

Evaluation of the User-Friendliness to Promote Technological Engagement Among Nursing Home Residents

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Abstract

This paper examines feasibility of using a digital kiosk known as siosLIFE Digital Kiosk as an aid to support and enhance the digital presence of those who live in nursing homes. The research conducted by evaluating the ease of use system and accessibility, as well as general user satisfaction intends to comprehend its potential in solving the digital divide problem as applied to aging populations. The assessment was based on observing the manners of interaction, soliciting feedback and evaluating performance indicators to determine strong points and weaknesses. The evidence indicates that the kiosk presents great opportunities to advance the access of residents to digital resources, to communication means hence supporting social connectedness and inclusion. Nonetheless, some of the interface design features and training are to be designed in order to make the user experience better.

Keywords: Digital inclusion, nursing homes, elderly residents, user experience, usability evaluation, assistive technology, siosLIFE™, technology adoption, digital engagement, human–computer interaction.

1.Introduction

How people approach digital services has completely changed since the beginning of the 90s where people were mainly interested in professional and task-oriented functionalities to one quite different of much more applications including personal entertainment, leisure activities, and socializing with others (Lowgren, 2008). This transformation has afforded alternative avenues to communicating and socializing enabling people to stay connected and experience things across far distances. Simultaneously, it has also brought into being the danger of the enforcement of stereotypes, and enhancing the modes of exclusion on some population groups (Hamelink, 2000; Gorman and McLean, 2009). With the increased trend of informal, day-to-day application of the digital platforms, the issue of digital equity in its ability to accommodate all age group levels has become a burning issue in society. In this context, all studies indicate that older adults are always at the bottom of most aspects of digital media consumption (Keränen et al., 2017)(1). The causes related to such difference are manifold and intertwined and should cover the lack of access to these tools, the lack of understanding due to economic, cultural, and educational limitations, and the poor quality of most digital platforms that neither satisfy the physical, cognitive, and motivational needs of older adults. All this coincides with a physiological and psychosocial level of normal ageing development, which present vast obstacles to inclusion into the digital world (Pfeil et al., 2009).

The other key aspect of the advancement made in humanity is longevity or rather the fact that new advances have made people live long since the onset of developments in the healthcare, educational, socio-economic changes and increased political stability. Nevertheless, the rise in the life expectancy along with the dwindling birth rates in previous decades have contributed to an average demographic shift of population ageing globally (Cabral et al., 2013; Chau et al., 2012), more so in industrialized countries (Nazareth, 2009). According to the estimates issued by the World Health Organization, the share of the population aged 60 or more in most of the countries is expected to exceed 30% by 2050 (WHO, 2015). Even though ageing remains a universal process, involving transformations in a number of spheres of human life, it is, in its turn, highly personal and is predetermined by personal history, experience, and conditions of people (Rocha, 2007). As a result, it may be complicated to establish precise people who are considered to be aged. Ageing, all by itself, is multidimensional a fact which implies that it entails physical or physiological changes, social factors, as well as psychological adjustments (Ferreira, 2013; Paúl, 2005).

The development of the interactive systems aimed at older users should be equally based on the possibilities of the technology and user requirements. Systems have to be versatile to various situations and sensitive to the problems encountered by the users to promote accessibility and easiness in interaction. On this note, kiosks based on touchscreen have a significant potential among older adults since they integrate direct manipulation interfaces and comparatively easy learning curve (Moti et al., 2014; Fonseca, 2011). The importance of making the elderly

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a part of the so-called network society is increasingly acknowledged in the research community as well, with the focus being on the need to empower the older generation using the power of digital technologies in order to curb both social isolation and the lack of inclusion (Wu et al., 2015).

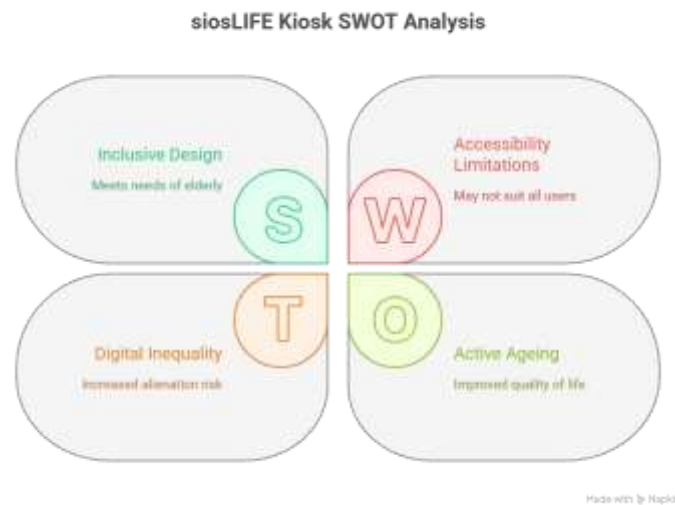


FIGURE 1 siosLIFE Kiosk SWOT Analysis

The current work focuses on the analysis of siosLIFE(tm), the interactive touch based kiosk targeted towards the nursing homes setting. The system is composed of a multimedia touchscreen display, a Kinect motion sensor, and card reader. It also focuses on promoting the mental activity and the exercise among seniors by facilitating numerous activities, including games, video chat, music streaming, and even drawing programs (ScaleUpPorto, 2016). The intention to meet both entertainment and communication needs in the same stage of the population that is normally at risk of being marginalized in digital realms is the solution to deal with the twofold goal of mental activity and social interaction as it is promoted by the suggestion to use both forms of tools(2).

The objective of the usability trial carried out and laid down in this report was to provide the assessment of the ability of siosLIFE tm to support an access as an inclusive digital system of the elderly, keeping in consideration the peculiarities of the accessibility and usability of the given group. The research aimed to determine both the positive aspects and the drawbacks of the design of the kiosk in the actual application among residents of a nursing home through a set of guided activities and observation schemes. The same practice is also reflective of the larger need of making sure that the advent of new technologies does not unwillingly allow levitating the overall problem of inequality but, on the contrary, should act as the means of helping move towards more active ageing, independence, and all-things-considered improved quality of life. The research also fits into the current arguments in the domain of gerontechnology, which proclaims the creation and adoption of products, surroundings, and services to circulate to older persons and their wellbeing, social engagement, and independence (Fozard, 2001).

Metaphorically speaking, the introduction presents the scene of a twofold challenge: although technological innovation has the potential to turn ageing into a more networked, interesting and rewarding phase of existence, it will also increase alienation unless the particular needs and limitations of older adults are taken into account. Thus, this study is framed at the nexus between usability, accessibility, and social inclusion questions and, namely, makes use of an empirical approach to evaluate a tangible technological intervention to be used within a nursing home setting. Due to the target object (siosLIFE), the study does not study a specific device but also considers a wider concept of inclusive design and digital inclusion in ageing societies.

2.The integration of context

In Portugal, the demographic patterns demonstrate a steady, significant increase in the percentage of citizens aged 65 years and above with this life threshold being the most commonly relied on by the World Health Organization (WHO, 2002) as the demarcation point when considering the number of aged citizens of the country. Statistics of 2015 demonstrate that among the population aged 65-74 years only 29 percent indicated to use computer and the internet (INE, 2015). This rather low percentage further decreases among the 75 years and older generation, but no conclusive national data exist in that category(3). The global studies validate this opinion by noting that the

coverage of technology continues to fall even lower in these older generations (Keranen et al., 2017). Excuses are numerous. Older adults have to encounter additional challenges not related to the physical access to technology but based on the perception of challenge and lack of confidence in their ability to use technology, despite the actual availability of the technology (Ferreira, 2013; Friemel, 2016). Whenever layered on top of each other, this inadequacy in digital literacy becomes a permanent deficiency in the capability to read and traverse the vernacular of digital technologies, the tools and modalities they implement and the paradigms they presuppose (Ferreira, 2013). In the absence of these skills, the elderly can be left out of the chance to access its benefits that online platforms offer.

Ageing alone results in physiological, sensory, and cognitive changes posing a direct obstruction of ability of an individual to effectively interact with the digital medium. Consequently, there is a need to ensure that during the requirements-gathering process, and the design process of any digital system, the particular needs of the older adults are put into consideration(4). With abilities to accommodate such factors, technology can even turn out to be not just available, but definitely empowering to this segment of the population. In practice, a great number of the advantages considered by older people in the usage of digital tools are associated with their potential to maintain and reinforce social bonds. According to Dias (2012), seniors attach great importance to communication with relatives and friends as well as the interaction with various generations. This can be enabled to a degree via variety of digital interactions, including group discussions, chats, email correspondences as well as recreational digital activities such as interactive games. Digital media are, therefore, an opportunity to address the issue of older adults staying engaged with others, having a sense of belonging and the capability to engage them in the lives of the communities.

Furthermore, with the help of digital platforms, intergenerational interactions may be activated, involving younger and older people in the interaction that will be mutually beneficial. Online mediums and interactive media that makes use of these technologies have the potential to foster companionship, as well as social support among older adults, as a single but not an exclusive option to another purpose. Engagement in online spaces may encourage them to go out, get involved in the community activities, or even civil society (Bouvy et al., 2014). Moreover, digital technology also allows the older adult to plan future activities, achieve personal goals, as well as persevere in life projects. Practically, they can be also used to supplement everyday life activities, help monitor health conditions, and enhance individual safety (Azevedo, 2013; Ashok and Jacko, 2009; AGE, 2008; Dickinson and Gregor, 2006; Blit-Cohen and Litwin, 2004).

One of the most important aspects of this process is the direct incorporation of the older adults into the process of developing technological solutions. Whereas user-centered design is now highly acceptable to other age groups, it is not yet an all appropriated measure regarding seniors. Elderly participants are also involved at different steps of execution, including needs assessment, usability testing, which makes tools tailored to elderly needs, preferences, constraints, and actual experiences. This participatory process fits in the general ethical issue, including respect of dignity of individual human beings, safeguarding human rights and having the values of universality, non-discrimination and equality (AGE, 2008). These concepts are critical in the establishment of genuine participation and inclusion as opposed to token inclusion.

There are challenges and opportunities in the Portuguese context in this respect. On the one hand, the low rates of technology usage among the elderly denote the obvious digital divide that should be reduced. Conversely, the demographic issues in Portugal are rather negative since the country is faced with the problem of rapid ageing, which necessitates the development of specific programs to support digital literacy, social activity, and active ageing. Local governments, community organizations, and even both public and private institutes, are able to cooperate to design and implement and maintain technological infrastructure that is truly inclusive. This may involve the provision of user-friendly digital platforms in areas where the older persons visit regularly, e.g. elder homes, day centers, libraries, or community centers(5).

The gap closing should embrace other elements other than usability in terms of technology but also the social and emotional aspects of using the digital world. The barriers that come with using new technologies are mostly due to some older adults being apprehensive to making errors, the feeling that they are not relevant in today world, or that they are uncertified like younger people when it comes to technology. These barriers can vary and progressively be removed through the establishment of conducive learning environments, the provision of long term training and making the content personally relevant. In that respect, digital literacy should not be a single event, the intervention, but also an ongoing adaptable support.

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The other key consideration is the matching of the digital solutions in to cultural contexts and interests among older adults. Material which can tie in to their lives, memories and values has much more chance of generating long-term interest. E.g. in Portugal services using digital technology that includes local news, local music, religious, or local culture may be especially attractive. Simultaneously, the issue of flexibility should remain central to the design with the possibility of customization and incorporation of assistive technologies to suit different demands, including visual or hearing impairment, mobility or cognitive disability.

All in all, this is a theme that should be understood against the backdrop of the marked situation or scenario in Portugal today as the world/country in question needs to be assured that technological innovation can be one way of minimizing and not even supporting and sustain inequality as it exists just now. As the number of older persons continues to grow and given the compounding disadvantages that many of them experience when it comes to participating in the digital realm, the creation of open, accessible, and socially-relevant online spaces is no longer just something that would be nice to do but something that is needed. This provides a context within which solutions such as siosLIFE 2020 needs to be judged that are focused on integrating technology into sensible and user-centric design to encourage the healthy ageing and social integration(6). The contextual sense described here offers the scenery before which the usability, accessibility, and inclusiveness of such platforms needs to be harshly evaluated thus they answer to the structural and personal reality of older adults in the modern Portuguese society.

3.Methodology

The siosLIFE platform has three main user groups characterized by ageing users, institutional administrators and relatives, and features are aimed at them. To narrow down to this research, therefore, the focus of this research was on the elderly user profile since it is the most direct interaction of the residents of nursing homes with the system. Its aim was to know how they found the experience through their testimonial with respect to accessibility, ease of navigation, and design inclusivity.

Investigators had the opportunity to use the current edition of the siosLIFE(tm) program, which was on the market at the moment of its application. This assessment was conducted in one of the most active nursing homes in Portugal regarding the implementation of the concepts of active ageing, which represents an optimal setting to witness a proportionate set of interactions. The use of several introductory sessions with the platform enabled the research team to get accustomed to the platform, its navigation, and possible places of challenge prior to designing the usability test itself(7).

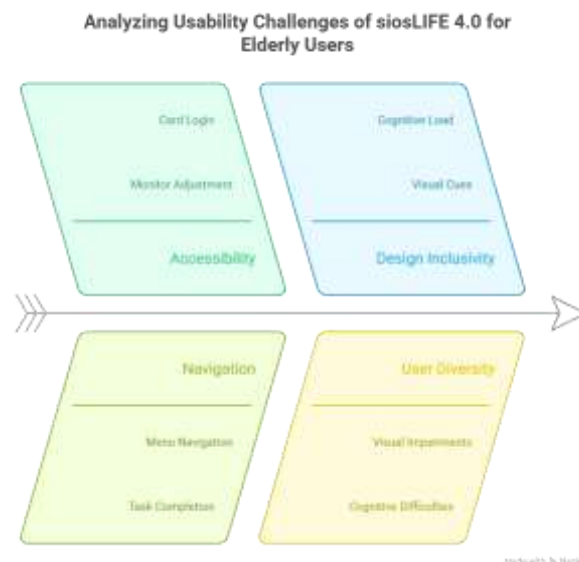


FIGURE 2 Analyzing Usability Challenges of siosLIFE 4.0 for Elderly Users

The research question that acted as its guide was really simple but very important: Does siosLIFE 4.0 system satisfy accessibility, usability, and inclusive design requirements, which suit elderly users? Responding to this, technical observation was not enough but needs more insight into emotional and cognitive reactions of the users when operating the kiosk.

The usability test was carried out in December 2017 where two researchers presided over in every session. A number of seven preformulated tasks were used to guide the participants step-by-step, where one researcher read them loudly, and another observed attentively and noted the performance errors, behaviors, and any significant challenges. The sample size was 6 participants (3 male and 3 female) residents of the nursing home aged over 64 years with a mean age of 77 years. Participants did not form a uniform group, which means that they had various abilities and medical conditions because of the small size of the institution and a low number of involved persons who can or willing to participate. Such variations were taken into account when interpreting the results to avoid penalizing or frustrating the participants due to their limitations that are not related to the system itself.

The team consisted of three people with visual issues, one with cognitive difficulties as well as two people with mobility limitations; one of them was using a wheelchair with decreased mobility of the upper limbs. Although such conditions would be eliminated as exclusion criteria in large trials, here they were viewed as possible ways to see how the platform would handle the diversity in the real world.

Think-aloud protocol was used to understand the process of decision-making and mental model of the participants as they use the system (Hartson and Pyla, 2012). This method prompted the users to explain their thoughts progressing through the tasks, which showed not only where the problems were there but also why they were there. It was noted in several dimensions including autonomy of accomplishing assignments, the rate or the type of mistakes, the time, a route to follow in accomplishing the assignment, and the non verbal communication including hand signs, body posture and the facial expressions. Motor, sensory and cognitive reported difficulties were recorded.

The seven tasks addressed an assortment of functions and interaction forms:

Initial Setup and Login -Customizing monitor position so that the words can be read and instructions on the screen followed, logging in by slotting in the assigned card which carries the username, logging in and going through the assigned user profile and navigating the main menu.

- Part 1 Game Navigation – Opening the Games menu and choosing game Smashing Bugs and playing till the goal was met.
- Game Navigation (Part 2) - Back through to the main menu and choosing a different game (Picking Fruit), and completing a turn.
- Music Interaction- clicking to go to listen to music screen, selecting an audio I am comfortable with- a song performed by an artist I am familiar with- and playing with the volume both up and down.
- Information Access - Choosing the News menu, going through to the section called Sports and reading an item about soccer.
- Communication Feature- Calling a particular contact, doing and ending a call using the applications call buttons.
- Logout Process The card should be removed and it should be ensured that the logout has occurred and what visual response the NFC reader provides.

All the tasks were intended to challenge various elements of usability: interaction with hardware (monitor adjustment, card login) to menu navigation, content selection, understanding their instructions, fine and gross motor skills, and acquisition of visual or audible cues. By so doing, the study managed to reflect an overall outlook of how successful the siosLIFE L. 2 system was at achieving the various needs of its target audience.

Notably, the research investigative team attempted to provide an environment that is not intimidating. There were supportive instructions, which were encouraged in such a way to minimize anxiety and make a person feel achieved. This played an imperative role in ensuring that participants were not demotivated as some of them were admittedly uncertain that they could handle digital technology.

Through this organizational format of being observational, task-focused, and real user centric, it was not just expected that the study would obtain quantitative outputs specific to the technical aspects of usability, but also to provide qualitative findings on the experience of having an older adult go through a digital interaction. Such observations would serve as guiding points towards the interpretation of findings, noting the areas where the platform excelled and the additional development aspects that would be required to make it truly inclusive of the outdated elderly in the nursing home facility.

4.Results and Discussion

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All six were capable of performing the entire list of assigned tasks but the degree of independence was quite different. There were different individuals who could move about the interface without much hesitation and there were other individuals that needed the researcher to read the instructions given in the task. These disparities were influenced not only by the level of familiarity with the digital systems previously but also by differences in sensory, cognitive, and motor skills.

Logging in, adjusting monitor and logging out were categorized as the first task and last task of the analysis because of their similar interactions with the hardware. There were mixed findings; four users logged in their details without any support, and two individuals had to be helped. There were three who could do it without adjusting the monitor meaning it was a bit easier. The most problematic of steps was the logging out, only one of the participants successfully managed to log out without assistance. Users who had constant access to the computers were, clearly, faster and more confident taking these steps, particularly with the card-based log in that they found easy and fulfilling. Conversely, when they did not know computing, there were simplest cases when people did not realize that the card could be used as a means of logging in. Others took to inserting the card in and out to experience the inserted light response of the NFC reader, which appeared to interests the individuals.

Going into the gameplay, every participant passed the Smashing Bugs task successfully. But, only two were able to locate and initiate the game with the help. The rest had to be guided on how to find it in the menu structure and this resulted to more page numbers being chosen instead of hitting the next page button and this delayed the movement. There is also a factor of visual disability, in that one of the subjects was unable to read the status text of the game, and another, who was illiterate, could only go by the suggestive images to tell which option is the correct one. Interestingly two participants were engaged in the game such that they played beyond the completion prompt.

When they changed to the Picking Fruit game, it brought other obstacles. Four of the participants needed assistance in switching games and two of the participants had a difficult time in comprehending the start-up instructions, which mandated them to be three meters apart from the Kinect sensor(8). Even the instructions omitted to give details about the actual actions required of people to pick fruit physically giving rise to the confusion. A couple of participants made some improvisations such as one trying to use his head to catch apples, whereas others experienced problems with the parallax effect, finding it difficult to imitate their movements in the physical world to the location of the fruit on the screen. The visual impairment further made it difficult to monitor performance as some of them were unable to read their numbers at a glance. Those complications notwithstanding, the game turned out to be popular attracting the participants to laugh, clap, and evidently have fun.

Both the interface understanding problems and navigation problems were manifested in the music task. Four of the participants were not able to pick a song or artist by themselves tending to waver between the text label and the related picture. Two more familiar with using computers were able to recognise the use of the arrow navigation and use it without challenges, probably as it is what they are used to working with in other music programs. It was particularly difficult to change the volume, only one of the participants could do this independently. Its tiny icon and low position in the screen might have worsened the issue particularly to persons with impaired vision.

Viewing of the news content was the least confusing. The number of them that moved to Sports section without assistance was four. Nonetheless, there are too many people who kept clicking at the back arrow which caused them to log out of the news section. When asked what she would prefer doing to turn pages, one participant spontaneously mentioned swiping saying that it would be more natural and even simulated the action in the course of the meeting. Surprisingly, just a single participant stated their preference to digital news over the printed ones, which could be an indication that at least a part of the older adults still find traditional media interesting.

The calling service was simple, in general four people made and received a call and hung up on their own responsibility. An obvious exception was a person with cognitive impairment, who did not realize that the phone icon was interactive but actually tried to find a real mobile phone. Upon the verbal clarification, they could fulfill the task successfully(9).

In general, the observations point out that although siosLIFE 0 meets some of the basic usability criteria, including clear task paths and interesting content, it remains problematic in regard to visual accessibility and instruction clarity, as well as to physical interaction. When difficulties with reading small elements on the displays, perception gesture basis controls without clue, or navigating in step command or menus were thematized repeatedly. On the one hand, the multiplicity of activities the system provided, visual feedback (like NFC lights), or the cultural relevance of the content inside the system allowed maintaining the engagement and spirits of the participants, despite their limited exposure to the digital world.

Concisely, the findings point to a paradoxical landscape: that the kiosk can definitely work to encourage digital inclusion among nursing home residents, provided that its interface design and assistive incorporation are improved upon and training is provided.

5. Conclusion

There is a consistent increase in life expectancy and on-going demographic change towards the ageing populations, which is why developing initiatives promoting the purposeful ageing and maintenance of the older adults quality of life becomes more crucial. Digital technologies are capable of being very useful in this endeavor, provided that they are designed to be inclusive: providing the chance to stimulate their minds, socialize and have some independence. However, such tools have to be properly modified towards the realities of the ageing, which, in turn, might involve declining vision, hearing, mobility, cognition, and the confidence in the technology use.

The assessment of the siosLIFE dtm digital kiosk performed in this research showed that nursing home residents with a highly average age able to respond to and use interactive systems given that said systems are informal, entertaining and relate to the life of said residents. The assortments of choices that were provided were a success in the form of interest and stimulation to interact among themselves, such as games, music, news, and video communication. Even more physically or mentally challenged participants were enthusiastic and tended to adjust the forms of interaction with the system to suit them creatively. This supports the notion that chronological age is not the sole inhibitor of inclusion in the digital environment, instead, that the match between the technology, the capabilities, needs, and practices of the individual determine whether one can be successfully included or not.

Nevertheless, there were also evident ways of improvement to be found. There were useless obstacles brought about by the use of small icons, interface elements that are placed in low positions, and unilateral guides on interactions by gestures alone. Accessibility features may be extended to visual and audial ways in which users with sensory or cognition issues can utilize, and interaction hints where they can be more verbose. Moreover, although the NFC login card was overall quite positively accepted, tasks requiring hardware modifications or Kinect calibration used to be at times cumbersome.

Using a larger scope of things, the findings reveal the significance of the interdisciplinary process, which is the combination of gerontology, human-computer interaction, and inclusive design, to make the technologies available to older adults not only usable but also significant. Gerontechnology is the domain devoted to the explicit goal of aligning the development of technologies with existing demands of ageing societies, which offers a similar framework to consider this type of development.

The identification of the narrow scope of this study with a small and heterogeneous sample should be weighed against the insights implied by the research, which suggest practical changes to the design of siosLIFE that can increase its applicability to more people. Bigger and more varied study, involving samples with fewer impairment, should potentially aid in their clarification of whether the problems identified in this case are broad or rather particular to specific user groups.

Essentially, siosLIFE is an encouraging initiative to mitigate devolvexion among the elder seniors in nursing homes. By making specific improvements to interface design, train support, and assistive integration, it can have the power to become not only a form of entertainment/communication, but an aid to building autonomy; an aid to cognitive well-being; and a support to being nurtured in later life. Further research as well as development, and the opportunities to partner with older adults themselves, will be important to this potential.

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Conflicts of interest

The authors have no conflicts of interest to declare

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