17.78% of the elderly population had never used the Internet, whereas elderly non-users represented 60-68% of the population in Italy, Poland, and Spain, and 79-90% in Greece, Bulgaria, and Turkey. In an editorial review, Roberts et al. (2017) explores how the use of digital technologies and telecommunication infrastructures differ in diverse rural spaces, and how the digital disadvantage and vulnerability create different forms of social, economic, and cultural disadvantages. In fact, the digital divide is considered a new form of unequal opportunity in rural areas (Robinson et al., 2015).

According to Internet World Stats (2017), in December 2000 there were 360 million Internet users worldwide, and in just 17 years (August 2017) this number rose to 3.83 billion Internet users worldwide. Digital exclusion can have multiple causes, but all of them are related to the lack of the fundamental requirements for the democratization of technology: hardware access (affordability, availability of energy networks, etc.), access to the Internet (affordability, availability of infrastructure to connect to a network, etc.), and mastery of technology, among others. ICTs have considerably increased the information and communication channels, favoring the emergence of new models for relations. Social networks that exploit the capacity of ICTs to increase the number of relationships and contacts a person can maintain are a good example. Social Networking Sites (SNSs) are becoming a popular method for social interaction, and although there is evidence about the benefits of SNSs as communication platforms between the elderly and their families, ICTs can also increase social isolation in certain sectors of the population that do not participate in the flow of the digital world (Norval et al., 2014). Traditional mail has been progressively replaced by email for personal communications, and instant messaging programs and audio- and videoconference through the Internet seem to have largely replaced telephone communications. Moreover, the access to and search for information are increasingly performed over the Internet, and the changes are not limited to the media we use because the content has also adapted to the changes brought about by ICTs. A clear example is the way we store and share images. Photographs are taken with digital cameras or phones and widely shared via computer applications or apps, whereas printing a photo is no longer part of the usual form of image consumption. In short, the information flow has shifted from the traditional uses of communication, and it is now supported by ICTs and, fundamentally, by Internet services, completely changing our understanding of work and entertainment. Nevertheless, there is an unequal representation of the population on the Internet. In Europe, there is a clear difference between the proportion of young (2%) and elderly (48.73%) Internet non-users (European Commission, 2016). In addition, elderly people

in rural communities are more vulnerable to the digital divide due to their lack of access to the Internet and computers (Goodwin, 2013). Although the digital gap is narrowing because Internet users are aging, it will be several years before the gap is closed (Friemel, 2016).

1.2. What is the ICT experience like for elderly people?

Studies of web usability with elderly users largely coincide in affirming that in usability testing, elderly users have greater difficulties (Bernard et al., 2001; Chadwick-Dias et al., 2002; Chadwick-Dias et al., 2004; Fidgeon, 2006; Zhou at al.,2012; Wagner et al., 2014; Sonderegger et al., 2015). According to Nielsen (2002), they even obtain results that are half as satisfactory as those obtained by younger users. However, elderly people's experiences with ICTs not only differ from those of other users in terms of their success rate, but they also experience the use differently. A study conducted by Mitzner et al. (2016) with 300 non-computer users from 64 to 98 years old revealed that emotional attitudes such as self-efficacy, comfort, and interest, are predictive of perceived usefulness and perceived ease of use. Elderly users are likely to be influenced by their emotional experience, which may affect their future intention to use ICT.

In a study by Fidgeon (2006), emotional factors were included as an important part of the elderly user experience, revealing that elderly users (over 65 years), compared to younger ones (under 40 years), use more emotional terms when describing web pages and have a more pronounced tendency to blame themselves when they encounter difficulties in using them. In fact, technophobia, understood as an emotional fear or phobia of interacting with computers or thinking about them, usually causes computer avoidance (Chua et al., 1999), and it is more prevalent in elderly people and communities who did not grow up with computers (Hogan, 2009; Wang & Chen, 2015). Two-thirds of offline seniors expect the Internet to be difficult to use and understand (Friemel, 2016). In a study carried out by Vroman et al. (2015) with online users over 65 years old, the authors found that the majority of non-users felt "intimidated" and "anxious" about using technology. Hill et al. (2015) concluded that, without appropriate measures to address the fear of technology of senior citizens, the digital divide could become larger as more services migrate into the digital world.

The Technology Acceptance Model (TAM; Davis, 1985) is one of the most widely used frameworks to explain and predict the individual acceptance of new technology (Ramon-Jeronimo et al., 2013). According to a study by Venkatesh and Morris (2000), perceived ease of use (PEOU) and perceived usefulness (PU), the main variables of the original TAM framework, explain 75% of the variance in the future intention to use technology. Several studies have explored the influence of emotional factors, previous experience, and their relationships with PEOU and PU in elderly users (Igbaria & Iivari, 1995; Mead, Sit, Rogers & Jamieson, 2000; Venkatesh et al., 2003; Arning and Ziefle 2007; González et al., 2012). Dogruel et al. (2015) propose an expanded Technological Acceptance Model (eTAM) for elderly people that considers other variables apart from PEOU and PU as predictor variables of system use, such as technophobia, self-efficacy, previous experience, and expertise with media technology. Their conclusions suggest that elderly people can enjoy technology only if they feel they can handle it, and they highlight self-efficacy as an important predictor of the hedonic use of ICTs. In addition to the lack of technical access to the Internet, the main reason the elderly give for not using the Internet is motivational indifference (perceived uselessness) or deficient knowledge (Friemel, 2016). However, when older adults successfully use online social

networks, studies show that these concerns decline, and connectivity with others is cited as a frequent benefit (Vroman et al., 2015)

Thus, elderly users have less familiarity due to their limited experience with ICTs and greater interaction difficulties due to age-related physical deficits (Spinelli, 2014). Moreover, their experiences with ICTs also have emotional nuances because they tend to take the blame for any mistakes. Finally, frustration can have negative effects on the use of ICTs, producing less interest and a less favorable attitude among elderly users (Van Volkom et al., 2014).

1.3. Why is the navigation variable important in the ICT experience of the elderly?
The elderly represent one of the groups most affected by the digital gap, with limited access, knowledge (Karahasanovic et al., 2009), and use of Internet (European Commission, 2016), and their prior experience is mostly related to analogue references and linear information structures. Internet is undoubtedly a complex technology based on hypertext, where the information requires the user, in addition to reading, to perform other tasks specific to this type of information, such as selecting what sections of text to read, reading order, acquiring text structure (Lin, 2003;Salmeron, 2006), or learning from audiovisual elements (also called hypermedia), among others. This way of consuming information requires the involvement of different cognitive processes from those involved in linearly reading traditional media (e.g., textbooks, journals, etc.). The elderly have based all their learning on linear analogue media (books), where the user's intervention does not change the content and the user is not responsible for organizing the information, but rather consumes it in the order provided by the author. However, on the Internet, which is by definition an almost infinite hypertext structure, elderly users with no previous experience with these types of structures based on information nodes (European Commission, 2010) must learn to use ICTs and, at the same time, learn what the Internet is and its purpose, in addition to building a framework for the information while consuming it. In other words, in hyperspace the user is no longer a passive consumer of information, as occurs in linear analogue media. He/she becomes an active part of the process of structuring and using information from the first moment of entering the Internet. All of these decisions also form part of a process that is usually learned individually and in no particular order, so that the responsibility for knowing and structuring the steps for each task lies with the end user. Thus, when they first enter the Internet, elderly people face graphic interfaces full of elements, new metaphors, and terms, which, without an analogue reference, they are unable to intuitively understand. Moreover, there is an infinite amount of information with no particular order, beginning, or end.

The learning and memory processes are faster when there is familiarity with the object of learning, that is, when the user finds a clear internal correspondence between previous and recent experience (Mandler, 1980, 1991; Graf & Mandler, 1984). However, ICTs seem to have adopted standards that are appropriate for middle-aged and younger people (Sloan, 2006). The meta-analysis carried out by Techetin et al. (2014) revealed a clear pattern of negative age effects on spatial abilities. It is reasonable to imagine that age differences in spatial cognitive performance would also be reflected in Internet use because navigation requires spatial abilities. In fact, there is evidence that the hypertext structure produces disorientation in elderly people during navigation, and that this disorientation can impair performance and learning (Kim & Hirtle, 1995; Puerta et al., 2006; Ziefle & Bay, 2010; Ariel & Moffat, 2017). Therefore,

studying the mental model of the user, as well as the capital from previous experiences, and implementing them as part of the interaction, could enhance the end user's experience, improving learning time and satisfaction with the experience. Puerta et al. (2006) pointed out the importance of ergonomic recommendations in the use of a website by the elderly to reduce the involvement of executive functions that are impaired with age.

A study carried out by Castilla et al. (2016) with a single task hypothesizes that linear navigation is closer to the mental model of the elderly and can facilitate their user experience. Results showed greater efficiency and usability of linear navigation on a web usability test.

Lee et al.(2011) identified four factors in Internet use by the elderly that cover most of the aforementioned issues: (1) intrapersonal factors, such as motivation and self-efficacy, (2) functional limitations, such as cognitive decline or spatial orientation, (3) structural limitations that impede access to ICTs, and (4) interpersonal limitations, such as lack of social support.

Given that the linear navigation variable is related to a high success rate using ICTs and to overcoming spatial disorientation in elderly users (Castilla et al., 2016), and that online social networks have been shown to be beneficial from an interpersonal and social point of view (Vroman et al., 2015), we establish a new research question: Can a social network system with predominantly linear navigation also be useful as a digital literacy method for elderly people?

To answer this question, we conducted an observational study in which a group of elderly users from a rural community tested a social network that includes most Internet services with a predominantly linear navigation style in real use conditions, i.e., in a recreation center for the elderly as a digital literacy method. We aimed to study whether users were able to use a social network autonomously after eight sessions of use, and explore whether sustained use affected participants' evaluation of the system or their own capabilities as users, and their attitude towards ICTs in general.

2. MATERIAL AND METHODS

2.1. Design

The study consisted of an observational, uncontrolled study with repeated measures at different time points throughout the intervention. The study was conducted using the classic assessment method "empirical method or usability test" (Woodward, 1998), where the sample, not related to the project (Holleran, 1991), uses the system in their real environment, i.e., a recreation center for the elderly in a rural community. To facilitate the introduction of the tool into the environment and standardize the number of uses, an eight-session protocol (once a week) was designed as a computer course given by the center's staff, and information collection was automated through questionnaires administered by the system. The classroom had a capacity for six people. In addition, for those users who had difficulty handling the mouse, an individual classroom with a touch screen was available. At the end of the study, the measures were complemented with qualitative information collected through focus group sessions with the participants and an interview with the center's staff.

2.2. Participants

The final sample consisted of 46 participants, 18 men and 28 women, between 60 and 76 years old, with an average age of 65.39 (SD = 4.84).

Regarding the educational level, 4.30% of the sample had no education, 78.30% had basic studies (up to 14 years), 6.50% had some form of vocational training, and 10.90% had university studies.
With regard to previous experience in the use of ICTs, 82.6% of the sample (38 participants) had received previous training in ICT tools, using hypertext navigation systems. However, not all users reported successful training. When asked about their knowledge about computers or Internet, 34.8% reported having little or no previous experience with PCs, whereas 65.2% reported having considerable experience with PCs (21.7% had used this technology more than 10 times, and 43.5% reported using it on a regular basis). With regard to Internet use, 39.2% reported having little or no experience with the Internet, compared to 60.8% who said they had considerable experience (21.70% stated that they had used the Internet more than 10 times, and 39.10% reported using it on a regular basis). Although 80.85% of the sample reported having an email address, only 55.32% reported knowing how to write an email, and only 59.57% said they knew how to read one. This difference was due to the fact that, among users who had an email account, nearly 40% did not use it directly, with the email being managed by someone close to them (a relative or a friend who received the emails and read or wrote them on his/her behalf). Based on their previous experience with the Internet, the sample was divided into two groups: no experience and low experience users (39.2%) and medium and high experience users (60.8%).

2.3. Materials

2.3.1. Hardware

For this study, two types of hardware configurations were used. For the individual sessions, the hardware consisted of a 21" touch screen with integrated speakers, a webcam, and an ergonomic *BigKeys* keyboard (each key measured 1cm) with the ABC layout. For the group sessions, screens and standard keyboards were used, along with the mouse as a pointing device. Regarding PC settings, basic office computers with an Internet connection were used by all participants.

2.3.2. Software

At the software level, the Butler 1.0 system, a system oriented toward aspects of Telepsychology (Etchemendy, 2011), was taken as a reference. The system was redesigned following the standards for system design (Castilla et al, 2013) as an open social network oriented toward leisure use (Butler 2.0). Thus, the system changed its purpose of use, but kept the design of the interaction elements, the type of graphic metaphors, the navigation style, the audio and text help offered by the avatar, etc. Butler 2.0 was designed with linear navigation and hierarchical style at the main menu level, where the user chooses the application from the main menu. The structure of each application is characterized by dividing the actions into small steps, and so the user should only choose between a maximum of 2 or 3 options on each screen (Castilla et al., 2016). The main objective of the system is to improve the social support network and quality of life of the elderly population through the use of new technologies that help to remove the digital barrier for this sector of the population, encouraging their e-inclusion.

In modifying its purpose of use to a social network that can be entered autonomously from the home or centers, it was necessary to broaden the scope of some of its functions and the feedback offered to the user.

Thus, the Butler 2.0 system is composed of the following applications:

- News. Users view the feedback about all the updated contents on a single screen.
- Profile. An area where users can view and modify their data within the platform.
- Videoconference. An area for audio and video calls to other users of the system through the system's own website.
- Email. It has the option to attach images from the system or any type of file. The application separates emails into two inboxes, read and unread.
- The Book of Life. It is a blog-type application that functions as an online diary where users can share their memories with users of their choice, through text, photos, video, and music. They can also choose which pages of this diary remain private, that is, visible only to the author, and which pages are shared with other users.
- My memories. It is a library of online music, videos, and images with two areas: one private and one public. In the private area, the users can save received files or upload files from their own PC, view them, or share them via email or through the Book of Life. In the public area, the system administrator can publish photos, images, or videos to communicate news, introduce new tools, or motivate users to engage in activities that promote a healthy and active life.
- Friends. It is a section where users can expand their network of contacts and perform a search by criteria (current town, hometown, hobbies and interests, etc.). The system automatically offers suggestions for those users who have more matches with their profile in the database.
- Internet. On this page, the control over the design of the external web pages is lost; thus, an intermediate page was implemented. This page offers different button-shaped links that are relevant to the elderly, including access to a well-known and free search engine (Google). All these links open in a new window, so that Butler remains in the background, and the users will be able to return to the system just by closing the page they are visiting.
- Walk in nature. It has two video settings, extracted from the original virtual reality environments, where different narratives are offered to promote psychological wellbeing through relaxation techniques and meditation.

Figure 1 shows the main menu of the Butler 2.0. system.

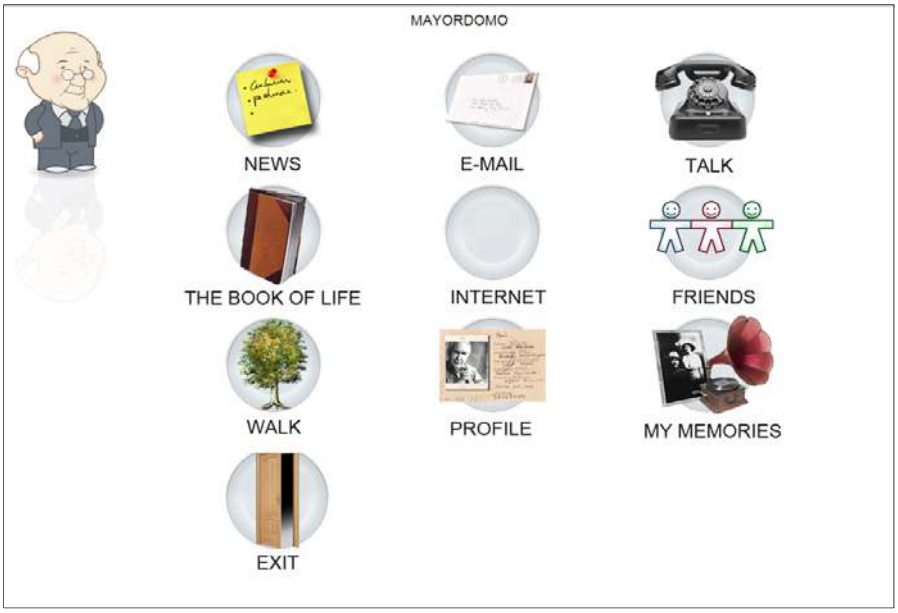

Figure1 –Butler 2.0.Main menu

2.3.3. Variables and measurement instruments

The variables defined for this study were the following:

- Independent Variables
  - Sociodemographic data
  - Technological profile (previous ICT experience).
- Dependent Variables
  - Opinion about ICTs in general
  - Usability and acceptability items
  - Satisfaction with use
  - Recommendation of the system
  - Intended Use
  - Preference

To collect these variables, we used different instruments divided into three categories:

a) User Profile
b) Quantitative tools based on the user's opinion

Opinion about ICTs in general–The questionnaire on the opinion about ICTs in general was designed *AD HOC* for this experiment, and consists of three items with a 5-point Likert scale. The items explore: how the participants feel while using ICTs (using a graphic scale), to what extent they feel capable of using them, and to what extent they are interested in ICTs (see Table A1).

Usability and acceptability items– To measure usability and acceptability, we used 10 items. Four were adapted from the System Usability Scale (Brooke, 1986), and six were designed specifically for this research, taking as reference the variables defined by Adams et al. (1992) in their TAM (Davis, 1986) replication study and the self-efficacy variable (Mitzner et al., 2016; Dogruel et al., 2015) as an emotional measure (see table A2).

The 10 items are written in direct style and rated on a 5-point Likert scale, from 0 (strongly disagree) to 4 (strongly agree) (see Table A2). These items collect

users' feedback about their experience, after using the system. Although these items were adapted and designed specifically for this investigation, and there are no prior data on its statistical goodness, the Cronbach's alpha for the items was 0.89, a positive figure, despite the study's preliminary nature.

Satisfaction of use questionnaire (SQ). It is a questionnaire specifically designed for this research (see TableA3) to measure:
- *Satisfaction with the system* – Four additional items were developed for this study, also using a 5-point Likert response scale. The items measure overall satisfaction with the system, the extent to which users feel more capable of using the computer after using Butler, interest in future use, and how they feel while using Butler (See items 1-4, table A3).

- *Recommending the system* – An item designed specifically for this experiment asks the user if he/she would recommend this system to people of the same age. The response scale for this item consists of three nominal alternatives (see item 5, table A3).

- *Intended use* –Dichotomous information about intended use was collected from all users (see item 6, table A3).

Preference – Finally, for users with previous ICT experience, the previous learning method was identified. Users with previous experience with hypertext systems were asked about their preferred learning method.

c) Qualitative information obtained through:
Focus group with end users, structured using the following questions:
- What did you like the most about Butler?
- What did you like the least about Butler?
- Would you recommend Butler to other people of your age?
- What could be improved?
- What does it contribute to people who have already used a computer?
- Define your experience of learning with Butler in just one word.

Open interview with the center's staff, exploring qualitative opinions about difficulties and benefits found.

3. PROCEDURE

For this study to be carried out, a cooperation agreement was developed and signed by the Government of La Rioja, Social Services, and Jaume I University. The purpose was to launch, for the first time, the Butler 2.0 leisure social network in recreation centers for the elderly, under the conditions defined in the agreement for this study. The sample was obtained from the users of the Elderly Leisure Center in a rural community (Arnedo, La Rioja; Spain), with the support of the center's staff, who had extensive experience working with the elderly.

For the call, the center convened an open session for all users, where the research staff from Jaume I University gave a demonstration of the functioning of the Butler 2.0 system by showing a video of real users interacting with the system projected on a large screen. Afterwards, the confidentiality and study conditions (number of sessions, time

commitment, etc.) were explained. In addition, the same information was provided in leaflets that users could take home.

The center's staff attended to the voluntary participation applications, choosing participants who fit the study's inclusion criteria: aged 55 and older, sufficient cognitive capacity to maintain a conversation, and sufficient auditory, visual, and motor capacity to interact with the system. All the study participants gave their consent to participate (informed consent) in conditions of confidentiality and strict use of the images and results for scientific dissemination. After signing the informed consent, participants completed the initial questionnaire, which collected participants' sociodemographic data and technological profile.

To facilitate the introduction of the tool into the environment and standardize the number of uses, an 8-session computer course was designed, and the system administered automated information collection through assessment questionnaires.

The system features were presented in the following order:
Sessions 1 to 5:

1. Information about the website www.mundomayordomo.com
2. User registration.
3. General information about the home page.
4. Specific information about each resource.
5. Creating a personal profile.
6. Using email.
7. Using videoconference
8. Using the search tool and making friends.
    a. Request friendship.
    b. Accept friendship requests.
9. The Book of Life.
    a. Write a page.
    b. Read one's own book of life.
    c. Read the book of life of friends.

Sessions 6 to 8:

10. Internet search.
11. Independent exploration of the system's resources.

The center's staff balanced the groups based on users' previous experience with ICTs. On the one hand, users who had never used a computer began with individual sessions on a PC that had a touch screen and an ergonomic keypad in ABC order. These users were introduced gradually to mouse use. Later, when these users started to successfully use the mouse, specific groups were formed. On the other hand, users who already had some contact with ICTs and knew how to successfully use the mouse attended the sessions from the beginning in groups limited to six people, due to the capacity of the center's computer room (see figure 2). The course lasted eight weeks, with sessions once a week per group, all conducted by professionals from the Elderly Leisure Center. After each session, a researcher from Jaume I University contacted the center staff by phone in order to collect information related to the performance of tasks.

As part of the computer course, a videoconference was held between Jaume I University and each group in the center, so that all users had the experience of speaking via videoconference at least once.

Group session Videoconference session

Figure2 - Example of group sessions

The system automatically counted the number of sessions for each user, and depending on the number of the session, the corresponding questionnaire from the assessment protocol was presented.

For this study, repeated measurements were considered after some of the user sessions, in order to assess how continued use of the system affects the user's feedback on certain variables. Thus, the assessment protocol for the system contemplated four distinct measurement moments: 1) before the use of the system to gather user profile and sociodemographic data; 2) after the first contact with the system (post session 1) in order to avoid the mediating effect of learnability on perceived usability (Jung &Yim, 2015); 3) after session 5, when the users have explored and practiced with the entire system; and 4) after the last session of use, to gather the users' opinion about ICTs and intended use.

Table 1 presents a summary of the various measures and information collected automatically by the system at different time points in this study.

Table 1. Summary of measures collected by the system

Quantitative measures	**Time point in study 4**			
	PRE	SS1	SS5	SS8
Sociodemographic data Technological profile	X			
Opinion about ICTs in general	X			X
Usability and acceptability items		X		
Perceived ease and usefulness		X	X	
Satisfaction with use		X	X	
Recommendation of the system		X	X	
Intended Use				X

Note: Pre=Pre Study; SS1= Post Session 1; SS5= Post Session 5; SS8= Post Session 8.

After completing the eight sessions, all the participants were invited to a focus group, and 35 users attended. Due to the high number of users, the session was divided into two groups, each led by a researcher from Jaume I University and a professional from the center. Subsequently, both groups met in a general session where the findings from the two groups were pooled (see Figure 3). Both sessions were videotaped for later analysis.

Figure 3 –*Focus group* parallel sessions and general session

To finalize, an open interview with the staff at the center was held in order to obtain qualitative performance data about the course.

Statistical analyses were performed with IBM SPSS Statistics 20, using descriptive statistics for all variables and *t* tests with a significance level of less than or equal to .05 to analyze whether there were significant differences in the continuous variables at the different evaluation moments. The effect size was determined using Cohen's *d*. Repeated-measures ANOVAs were conducted to find out whether participants who were low and high on previous experience with ICTs behaved differently while using Butler.

4. RESULTS

4.1. Quantitative results

Regarding the differences between users with low and high ICT experience, there were differences in only one variable, perceived usefulness of Butler, $t(44) = 2.12$, $p = 0.040$. After the first session using the system, users with less experience with ICTs rated a lower perceived usefulness than users with high experience. We then conducted repeated-measures ANOVAs in order to find out whether participants who were low and high on previous experience with ICTs behaved differently while using Butler. Again, the interaction effect was statistically significant only for perceived usefulness of the system $F(1, 44) = 4.277$, $p = 0.045$. Users with low ICT experience began with a lower score on perceived usefulness than users with high ICT experience, and the use of the system resulted in increased perceived usefulness for low ICT experience users. After session 5, perceived usefulness was equal in both groups (A t-student test revealed no differences in perceived usefulness after session 5; $t(44)=1.150$, $p=0.257$).

Because no other differences were found due to previous experience with ICTs, the remaining analyses were performed with the entire sample.

After the first session, all usability and acceptability items exceeded the midpoint of the scale (i.e., 2), placing Butler in the positive area of the scale on all variables, i.e. between "Neither agree nor disagree" and "Strongly agree" (see Table 2).

Table 2- Results of usability and acceptability items

ITEM	$\bar{X}$	SD
1. I think most people could learn very quickly to use BUTLER.	2.65	1.04
2. I felt confident about myself (capable) while using BUTLER.	2.80	0.91
3. Overall, I knew what to do at all times. For example, when I wanted to press a particular button I knew how to do it, and I did it.	2.72	0.96
4. Once I learned to use BUTLER, I could perform tasks quickly.	2.74	0.10
5. BUTLER can be used anywhere and in any context.	2.30	1.17
6. The instructions in BUTLER are easy.	2.96	0.82
7. The font and button sizes are sufficient for me.	3.37	0.65
8. I would like to use BUTLER frequently.	2.96	0.79
9. Overall, I think BUTLER is very useful to me.	3.02	0.72
10. Overall, I think BUTLER is easy to use.	2.98	0.83

Note: SD: Standard deviation. Scale from 0 to 4 for all variables, 0= Strongly disagree, 1= Somewhat disagree, 2= Neither agree, nor disagree, 3= Somewhat agree, 4= Strongly agree.

Regarding the way users felt when interacting with the system, we found that all the items also exceeded the midpoint of the scale (i.e., 2), placing Butler in the positive area of the scale on all the variables (see Table 3).

Table 3 - Results for items about feeling interest, satisfaction, and capacity

Questions	$\bar{X}$	SD
Considering your previous experience using new technologies, how did you feel using the BUTLER system?	2.98	0.72
To what extent would you be interested in using this system again?	2.67	0.70
How satisfied are you in general with the system?	2.67	0.76
After your experience with BUTLER, to what extent do you feel capable of using the computer?	2.41	0.83

Note: SD: standard deviation. Scale from 0 to 4 for all variables.

In addition, after the first use of the system, 83% of the users said they would recommend Butler to other people of the same age, 2% said they would not, and 15% said they did not know if they would recommend it.

No significant differences were found between the first and fifth sessions on perceived ease and usefulness and how the users felt while using the system. That is, users perceived the same ease and usefulness of the system, and they felt the same way as they did in the first lesson (see Table 4).
The repeated use of the system significantly improved confidence, interest, and satisfaction with the system, and the sense of self-efficacy with regard to computer use. The effect size for these variables was small to medium, following the recommendations by Cohen (1988).

Table 4. Comparisons of measurements from sessions 1 and 5

Variables	**POST session 1**		**POST session 5**				
	$\bar{X}$	**SD**	$\bar{X}$	**SD**	**t**	**p**	***d***
Overall, I think BUTLER is easy to use.	2.98	.830	3.15	.759	-1.273	.209	-0.21
To what extent would you be interested in using this system again?	2.67	.701	3.20	.719	**-4.372**	**.000**	**-0.75**
How satisfied are you in general with the system?	2.67	.762	3.11	.737	**-3.239**	**.002**	**-0.59**
Considering your previous experience using new technologies, how did you feel while using the BUTLER system?	2.98	.715	3.00	.919	-.144	.886	-0.02
I felt confident about my ability to (capable) use BUTLER.	2.80	.910	3.15	.729	**-2.228**	**.031**	**-0.42**
After your experience with BUTLER, to what extent do you feel capable of using the computer?	2.41	.832	2.72	.720	**-2.094**	**.042**	**-0.40**

*Note: For all variables, degrees of freedom = 45. SD: standard deviation. Scale from 0 to 4 for all variables.
Cohen (1988) defines d= 0.2-0.49 as a "small" effect size; d=0.5-0.79 as "medium"; and d>0.80 as "large".

After five sessions of Butler use, the number of users who would recommend the system increased to almost the entire sample (see Figure 4).

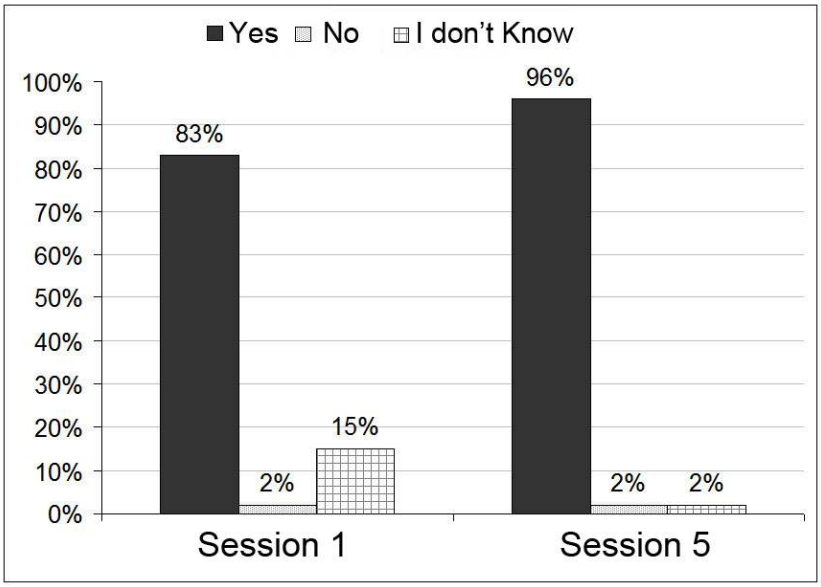

Figure 4- Users who would recommend the BUTLER system to other people of the same age

Regarding the users' attitude toward new technologies in general, as shown in Table 5, after the eight sessions of using the Butler 2.0 system, there was an improvement in all variables. The ability to use ICTs and interest in ICTs reached statistical significance, with a confidence interval of $p<0.05$ and a medium effect size (Cohen, 1988).

Table 5. Means and standard deviations PRE-POST use

Variables	**PRE session 1**		**POST session 8**				
	$\bar{X}$	**SD**	$\bar{X}$	**SD**	**t**	**p**	***d***
How do you generally feel when using new technologies?	2.85	1.14	3.09	.84	-1.400	.168	-0.24
To what extent do you feel capable of using new technologies?	2.30	.92	2.74	.80	-2.613	**.012**	**-0.51**
To what extent are you interested in using new technologies?	2.59	.98	3.00	.60	-3.083	**.003**	**-0.50**

*Note: For all variables, degrees of freedom = 45.SD = standard deviation. Scale from 0 to 4 for all variables.

After completing the eight sessions of Butler use, 83% of the users expressed the intention to continue to use the system in the future, compared to 2% who expressed no intention to use it, and 15% who were unsure (see Figure 5).

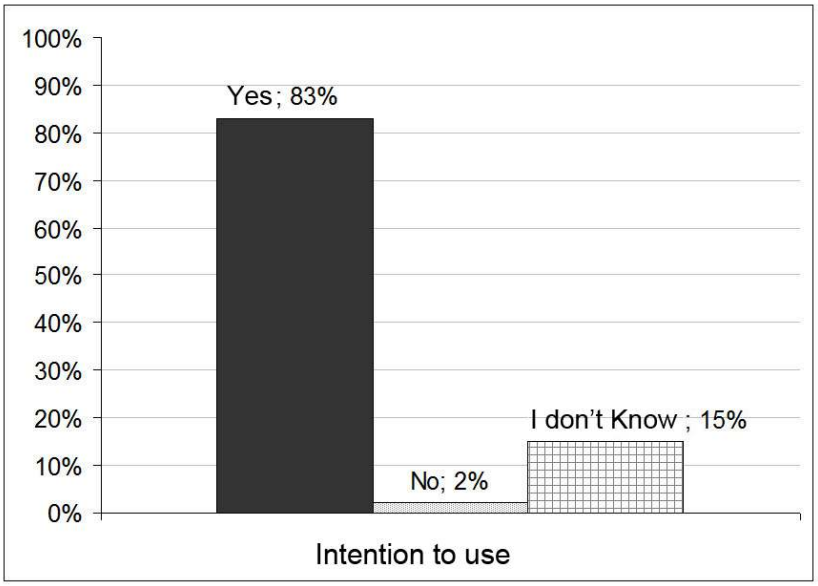

Figure 5– Do you think you will continue to use Butler in the future?

The users who had previously received training in the use of ICTs with hypertext navigation (82.6% of the sample) reported a strong preference for the Butler system (figure 6).

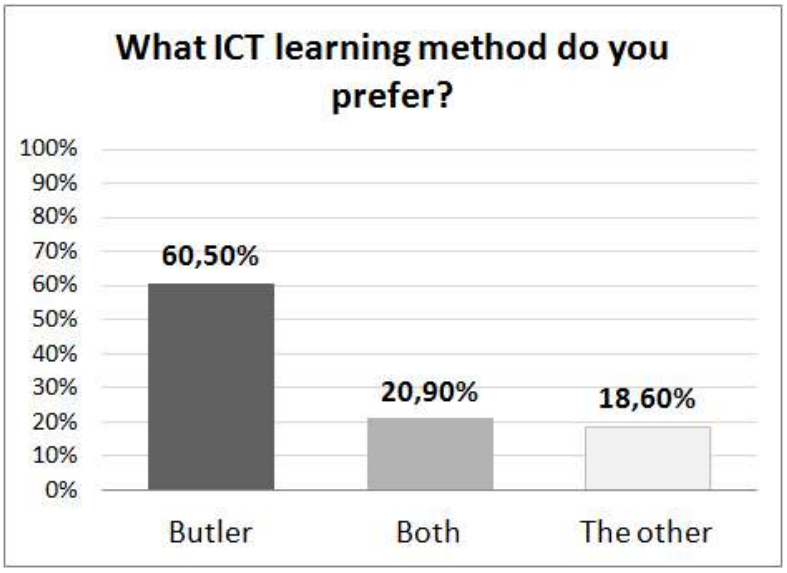

Figure 6– ICT learning method preferred

Perceived ease of use was one of the major reasons they preferred Butler as their ICT learning method (see table 6). However, this variable was not important when choosing other ICT learning methods.

Table 6 - Why do you prefer a specific method?

Method Preferred	Easier	Other reasons

Butler	92%	8%
Other ICT learning methods	20%	80%

4.2. Qualitative results

Focus Group

The general conclusions from the focus group session were highly positive. Users highlighted the ease of use of the system compared to other systems, the tutoring function of the linear system, the step-by-step structure, the immediacy of the results, and the loss of fear of technology.

At the interpersonal level, users stressed Butler's ability to connect people more, either through the possibility of establishing new friendships or due to being able to talk to family and friends who are far away via videoconference. Here are some of the opinions expressed by users during the focus group:

User 5. "I think it is a very reasonable method for all ages, especially for us, and first of all for me, who never touched a computer before, and even feared it a little. I was thinking, "What am I going to learn?" I am doing many strange things but I have lost the fear."

*User 9. "I have also taken several computer courses before, but the experience with this man (*referring to Butler avatar*) who is telling you "Good job!" is giving you confidence to do things by yourself. It is not like before, when you had to ask the teachers or interrupt your peers because you were slower. Here you can find your way by yourself because that man named Butler is telling you to go here, this button or that one, or he congratulates you because you are doing well. In other words, it is an animation that gives you a good experience."*

User 13. "Well, I value it very highly too, although I used it for a brief time, but I have a daughter who lives abroad, so for me it is an immense pleasure to send and receive emails, send and receive photos, chat; it is as if she were at home."

User 17. "I think it is a program that can be very valuable for the future. We are seeing the experience here. I wish I had a program like this when I began. I would have adapted much faster. The other way is too broad. This guides you step by step starting from the beginning."

*User 18. "With this you can connect to everybody. With the other one (*referring to a conventional Webmail*), you need to take three courses before sending a picture. But here, you are doing this from the first session".*

User 29. "With this program it is easier. Because you do not have to start with the subject, recipient, and by the end I do not even remember if the recipient is me ... or who I am sending the email to, or I end up sending an email without saying anything. I find it much easier."

Moreover, users gave feedback about the system features and made some requests for improvement, such as including a spellchecker in the browser, the possibility of

attaching multiple files in an email, or providing a paper manual for users where they can take notes.

Interviews with the center's staff

From the beginning of the study, every day, after each session, a phone meeting was held between researchers from Jaume I University and the center's staff in order to gather information about the use of the system. Different set-ups were used: a PC with a touch screen for individual sessions with users without any ICT skills and a PC with a mouse for group sessions with those who could use a mouse. An early important finding from the point of view of design was the fact that elderly users needed to see what they were pressing on while interacting with the touch screen, and so they clicked under the buttons and outside the interaction area. To solve this problem, although the buttons had a height of 120px, the interaction surface was extended below the space reserved for the text label (170px) to offset elderly users' tendency to press the bottom of the button, in order for them to see the item on which they are pressing.

Figure 7 –Change in the interaction area design

In the different phone interviews with the center's staff, they reported that most users positively passed the eight user sessions. One of the most frequent difficulties in Butler use reported during the sessions was the inconsistency in the use of the mouse between the operating system (double click) and the webpages (single click). In the final interview with the center's staff at the end of the experiment, they reported that all users were able to use most of the system's applications independently.

They also stressed the initial fear felt by the elderly people from the center in dealing with ICTs, and how the "step by step" function of the system helped users to feel safer and quickly lose their fear of the system. In addition, the center's management stated that the use of the Butler tool influenced aspects related to the real functioning of the center, apart from the online medium, for the group that participated in the study. The research produced strong cohesion among study participants, forming a mentality of belonging to the "Butler Group," which helped to break down social barriers that previously existed between people from different educational or socioeconomic backgrounds, such us farmworkers and landowners. This effect remained once the study was over, and the participants continued to meet outside the center for "Butler group" dinners.

Moreover, the center's staff reported that the use of the Butler tool significantly helped to improve the mood of the participants whose families were in different geographic locations because they could communicate more frequently and closely with the family through the e-mail and video conferencing tools. This circumstance led to an initially unexpected result, which was the registration of users born in the 1980s and 90s (grandchildren of the Butler users).

Once the experiment was over, the center decided to adopt the Butler system as a digital literacy method for its elderly users. Currently, the Butler course is led by four elderly users with high skills in the Butler system who are teaching new elderly users how to use the system.

5. CONCLUSIONS AND DISCUSSION

The present study aimed to test the usefulness of a social network consisting of multiple applications with linear navigation, as a digital literacy method for the elderly in the context of rural areas. For this purpose, a computer course with eight standardized sessions was established in the computer room of an Elderly Leisure Center located in a rural area in Spain. As a general result, we note that at the end of the study, the participants were able to independently use the system with its different applications after the eight sessions. Previous literature underlines, on the one hand, a clear pattern of negative age effects on spatial abilities (Techetin et al., 2014) and, on the other hand, a clear correlation between user experience with computers and overall performance. Furthermore, although the best predictor of performance for this group of users is their age, regardless of experience (Chadwick-Dias et al., 2004), it appears that experience helps them to obtain better outcomes. The quantitative results of our study show that the ICT experience variable had a limited influence on the dependent variables. Previous experience only had an influence on the perceived usefulness variable (PU) at the beginning of the study. In the first session, all users rated PU in the positive range of the scale, but PU was significantly lower for users with low ICT experience. After five sessions of use, PU differences between the two groups (low and high ICT experience) disappeared. This result reflects, consistent with Friemel (2016), that users with little or no ICT experience have a previous attitude of lower perceived usefulness of ICTs than users with ICT experience.

It is important to note that there were no differences in task performance based on previous ICT experience. Nevertheless, it is necessary to take into account that in our study, task performance was closely linked to the type of navigation system because the users chose which application to use, and from there the system guided them linearly until the task was finished (i.e., the only way to leave a task unfinished was to close the browser).

The hypertext structure can frequently disorient the elderly and cause them to be afraid of getting lost in cyberspace because it requires more cognitive resources than linear reading (Rosello, 1997; Lin 2003; Madrid et al., 2009; Ziefle & Bay, 2010; Ariel & Moffat, 2017), or they express difficulty in recalling and organizing the pages they have visited, and they take more steps than younger users to solve tasks with hyperlinks (Fukkuda & Bubb, 2003; Sayago & Blat, 2010). This lack of familiarity with hypertext structures clashes with the active role users must play online, organizing and structuring the information while consuming it (Salmerón, 2006), which leads them to develop their own navigation strategies (Fukkuda & Bubb, 2003). For this reason, we believe that our results could be consistent with these studies. Elderly people's orientation is affected by age-related decline (Techetin et al., 2014), and their learning strategies have been based on analog media with linear structures (books, magazines, etc.).Therefore, with Butler's linear navigation structure, users find a clear internal correspondence between their prior and new experiences, thus facilitating the learning and memory processes (Graf &

Mandler, 1984; Mandler, 1980, 1991) and obtaining highly positive results from the first session of use.

However, in addition to the navigation variable or other design factors (Castilla et al., 2013), the lack of relationship between the interaction area and graphic elements should be taken into account. The age-related decline in the elderly, in terms of physical, cognitive, and even emotional problems (Dommes et al., 2011; Spinelli, 2014), and their lack of experience with ICTs (Alm et al., 2005; Dickinson et al., 2007; European Commission, 2010; Gowans et al., 2004; Osman et al., 2005), could be the reason users click under the buttons rather than in the middle: they need to see in order to be sure of what they are clicking.

Quantitative results remained positive over time. After the first session, all the variables measured, i.e., learnability, sense of control over the system, ability to use the system, orientation, efficiency, accessible design, perceived ease, perceived usefulness, and intended use, were in the positive range of the response scale, specifically between the midpoint and the maximum point.
A comparison of measures shows that the repeated use of the system caused a significant improvement in users' confidence while using the system, their interest, and their satisfaction with the system, and it also caused a significant increase in the feeling of self-efficacy in using a computer. However, the repeated use of the system did not produce significant differences in the way users felt while using the system or in the perceived ease of use (PEOU). From the first session, users perceived the system to be fairly easy to use; the experience of use induced positive emotions, and these results remained unchanged throughout the sessions. These results for the continued use of the system indicate that, from the first session, maximum PEOU was reached, and continued use, learning, and familiarization with the tool did not increase the value of this variable. However, the continued use of the system did change other internal attributes of the user regarding technology, as users felt more capable, satisfied, and confident, and they showed more interest in the system. At the end of the study, users with ICT experience were consulted about their preference. The results show the importance of the PEOU variable: Butler was the preferred digital literacy method for 60.5% of the participants with ICT experience because they considered it easier than other ICT methods.

The percentage of people who would recommend Butler to people of the same age increased from 83% in session one to 96% in session five, that is, almost the entire sample. The intended use was the variable that changed the most between the first and fifth sessions (with a large effect size), reaching 96% of sample with responses between "somewhat agree" and "strongly agree" on the response scale.

Moreover, the continued use of the system produced an increase in the intended use and in the variables related to the internal attributes of users toward the system (more capable, more confident, and more interested), and there was also a significant change in their interest in ICTs in general. Several studies with elderly users have explored the relationship between the PU, PEOU, previous experience, and emotional factors (such as self-efficacy and technophobia) and future intended use (Igbaria &Iivari, 1995; Mead et al., 2000; Venkatesh et al., 2003; Arning &Ziefle 2007; González et al., 2012, Van Volkom et al., 2014; Dogruel et al., 2015; Friemel, 2016).

Mitzner et al. (2016) points out the importance of emotional experience with ICTs in the future intended use by elderly users. Thus, it seems logical that if lack of experience with the Internet causes users to fear and avoid its use (Chua et al., 1999; Hogan, 2009; Wang & Chen, 2015), a positive experience in the use of a system could improve the user's attitude, not only toward the system itself, but also toward ICTs in general. Our results showed that the perceived ease of use did not change throughout the study, but PU, internal attributes, and intention of use increased. It is necessary to take into account that the level of PEOU reached in the first session was high, and according to the revised TAM model proposed by Dogruel et al. (2015), PEOU is a significant predictor of PU, and PU an important predictor of system use. Our results seem to support this model.

The qualitative results stem from the data collected in the focus group sessions, where participants indicated their preference for the system used in the study compared to other known systems, due to the "ease" and "confidence" that Butler generates, often referring to how quickly they got results (e.g., sending an email with an attached photo in the first session of use) and its step-by-step structure. These results seem consistent, on the one hand, with Nielsen (2002), who states that elderly people mainly prefer web pages that are easier for them to use, and, on the other hand, with studies that explore the relationship between Internet structure and the elderly mental model (Kim & Hirtle, 1995; Bay, 2003; Puerta et al., 2006; Ziefle & Bay, 2010; Castilla et al., 2016; Ariel & Moffat, 2017).

In the qualitative results from our study, we also found that the elderly attributed an important emotional component to the use of the system, including a large number of internal attributions about the results of use (“at my age”, “will I be clumsy”, “I'm doing many strange things”, etc.), along with an emotional relationship with the system avatar, which allows them to form new relationships (create friendships with new users) or maintain existing ones with a greater sense of proximity. These data highlight the emotional load that the elderly users maintained with the system, coinciding with the literature (Mitzner et al., 2016; Savolainen et al., 2008).

The results obtained are very encouraging; however, they make us reflect on elderly people’s predisposition toward technology. We agree with the literature (Chua et al., 1999; Fidgeon, 2006; Hogan, 2009; Wang & Chen, 2015) indicating that in real life the elderly are afraid of not knowing how to use technology, of getting lost, or of appearing ridiculous. In our opinion, it is not enough to design highly usable systems for these users. The elderly need a reason to try to use the system, and, more importantly, they need to feel supported by a support figure until they build up enough confidence and feel able to use the system by themselves. In our study, although the users were capable of using the system autonomously from the first session, they considered it essential to know the different tools and options of the system throughout the "eight-session course", with the support figure of a teacher. These results agree with several studies (Hawthorn, 2005; Dickinson et al., 2007; Osman et al., 2005) that state that in order for this age group to adapt to ICTs, a support figure and previous training are indispensable, not only for task support, but also for emotional reasons.

Finally, we would like to highlight the generalization that occurred by increasing the sense of ability and interest in ICTs in general, and how the use of ICTs extended beyond the limits of the social network, thus producing a social impact on the physical

reality of the center, improving functioning between participants and breaking down existing social barriers (cultural and economic).This unexpected result opened up new possibilities, not only for reducing inequality and cultural disadvantage between urban and rural areas (Robinson et al., 2015), but also for other social divides within rural communities, through online social networks.

This study has some limitations. The first is based on the age range of the participants considered in the "elderly" group. Although initially we established the possibility of working with an age range of 65 years and older (with reference to the retirement age in the country of the sample), the social reality is that in elderly centers there are younger users who, due to health problems or early cognitive impairment, have obtained early or disability retirement, thus entering prematurely into the area of services for the elderly. Therefore, we reduced the minimum age range in the inclusion criteria to adapt to the social reality of the center. Second, the voluntary participation and presence of users with severe physical and/or cognitive deterioration reduced the final sample to 46 participants; in addition, due to the high percentage of users with an elementary level of education, we do not have a large enough sample to establish the possible influence of variables such as academic training or age on the results of the experiment. Moreover, the experimental design of this study limits our findings to the use of a social network in the context of a "digital literacy" course for elderly users in rural areas. This study opens the door to future studies aimed at discovering whether these results are consistent in other contexts, such as self-learning at home, with and/or without a support figure, or performing a more in-depth exploration of the impact of the use of a social network on the social structure and intergenerational relationships.

As future lines of research, we would like to emphasize that the system has been accepted by the European Union as part of the European Innovation Partnership action on Active and Healthy Aging (EIP-AHA), a major European initiative that aims to increase the quality of life and health of the elderly. Therefore, the system, in addition to being available in Spanish, has already been translated into English, German and Romanian, and it is currently being translated into Italian. It is operating at www.mundomayordomo.com free to the public. Finally, Butler 2.0. has provided the basis for the application of a H2020 European Project that has been awarded a grant and is currently ongoing (www.ehcobutler.eu). The project aims to assist seniors with cognitive impairment and promote social activity, health, satisfaction, and personal wellbeing with different intervention levels. ehcoBUTLER was created by adapting the Butler design principles (Castilla et al., 2013) to elderly users with a diagnosis of mild cognitive impairment.

With regard to the line of research opened up by this work, collaboration with the center where the study was conducted continues because the center has adopted the Butler system as an ICT training method for the elderly. Four elderly users who participated in this study as learners are now acting as teachers, training new elderly users in the center. To date, more than 2,400 users have used Butler 2.0. In other countries such as Switzerland, Romania, and Mexico, various actions are being put into practice with the Butler system as a result of collaboration with different universities and institutions in these countries.

Finally, we would like to point out that the main contribution of this work consisted of showing the usefulness of a social network with linear navigation in the context of digital literacy for elderly users in rural areas.

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APPENDICES

Table A1.
Opinion about ICTs in general questionnaire

How do you generally feel when using new technologies?	
To what extent do you feel capable of using new technologies?	0= Not at all capable 1= Somewhat capable 2= Normal, neither capable, nor incapable 3= Pretty capable 4= Absolutely capable
To what extent are you interested in using new technologies?	0= Not at all interested 1= Somewhat interested 2= Normal interest 3= Pretty interested 4= Absolutely interested

Table A2.
Usability and acceptability items

ITEM	**Variable**	**Theoretical origin**
1. I think most people could learn very quickly to use BUTLER.	Learnability	Adapted from SUS; (Brooke, 1996)
3. Overall, I knew what to do at all times. For example, when I wanted to press a particular button I knew how to do it, and I did it.	Control	
4. Once I had learned to use BUTLER, I could perform tasks quickly.	Learnability	
10. Overall, I think BUTLER is easy to use.	Perceived ease of use	
2. I felt confident about my ability to (capable) use BUTLER.	Self-efficacy	(Mitzner et al., 2016; Dogruel et al., 2015)
5. BUTLER can be used anywhere and in any context.	Flexible	(TAM; Adams et al., 1992)
6. The instructions in BUTLER are easy.	Clear and easy to understand	
7. The font and button sizes are sufficient for me.		
8. I would like to use BUTLER	Intended use	

frequently.	
9. Overall, I think BUTLER is very useful to me.	Usefulness

* Items adapted from System Usability Scale (Brooke, 1986)
Note: 0= Strongly disagree, 1= Somewhat disagree, 2= Neither agree nor disagree, 3= Somewhat agree, 4= Strongly agree.

Table A3.
Satisfaction with use questionnaire

1- Considering your previous experience using the new technologies, how did you feel while using the BUTLER system?	
2- After your experience with BUTLER, to what extent do you feel capable of using the computer?	0= Not at all capable 1= Somewhat capable 2= Normal, neither capable nor incapable 3= Pretty capable 4= Absolutely capable
3- To what extent would you be interested in using this system again?	0= Not at all interested 1= Somewhat interested 2= Normal interest 3= Pretty interested 4= Absolutely interested
4- How satisfied are you in general with the system?	0= No satisfaction 1= Little satisfaction 2= Normal 3= A lot of satisfaction 4= Extreme satisfaction
5- Would you recommend the BUTLER system to people of your age?	1= Yes 2= No 0= I don't know
6- Do you think you will continue to use BUTLER in the future?	1= Yes 2= No 0= I don't know

REFERENCES

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179–211.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior.* Englewood Cliffs, NJ: Prentice-Hall.

Alm, N., Dye, R., Astell, A., Ellis, M., Gowans, G. & Campbell, J. (2005, March). *A computer-based hypermedia conversation support for people with dementia*. In: Proceedings of the CSUN Conference on Technology and Disability, Los Angeles, CA.

Ariel, R. & Moffat, S.D. (2017). Age-related similarities and differences in monitoring special cognition. *Aging, Neuropsychology, and Cognition.* 1-27. http://dx.doi.org/10.1080/13825585.2017.1305086

Arning, K. & Ziefle, M. (2007). Understanding Age Differences in PDA Acceptance and Performance. *Computers in Human Behavior 23* (6): 2904–2927. doi:10.1016/j.chb.2006.06.005.

Bernard, M., Liao, C. & Mills, M. (2001). Determining the Best Online Font for Older Adults. *Usability News, 3*(1). Retrieved from: http://usabilitynews.org/determining-the-best-online-font-for-older-adults/

Brooke, J. (1986). System usability scale (SUS): A quick-and-dirty method of system evaluation user information. digital equipment co ltd. *Reading, UK*.

Castilla, D., Garcia-Palacios, A., Breton-Lopez, J., Miralles, I., Farfallini, L., Botella, C., Banos, R. M., Etchemendy, E. (2013). Process of design and usability evaluation of a telepsychology Web and virtual reality system for the elderly: Butler. International Journal of Human Computer Studies, 71(3), 350-362.

Castilla, D., Garcia-Palacios, A., Miralles, I., Breton-Lopez, J., Parra, E., Rodriguez-Berges, S., & Botella, C. (2016). Effect of Web navigation style in elderly users. *Computers in Human Behavior*, *55*, 909–920. http://doi.org/10.1016/j.chb.2015.10.034

Chadwick-Dias, A., McNulty M. & Tullis, T. (2002). Web usability and age: how design changes an improve performance. In *Proceedings of the 2003 conference on Universal Usability* (CUU'03). ACM, New York, NY, USA, 30-37. Retrieved from: http://doi.acm.org/10.1145/957205.957212

Chadwick-Dias, A., Tedesco, D., & Tullis, T. (2004). Older adults and web usability: is web experience the same as web expertise?. In *CHI'04 Extended Abstracts on Human Factors in Computing Systems* (pp. 1391-1394). ACM.

Chua, S.L., Chen, D.-T., Wong, A.F.L.: Computer anxiety and its correlates: a meta-analysis. *Computer in Human Behaviour. 15*, 609–623 (1999)

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Earlbaum Associates.

Davis, F. (1985). *A technology acceptance model for empirically testing new information systems: theory and results*. (Unpublished Doctoral dissertation), School of Managemente, Cambridge. URI: http://hdl.handle.net/1721.1/15192

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance. *MIS Quarterly, 13*(3), 319–340.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35*(8), 982–1003.

Dickinson, A., Smith, M.J., Arnott, J.L., Newell, A.F. & Hill, R.L. (2007) Approaches to web search and navigation for older computer novices. In *Proceedings of the SIGCHI conference on Human factors in computing systems (CHI '07)* (San Jose, California, USA, 2007), (pp. 281-290) ACM Press, New York, NY.

Dogruel, L., Joeckel, S., & Bowman, N. D. (2015). The use and acceptance of new media entertainment technology by elderly users: development of an expanded technology acceptance model. *Behaviour & Information Technology*, *34*(11), 1052–1063. http://doi.org/10.1080/0144929X.2015.1077890

Dommes, A., Chevalier, A., & Lia, S. (2011). The role of cognitive flexibility and vocabulary abilities of younger and older users in searching for information on the web. *Applied Cognitive Psychology, 25*(5), 717-726.

Etchemendy, E., Baños, R. M., Botella, C., Castilla, D., Alcañiz, M., Rasal, P., & Farfallini, L. (2011). An e-health platform for the elderly population: The butler system. *Computers & Education*, *56*(1), 275–279. http://doi.org/10.1016/j.compedu.2010.07.022

European Commission (2006). *EU25 population aged 65 and over expected to double between 1995 and 2050.* Eurostat, Statistics in focus, 129.. Retrieved from: http://epp.eurostat.ec.europa.eu/cache/ITY_PUBLIC/3-29092006-BP/EN/3-29092006-BP-EN.PDF

European Commission (March, 2010) *ICT & Ageing users, markets and technologies*. Retrieved from: http://ec.europa.eu/information_society/activities/einclusion/library/studies/markets_ict_seniors/index_en.htm

European Commission (2016) *Digital Agenda Scoreboard key indicators.* Retrieved in August 2017 from: http://digital-agenda-data.eu/charts/analyse-one-indicator-and-compare-countries#chart={"indicator-group":"internet-usage","indicator":"i_iux","breakdown":"Y65_74","unit-measure":"pc_ind","ref-area":["BE","BG","CZ","DK","DE","EE","IE","EL","ES","FR","IT","CY","LV","LT","LU","HU","MT","NL","AT","PL","PT","RO","SI","SK","FI","SE","UK","EU27","EU28","HR","IS","NO"]}

Fidgeon, T. (2006, 1 February). *Usability for Older Web Users*. [blog WebCredible]. Retrieved from: http://www.webcredible.co.uk/user-friendly-resources/web-usability/older-users.shtml

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research.* Reading, MA: Addison-Wesley.

Friemel, T. N. (2016). The digital divide has grown old: Determinants of a digital divide among seniors. *New Media & Society*, *18*(2), 313–331. http://doi.org/10.1177/1461444814538648

Fukkuda, R., & Bubb, H. (2003). Eye tracking study on Web-use: Comparison between younger and elderly users in case of search task with electronic timetable service. *PsychNology Journal, 1*(3), 202-228.

Graf, P. & Mandler, G. (1984). Activation makes words more accessible, but not necessarily more retrievable. *Journal of Verbal Learning and Verbal Behavior, 23* (5), 553-568.

González, A., Ramirez, M. & Viadel, V. (2012). Attitudes of the Elderly Toward Information and Communications Technologies. *Educational Gerontology 38* (9): 585–594. doi:10.1080/03601277.2011.595314.

Goodwin, C.L., 2013. Use of the computer and the Internet by well older adults. *Activities Adapt. Aging 37* (1), 63-78.

Gowans, G., Campbell, J., Alm, N., Dye, R., Astell, A., & Ellis, M. (2004). Designing a multimedia conversation aid for reminiscence therapy in dementia care environments. In *CHI'04 Extended Abstracts on Human Factors in Computing Systems* (pp. 825-836). Vienna: ACM.

Hawthorn, D. (2005). Training wheels for older users. In *Proceedings of the 17th Australia conference on Computer-Human Interaction: Citizens Online: Considerations for Today and the Future* (pp. 1-10). Australia: Computer-Human Interaction Special Interest Group (CHISIG).

Hill, R., Betts, L. R., & Gardner, S. E. (2015). Older adults experiences and perceptions of digital technology: (Dis)empowerment, wellbeing, and inclusion. *Computers in Human Behavior*, *48*, 415–423. http://doi.org/10.1016/j.chb.2015.01.062

Hodge, H., Carson, D., Carson, D., Newman, L., & Garrett, J. (2016). Using Internet technologies in rural communities to access services : The views of older people and service providers. *Journal of Rural Studies*. 1-10. ISSN 0743-0167 http://doi.org/10.1016/j.jrurstud.2016.06.016

Hogan, M. (2009) Age Differences in Technophobia: An Irish Study. *Information Systems Development: challenges in practice, theory and education*. 117-130, http://doi:10.1007/978-0-387-68772-8_10

Holleran, P. A. (1991). A methodological note on pitfalls in usability testing. *Behaviour & Information Technology, 10*(5), 345-357.

Igbaria, M., & Iivari, J. (1995). The effects of self-efficacy on computer usage. Omega, International Journal of Management Science, 23, 587–605. http://dx.doi.org/10.1016/0305-0483(95)00035-6.

Internet World Stats. *Usage population and statistics.* http://www.internetworldstats.com/stats.htm. Retrieved in: August 2017.

Karahasanović, A., Brandtzæg, P. B., Heim, J., Lüders, M., Vermeir, L., Pierson, J., ... & Jans, G. (2009). Co-creation and user-generated content–elderly people's user requirements. *Computers in Human Behavior*, *25*(3), 655-678.

Khosravi, P., Rezvani, A., & Wiewiora, A. (2016). The impact of technology on older adults' social isolation. *Computers in Human Behavior, 63,* 594-603. http://doi.org/10.1016/j.chb.2016.05.092
Kim,H.,& Hirtle,S. (1995). Spatial metaphors and disorientation in hypertext browsing. *Behaviour & Information Technology*, 14,239–250 .

Graf, P. & Mandler, G. (1984). Activation makes words more accessible, but not necessarily more retrievable. Journal of Verbal Learning and Verbal Behavior, 23 (5), 553-568.

Lee, B., Chen, Y., Hewitt, L. (2011) Age differences in constraints encountered by seniors in their use of computers and the internet. *Computers in Human Behavior, 27*, 1231–1237 (2011

Lin, D. Y. M. (2003). Hypertext for the aged: effects of text topologies. *Computers in Human Behavior, 19*(2), 201-209.

Madrid, I., Van Oostendorp, H., & Puerta, M. C. (2009). The effects of the number of links and navigation support on cognitive load and learning with hypertext: the mediating role of reading order. *Computers in Human Behavior, 25*, 66-75.

Mandler, G. (1980). Recognizing: the judgment of previous occurrence. *Psychological Review*, 87 (3), 252-271.

Mandler, G. (1991). Your face looks familiar but I can't remember your name: A review of dual process theory. In *E. William, E. Hockley & E. S. Lewandowsky (Eds.). Relating theory and data: essays on human memory in honour of Bennet B. Murdock* (pp. 207-225). Hillsdale: Erlbaum.

Mead, S. E., Sit, R. A., Rogers, W. A. Jamieson, B. A. and Rousseau. G. K. (2000). Influences of General Computer Experience and Age on Library Database Search Performance. *Behaviour and Information Technology 19* (2): 107–123. doi:10.1080/014492900118713

Mitzner, T. L., Rogers, W. A., Fisk, A. D., Boot, W. R., Charness, N., Czaja, S. J., & Sharit, J. (2016). Predicting older adults' perceptions about a computer system designed for seniors. *Universal Access in the Information Society, 15*(2), 271–280. http://doi.org/10.1007/s10209-014-0383-y

Nielsen, J. (2002). Usability for Senior Citizens. *Nielsen Norman Group.* Retrieved from: http://www.nngroup.com/articles/usability-for-senior-citizens/

Norval, C., Arnott, J. L., & Hanson, V. L. (2014). What's on your mind?: investigating recommendations for inclusive social networking and older adults. *Proceedings of the 32nd Annual ACM Conference on Human Factors in Computing Systems - CHI '14*, 3923–3932. http://doi.org/10.1145/2556288.2556992

Osman, Z., Poulson, D., & Nicolle, C. (2005). Introducing computers and the Internet to older users: findings from the Care OnLine project. *Universal Access in the Information Society*, *4*(1), 16-23.

Prensky, M. (2001). Digital natives, digital immigrants. *On th Horizon (9)*5, 1-6. Retrieved from: http://www.marcprensky.com/writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part1.pdf

Puerta Melguizo, M. C., Lemmert, V. R., & Van Oostendorp, H. (2006). Lostness, mental models and performance. In V. P. Guerrero Bote (Ed.), *Current research in information sciences and technologies: Multidisciplinary approaches to global information systems* (pp. 256–260). Mérida: Open Institute of Knowledge.

Ramón-Jerónimo, M., Peral-Peral, B., & Arenas-Gaitán, J. (2013). Elderly Persons and Internet Use. *Social Science Computer Review, 31*(4), 389–403. http://doi.org/10.1177/0894439312473421

Roberts, E., Beel, D., Philip, L. & Townsend, L. (2017), Rural resilience in a digital society: Editorial. *Journal of Rural Studies.* http://dx.doi.org/ 10.1016/j.jrurstud.2017.06.010

Robinson, L., Cotten, S. R., Ono, H., Quan-haase, A., Chen, W., Schulz, J., … Digital, M. J. S. (2017). Digital inequalities and why they matter. *Information, Communication & Society, 0*(0), 1–14. http://doi.org/10.1080/1369118X.2015.1012532

Rosello, M. (1997). Los mapas del screener.El «Wandersmänner» de Michel de Certeau y el declive hipertextual de Paul Auster. En G. P. Landow (Ed.), *Teoría del hipertexto* (pp. 147-187). Barcelona: Paidós.

Salmerón, L. (2006). *Strategies of Text Comprehension in Hypertext*. (Unpublished Doctoral dissertation). Universidad de Granada. Granada. Retrieved from: http://hera.ugr.es/tesisugr/16098158.pdf

Sloan D. (2006) Two cultures? The disconnect between the Web standards movement and research based Web design guidelines for older people. Gerontechnology Journal 5(2) (July 2006) pp. 106-112. Retrieved from: www.gerontechnology.info/Journal/Content/Volume_5/nr_2/pdf/106-112.pdf

Savolainen, L., Hanson, E., Magnusson, L., & Gustavsson, T. (2008). An Internet-based videoconferencing system for supporting frail elderly people and their carers. *Journal of Telemedicine and Telecare, 14*(2*),* p79-82.

Sayago, S., & Blat, J. (2010). Telling the story of older people e-mailing: An ethnographical study. *International Journal of Human-Computer Studies*, *68*(1), 105-120.

Spinelli, G.(2014) Designing and Evaluating Web Interaction for Older Users.In Yannacopoulos, D., Manolitzas, P., Matsatsinis, N., Grigoroudis, E.(Eds.) *Evaluating Websites and Web Services: Interdisciplinary Perspectives on User Satisfaction: Interdisciplinary perspectives on User Satisfaction.* Hershey: IGI GLOBAL. ISBN978-1-4666-5132-2.

Sonderegger, A., Schmutz, S. and Sauer,J. (2016) The influence of age in usability testing. *Applied Ergonomics, 52*. 291-300. https://doi.org/10.1016/j.apergo.2015.06.012
Wagner, N., Hassanein,K., & Head, M. (2014) The impact of age on website usability. *Computers in Human Behavior 37*, 270-282. https://doi.org/10.1016/j.chb.2014.05.003

United Nations (2009). Department of Economic and Social Affairs, Population Division. *Population Ageing and Development 2009*. Retrieved from: http://un.org/esa/population/publications/ageing/ageing2009chart.pdf

Van Volkom, M., Stapley, J. C., & Amaturo, V. (2014). Revisiting the digital divide: Generational differences in technology use in everyday life. North American Journal of Psychology, 16(3), 557574.

Venkatesh, V., & Morris, M. G. (2000). Why do not men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behaviour. *MIS Quarterly, 24*(1), 115-139.

Venkatesh, V., Morris, M. G., Davis, G. B., and Davis F. D. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly 27* (3): 425–478.

Voyer, D., & Voyer, S. D. (2014). Gender differences in scholastic achievement: A meta-analysis. *Psychological Bulletin, 140*, 1174–1204. http://doi:10.1037/a0036620

Vroman, K. G., Arthanat, S., & Lysack, C. (2015). "Who over 65 is online?" Older adults' dispositions toward information communication technology. *Computers in Human Behavior*, *43*, 156–166. http://doi.org/10.1016/j.chb.2014.10.018

Wagner, N., Hassanein, K. & Head, M.. (2014) The impact of age on website usability. *Computers in Human Behavior 37*, 270-282.
Wang, C., & Chen, J. (2015). Overcoming technophobia in poorly-educated elderly – the HELPS-seniors service learning program, *International Journal of Automation and Smart Technology 5*(3), 173–182. http://doi.org/10.5875/ausmt.v5i3.980

Woodward, B. (1998). *Evaluation methods in usability Testing*. Retrieved from: http://www.swt.edu~hd01/5326/projects/BWOODWARD.HTML

Zhou, J., Rau, P.P. & Salvendy, G. (2012) Use and Design of Handheld Computers for Older Adults: A Review and Appraisal. *International Journal of Human–Computer Interaction 28* (12), 799-826.

Ziefle, M., & Bay, S. (2006). How to overcome disorientation in mobile phone menus: A comparison of two different types of navigation aids. *Human-Computer Interaction, 21*, 393–433.