ICT skills 4All

ICTskills4All

Empowering old adult citizens for a digital world

Intellectual Output 3

Development of materials for online platform and usability tests

Co-funded by the Erasmus+ Programme of the European Union

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Contents

Index of Figures and Tables

Introduction

One of the greatest achievements of the last century was the increase in average life expectancy (Mirkin & Weinberger, 2001). In 2015, there were 1.3 billion people aged 55 years or older, and this number is expected to be more than double by 2050, reaching 2.6 billion (representing 26% of total population). Also, the prevalence of people aged 80 or older will grow even faster when compared with old adults in general. By 2015, 125 million people were 80 years or older and that number is expected to be more than triple by 2050, reaching 434 million (approximately 4% of the world population) (United Nations, 2017).

Older adults facing an increasingly technological society, which make them feel naturally excluded, mainly due to the difficulty to handle and use the technology, the difficulty in access to this technology and the feeling of incapacity in learning new things (Sixsmith & Gutman, 2013). The absence of digital skills in the senior population is often synonymous of social isolation, segregation in access to information and services, loss of autonomy and increased sense of inability to adapt to the society (Borges, Sinclair, & AGE Universal access and Independent Living Expert Group, 2008).

Improving digital skills in old adults is one way of improving their quality of life through an active lifestyle (education, social participation, hobbies, etc) and freedom of choice and decisions (leisure time, information, travelling, health care, etc). By improving such knowledge, older adults can live healthier and in an independent way, enhancing their quality of life, which may even allow them to stay on the job market for an extended period, improving also society´s productivity (Damant, Knapp, Freddolino, & Lombard, 2017). Further education has also benefits for mental health, keeping older adults minds fresh and ready for modern era challenges, facilitating their participation in society, as independence and autonomy (World Health Organisation, no date).

Such a change in demographics brings with the important changes in the demands for products and services. As everything points out, more and more consumers and users of technology are in the category of "older adults". This demographic change forces important changes in the needs for products and services. Meeting these needs is not just the role of technology; most importantly, we can say, is the role of those who determine how technology should work. In other words, designers are the key, in many cases, not only to increase market share for a particular product, but also to increase the quality of life for the elderly. (Fisk, Rogers, Charness, Czaja, & Sharit, *Designing for Older Adults*, 2009).

In this intellectual output, an integration of the achievements of the intellectual output O1 was performed in order to create information, training tools and resource materials for the web

platform. The content was developed taking into attention accessibility for old adults, with the purpose of guaranteeing a greater autonomy to use website content, such as vision, hearing, motor control and cognition. The platform has general information, as well as simple training tools that can be accessed by the old adults in an autonomous way to improve their digital skills. The training tools focus on essentials about digital device use, including desktop computer, laptop, tablet or smartphone; basic functions of a keyboard, a mouse and a computer; essential skills to getting started online; essential skills to stay safe online; how to connect with friends and family using social networks; and how to make video calls, using Skype, WhatsApp and Facetime. These tools are innovative as they allow increasing the digital competences in a higher number of old adults across Europe without any associated costs. The platform and its content are in 4 European languages.

Framed by a user-centred design approach, the ICTSkills4All sets usability tests as an irreplaceable practice to provide input on how real users interact with the system. The inclusion of end-users throughout the R&D process is embedded on a participatory approach and tends to favour the future uptake of the solution, i.e. as usability tests result in recommendations for system's optimisation, the end point should be a platform adjusted to end-user's needs and requirements. The general goal of the usability tests for the ICTSkills4All was to identify the extent to which the interface facilitates a user's ability to complete typical tasks with efficiency, effectiveness and satisfaction. Hence, besides the user interface, the tests allowed to evaluate the information flow, and information architecture.

Three iterations were established as a minimum standard for the ICTskills4All user tests, which were implemented in a realistic but controlled environment, addressing first the core functionalities of the platform and lastly the complete solution. The first loop of user tests comprised high-level goals including the assessment of the platform's 'look and feel' appeal; of the extent to which the platform organisation makes it easy to find the information, keep track and predict where information is contained; on how well the platform prevents errors or helps the user to recover from errors; and how pleasant, satisfying, and interesting is the user interaction with the platform. The goals for the following loops relied on the findings from the first loop and implementation of system's improvements. The usability protocol was designed to capture the participant's navigational choices, task completion rates and ratings, overall satisfaction rates and ratings, think aloud protocol, video analysis and questionnaires. Therefore, objective (e.g. task completion rates) and subjective (e.g. satisfaction) measures were collected. Consenting participants were recruited by convenience according to pre-defined profiles corresponding to the project's target groups and, within those profiles, the recruitment of heterogeneous participants regarding demographics and ICT skills (by using an ICT skills questionnaire) were considered (e.g. to avoid overrepresentation of the so called 'lead users'). A screening tool tackling

demographics and, most importantly, psychographics was used to screen for eligibility in the recruitment stage. Since it is well accepted that about 15 users are able to detect 90 to 100%, with larger numbers resulting in redundant or saturation of findings and considering that the performance of smaller user tests in several iterations is the recommended practice (Nielsen, 2000), 6 to 8 users total were recruited per iteration (18 to 24 users enrolled for the 3 loops). Each individual test session lasted approximately one hour and was led by a test administrator and a data logger.

1. Characteristics of Older Adult Users and the underpinnings of Human Factors

"Getting older does not necessarily mean to limit the number of products used. However, it is true that older adults are less likely to use technology compared to younger adults as illustrated in Figure 1. Even for commonly available technologies, the older adults used fewer of them compared to younger and middle-aged adults; moreover, older women used fewer than older man did. Similar patterns were observed for breadth of computer use and Internet use (Fisk, Rogers et al, *Designing for Older Adults*, 2009)."

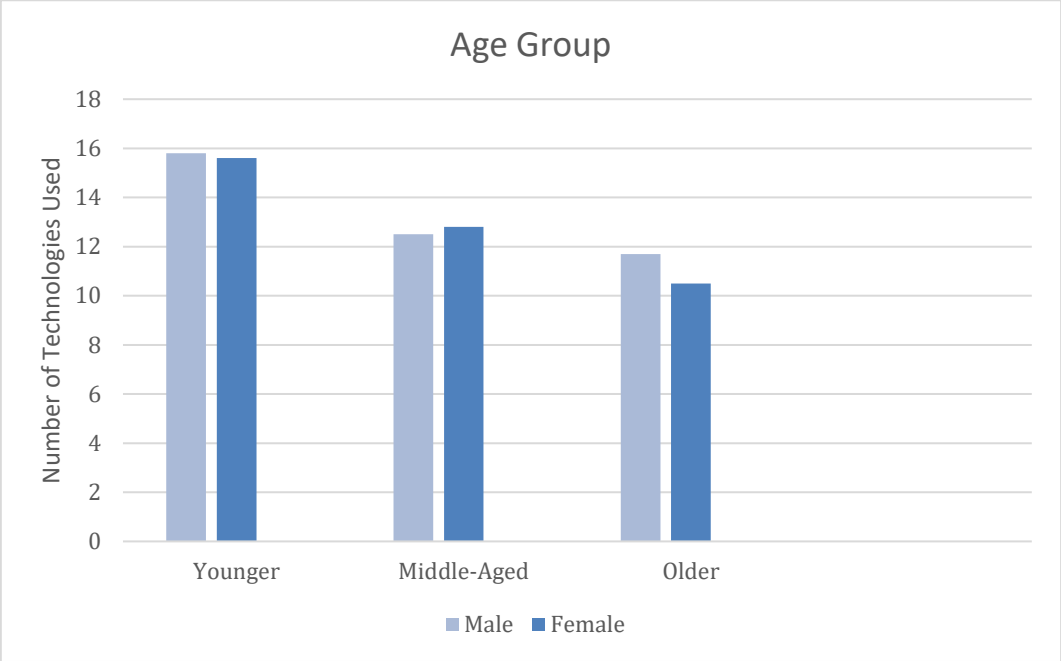

Figure 1 – Mean number (and standard deviation) of technologies used as selected from a list of 17 common items: answering machine, automatic teller machine, cellular phone, clock radio, compact disc player, copy machine, cruise control, fax machine, microwave oven, online card catalog, pay at the pump system, security system, telephone banking, videocassette recorder, video camera, video game, and voice mail. The sample consisted of 470 younger adults (aged 60-91). (Source: Czaja et al. [2006]).

More and more services are now offered online, the pandemic scenario has further accelerated this offer. We already use so many interfaces in our daily life. That is why it is increasingly necessary to design accessible interfaces that take into account the needs of the elderly with less digital literacy.

These needs are related to cognitive, perceptual, and psychomotor changes (Human Factors) that occur in the aging process, and that affect the way the elderly interact with digital devices. As a result, they often need support to carry out tasks and activities.

1.1 Human Factors

When designing for older adults there are several factors that should be taken into consideration. Their cultural references, digital literacy and the physical and cognitive degeneration – Human factors.

Human factors are the study of the characteristics of user and their interactions with products, environments and equipment when performing tasks and activities. The area of human factors develops the scientific knowledge base on the capacities and degenerations linked to the aging process of people and uses this scientific knowledge about human behavior in the development of the design and use of a human-machine (or human-environment) system. Human factors have as main goal to make the human-system interaction productive, safe, without errors, comfortable and pleasant. Human factors aim to ensure that human-system and human-environment interaction are safe, efficient and effective. (Fisk, Rogers et al, Designing for Older Adults, 2009)

1.1.1 The most relevant human factors to consider in the ICTskills4all context.

In the context of ICTskills4all website and learning tools perhaps the most pertinent human factors to take into consideration are the visual and cognition because these capabilities (impairments in the user) are directly relevant to design.

Term	Definition	Examples
Sensation	The awareness of simple properties of stimuli such as color; activation of sensation cells (e.g., retinal cells)	Seeing the color red; hearing a high-pitched sound)
Perception	The awareness of complex characteristics of things in the environment; the interpretation of information that results from sensation.	Recognizing a red object as an apple or determining that a sound is an alarm
Cognition	Processes by which the brain takes sensory information from the ears, eyes, etc. and transforms, reduces, stores, recovers, and uses that information.	Thinking, problem solving, reasoning, decision making.
Movement control	Carrying out an action based on perception or cognition; requires coordination of muscles for control of motion of some type.	Steering a car; double-clicking a mouse button; grabbing an object from a shelf.

Table 1 – Description of Categories, source Designing for Older Adults, Chapter 2, pp15

Vision - Like many other chronic diseases, there is a prevalence in the increase of visual impairments with age. With the changes that occur in the eye, the decline in vision becomes noticeable from the end of the fourth decade, sometimes earlier. Research done in this area shows a slowdown, which increases with age, in the speed of processing visual information. (Fisk, Rogers et al, Designing for Older Adults, 2009).

Cognition - In order to have a successful performance, in relation to an interaction with a product, there are several components of cognitive processing to consider. Age-related degenerative cognitive changes must be taken into account when designing for the elderly. (Fisk, Rogers et al, Designing for Older Adults, 2009).

Term	Definition
Working memory	Active memory of what has just been perceived and what is currently being thought about. It consists of new information and information that has recently been retrieved from long-term memory. Only a few bits of information can be active in working memory at any one time (think of holding three name sin memory versus ten names). Information held in working memory decays quite rapidly unless it is rehearsed to keep it there.
Semantic memory	Long-term memory for acquired knowledge; includes such concepts as vocabulary words, historical facts, cultural norms, rules of language, art and music information, and more.
Prospective memory	Remembering to perform an action in the future. Time-based prospective memory tasks are those in which the person must remember to do something at a certain time (e.g., at 2:00p.m.) or after a particular amount of time has passed (e.g., in 2 hours). Event-based prospective memory tasks are those in which something must be done in response to an event (e.g., when the buzzer goes off, turn off the oven).
Procedural memory	Procedural memory is knowledge about how to perform activities. Procedural memory varies along the dimension of automaticity, from knowledge that is executed almost without thought (e.g., shifting gears or steering a car) to explicit but well-practiced routines (e.g., following a recipe)
Attention	The process that controls awareness of events in the environment; attention determines the events to which we become conscious. Attention is limited – it operates selectively on stimuli in the environment. A person in the midst of multiple conversations can only "pay attention" to one particular conversation. Attention capture is a response to salient cues

	(e.g., if someone calls your name). Attention can be divided across sources of information or switched between tasks.
Spatial cognition	The ability to manipulate images or patterns mentally; the ability to represent information and transform it (e.g., mentally rotate an image) or to accurately represent spatial relationships among components.
Language comprehension	The ability to interpret verbal information, whether written or spoken. Includes the ability to understand sentences and paragraphs, and to draw logical inferences that are implied in a text or discourse.

Table 2 – Definition of Cognitive Constructs, source Designing for Older Adults, Chapter 2, pp19

Memory – For a successful performance, in relation to an interaction with a product, several components of cognitive processing are necessary. Degenerative age-related cognitive changes should be taken into account when designing for the elderly (Fisk, Rogers et al, Designing for Older Adults, 2009).

As referred by Fisk, Rogers et al, in Designing for Older Adults, these are some points regarding cognition, sensation and perception that decline with age:

Sensation and perception:

- Haptic changes cause an increase of the perceptual threshold for temperature and vibration and might make older adults more susceptible to falls.
- Hearing degeneration is also common, especially in older men and particularly for high frequency sounds.
- Visual acuity decreases in many older adults; the decline in vision begins to be noticed in the fourth decade.
- There are other aspects of vision where age-related declines also appear: adaptations to the dark decrease, the extension of the visual field decreases, the speed of visual processing and the perceptual flexibility decrease.

Cognition:

- Memory is a multifaceted structure; only a few features show age-related degeneration:
  - Working memory (i.e., the ability to hold and manipulate information) declines with age.

- Procedural memory is knowledge about how to do something. Well-learned procedures are maintained into old age and, in fact, are difficult to inhibit. Older adults are slower and less successful at acquiring new procedures, relative to younger adults.
- Procedural memory is knowledge about how to do something. Well-learned procedures are maintained until old age. Older adults are slower and less effective in obtaining new processes compared to youngers adults.

- Attention is a multifaceted structure; only some features show age-related degeneration:
  - Selective attention and dynamic attention (redirecting the focus of attention) show age-related degeneration.
  - Differences related to age in the proportion of the information processing grow with the complexity of the task (that is, attentional demands).
  - Older adults have a worse performance than younger adults when they need to coordinate multiple tasks, either by dividing attention or shifting attention.

Many users have problems interacting with products and systems, but those problems have more to do with the design process than with the user.
Most interfaces do not take into account the aging-related psychomotor degenerative process.

2. Methodology

The methodology User-Centered Design drives the iterative methods and tools used along the development cycle of the website. The Person, the older adult, was the core of our studies and actions, having had the central role in the plot, both, as a potential user in which the needs and expectations had to be study, as well as a key partner helping us to figure out his goals and frustrations in participatory design events.

The methodology also considered multiple factors related with both technology (access, availability, and level of difficulty of use) and users (several dimensions: age, gender, physical, mental, and cognitive skills, expectations, lifestyle, socioeconomic backgrounds).

User Research.

To trace a profile of these end users and identify their goals and pain-points, were used a generative method to generate data promoting participatory design sessions in which they talk to the team giving relevant clues about the learning topics they would like to gain or upper-level skills and dexterity. From software to devices, the information about their necessities and expectations was captured and gathered in a close and empathic approach between the older adults and team members, tackling and sharing ideas about the software and hardware that was on the table.

Beside the participatory design sessions, were fostered field observations in classes registering the difficulties, the adaptation capacity with the devices and pedagogical routine. More, the participants were interviewed and have answered to a questionnaire to better trace the profile about the current digital skills, inclusiveness, and autonomy.

Task Analysis

A Hierarchical Task Analysis systematized the main and sub tasks that should be considered to answer the goals depicted from the previous phase of user research driven where needs and expectations were identified.

Content Inventory

Task and subtasks, as long as users' needs deciphered from earlier stages, guided us to pin the type and format of the contents. From step-to-step learning texts to videos in 2D, screencast, live action and Gifs. Moreover, descriptive learning infographics and printable short guides.

The training modules were designed including key competences relevant for the entire European area, as its contents were tested and validated within the lifetime of the project.

The content was developed taking into attention accessibility for old adults, with the purpose of guaranteeing a greater autonomy to use website content, such as vision, hearing, motor control and cognition.

Prototyping and Evaluation

Several iterations were established as a minimum standard for the user tests, which were planned to be implemented in realistic but controlled environments, addressing first the core functionalities of the platform and lastly the complete solution.

Consenting participants were recruited by convenience according to predefined profiles corresponding to the target groups and, within those profiles, the recruitment of heterogeneous participants regarding demographics and ICT skills will be considered (e.g. to avoid overrepresentation of the so called 'lead users').

A screening tool tackling demographics and, most importantly, psychographics was used to screen for eligibility in the recruitment stage. Since it is well accepted that about 15 users are able to detect 90 to 100%, with larger numbers resulting in redundant or saturation of findings and considering that the performance of smaller user tests in several iterations is the recommended practice.

3. User Centered Design - UCD

3.1 User Centered Design

An User-Centered Design (UCD) was the driven methodology with a high participatory design demanding. Different and complementary methods were used to pursuing an UCD approach, not only for the study and identification of the needs and expectations of the older adults with low or none digital literacy but also, and most relevant, for their active engagement in different development stages, stimulating their contribution by using strategies and tools that fosters the empathy and, consequently, a better qualitative feedback and formative evaluation throughout the project (Giesteira, B., Silva, J. et al, *Carnival Play: eHealth Solution to Evaluate, Rehabilitate, and Monitor Dexterity and Manual Strength*, 2021)

3.2 User Research

3.2.1 Surveys

Surveys are a very usual method for collecting information. They are a very efficient tool to collect a big amount of data in a very short time, with little cost, and with a wide versatility in the type of information that can be collected. (Martin B., Hanington B., *Universal Methods of Design*, 2012).

A questionnaire completed by 84 volunteers was designed to assess digital skills and the needs of those same skills in the 55+ age group (Annex_1).
We ask the most important questions and answers for the development of the online platform and respective learning tools.

Figure 2 – Results to the questions "How would you rate your ICT skills level?"

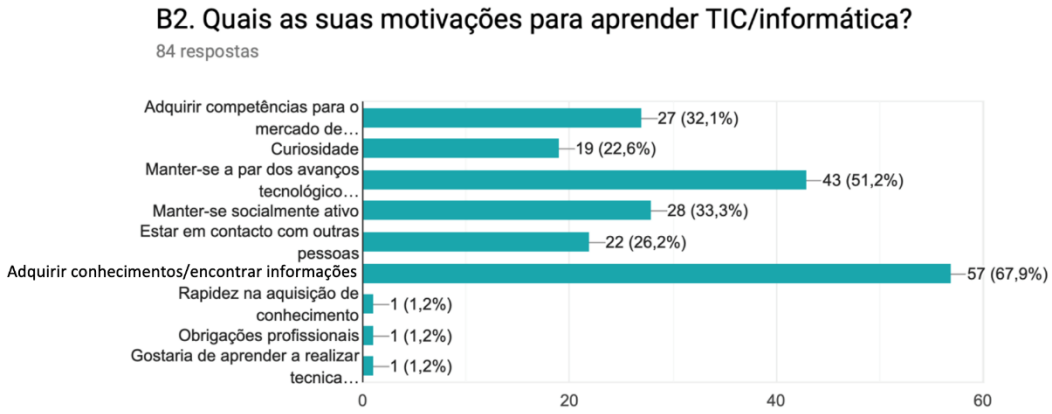

Figure 3 – Results to the question "What are your motivations for learning ICT skills?"

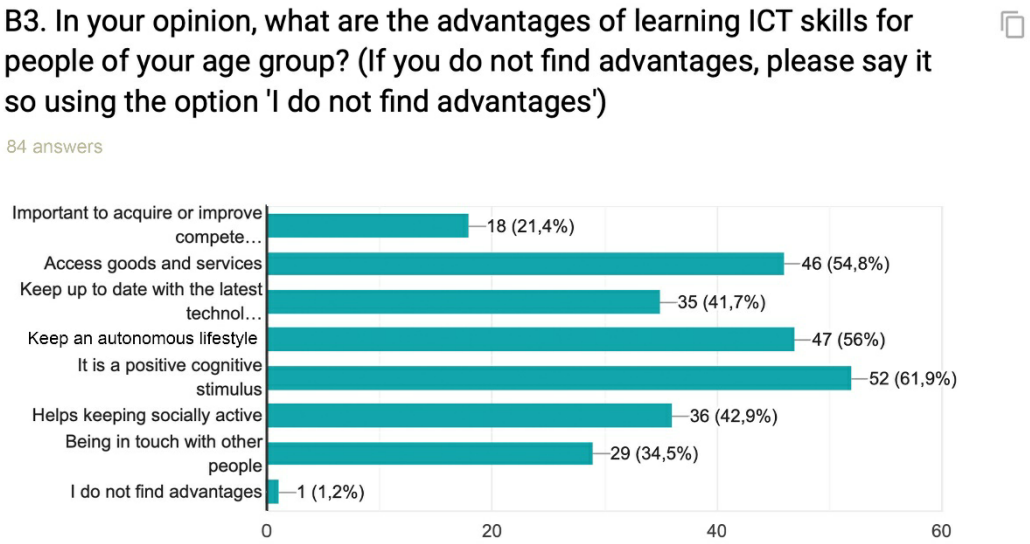

Figure 4 – Results to the question "In your opinion, what are the advantages of learning ICT skills for people of your age group? (If you do not find advantages, please say so using the opinion "I do not find advantages"."

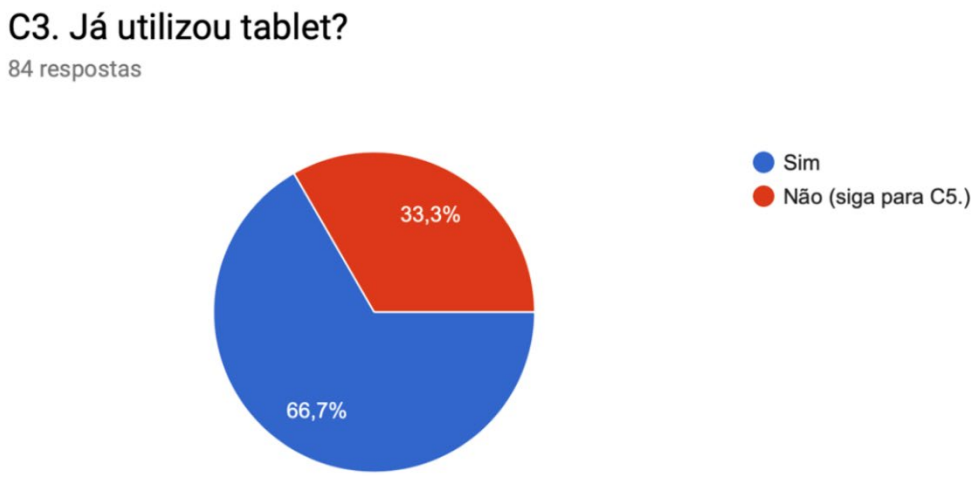

Figure 5 – Results to the question "Have you used a tablet before?"

Figure 6 – Results to the question "If you did, which tasks do you usually perform on a tablet?"

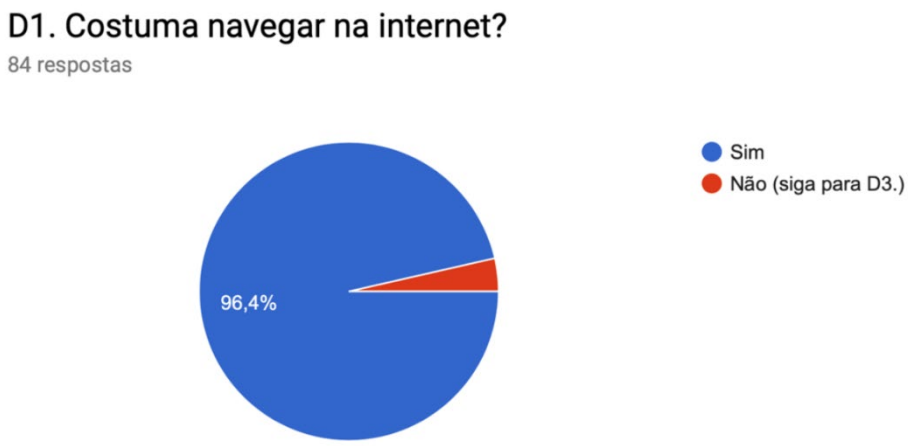

Figure 7 – Results to the question "Do you usually surf online?".

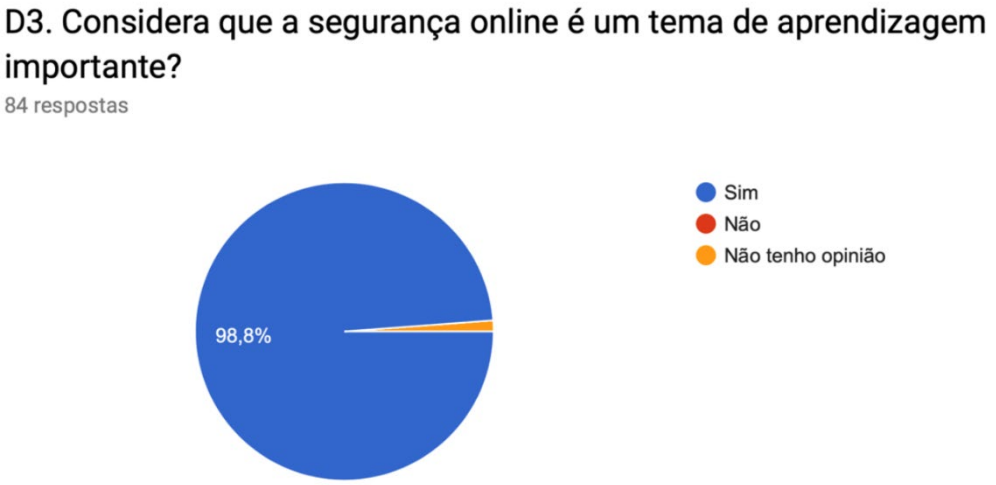

Figure 8 – Results to the question "Do you regard online safety as an important learning topic?".

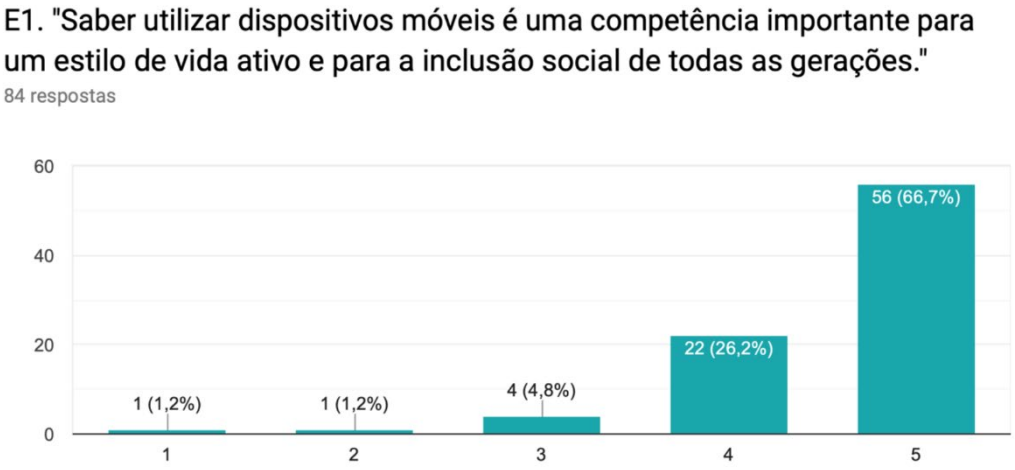

Figure 9 – Results to the question "Knowing how to use mobile devices is an important skill to have a more active lifestyle and to foster social inclusion amongst all generations?".

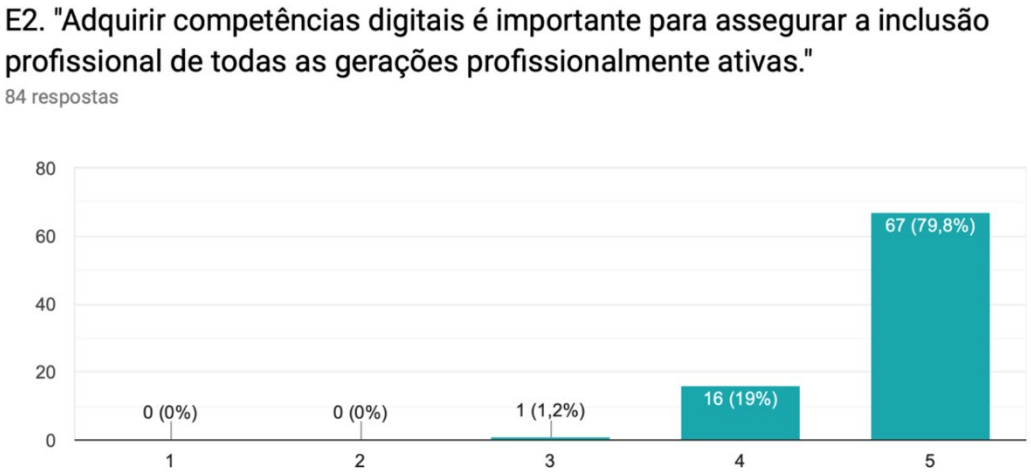

Figure 10 – Results to the question "Acquiring digital skills is important to ensure professional inclusion amongst all generations professionally active?".

Figure 11 – Results to the question "Knowing how to navigate online is an important skill for a more active lifestyle and to promote social inclusion of all generations?".

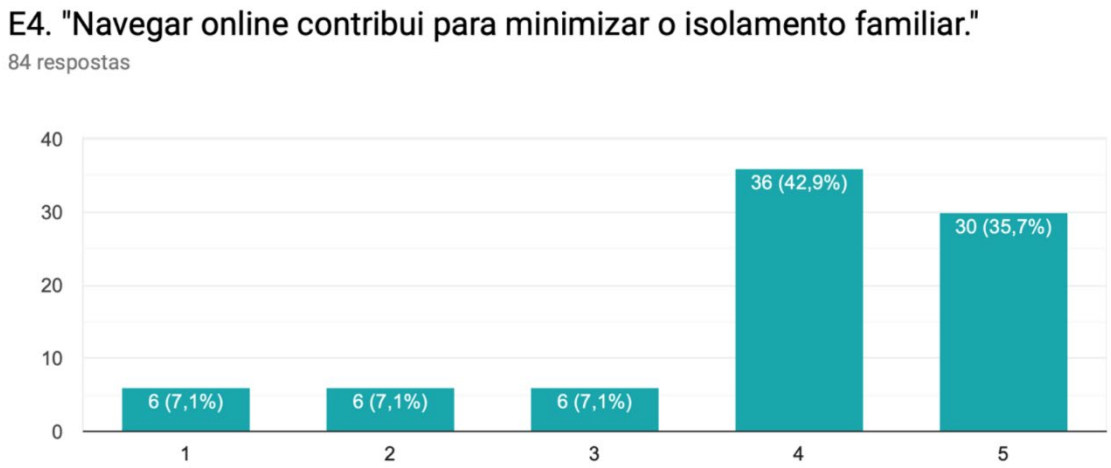

Figure 12 – Results to the question "Using the internet contributes to minimize family isolation?".

3.2.2 Field observation

Participant observation, or PO, is a fundamental anthropological method, adapted for its use in design. For the designer-researcher to know and experience events exactly in the same way the people he is studying, forming empathy and connections. Systematic observation and recording are essential, because documenting not only what is physically evident in the environment, but also the participants' behaviors, interactions, language, motivations and perceptions. For this purpose, participant observation is usually combined with several other ethnographic methods including interviews. (Martin B., Hanington B., *Universal Methods of Design*, 2012).

Three classes were attended at two Senior Universities, Porto CCD (Senior University Eugénio de Andrade), in Porto and the Senior University Florbela Espanca, in Matosinhos, with 3 different classes, in order to observe, detect strengths and pain points.

- First class at Porto CCD – Senior University Eugénio de Andrade, had 14 participants, with ages between 67 and 89 years old, all the seniors had prior contact with computers.

Pain points:

Structure / Dynamics of training	Learning contents / Software	Use of Hardware
Repetition of instructions by the trainer; Paused instructions and repetition of content already given by the trainer; Non-personalized support (class for all, clarification of doubts when requested.	Need to take notes; Need for autonomous study; Difficulty memorizing and using keyboard commands; Difficulty handling hidden menus, submenus, or menus that collapse; Loss of course / little ability to recover when lost in the menus;	On laptops, I avoid using the trackpad, mouse preference; Confusion between click and double click (preference for the second); Preference for the mouse over the keyboard - the keyboard appears to be a complex tool.

Table 3 – Pain Points

Strengths:

Structure / Dynamics of training	Learning contents / Software	Use of Hardware
Ease of learning in person and with guidance from the trainer; Sense of mutual assistance among seniors (autonomous peer-to-peer approach to assist colleagues).	Easier handling of static content or repetitive behavior / type of constant interaction; Easily turn on the computer and sign in. Check email, search google, YouTube and access google drive;	

Table 4 – Strengths

Conclusion:

There is an effectiveness in learning in person and in the see / do methodology. This learning logic cannot be replicated with video as it is interactive and alternating, whereas a video is continuous and non-interactive, forcing pauses to replicate the content learned.

Interactive class results to mimic the trainer's actions. Interactive whiteboard helps.

Similarity to teaching materials and entertainment for children: slow and repetitive explanations.

- Second class at Porto CCD – Senior University Eugénio de Andrade, had 8 participants, with ages between 65 and 75 years old, some seniors had very basic digital skills.

Pain points:

Structure / Dynamics of training	Learning contents / Software	Use of Hardware
Accompany the collective pace / conduct of the trainer.	Identify file types (ppt, doc, etc.) Difficulty finding memory and navigating the PPT menus; Log out / logout vs. to switch off; identify text selections; Identify and interact with overlapping elements; overlay creates overlap creates fear of interacting; Use / find my hidden (right button), sub-menus and sections; Edit, move or delete (the tendency is to redo (often redo without deleting what creates overlaps and conflicts of interaction); Distinguish mouse icons; Select text; Confusion between click and double click;	Use the keyboard (there seems to be a tactile need that the keyboard overrides because it is complex); Identify keys; Double-click;.

Table 5 – Pain Points

Strengths:

Structure / Dynamics of training	Learning contents / Software	Use of Hardware
Peer-to-peer to clarify individual issues; Punctual experimentation autonomously with the mouse, when they feel they are in a controlled / reversible environment or after long observation of the screen).		Alternative to double click: click + enter

Table 6 – Strengths

Conclusion:

There does not seem to be any structuring of content based on the interests of seniors.
About the methodology: faster pace than in the previous training. Faster, more memory challenge. The trainer was very quick and had some negative stimuli (pressure, showing wrong paths). The collective non-formal teaching methodology is not effective for identifying individual problems, which contributes to some feeling of "being lost" in classroom training.

- First class at Senior University Florbela Espanca, had 7 participants, with ages between 62 and 76 years old. This class has two level of students, some seniors had no digital skills and others low digital skills.

Pain points:

Structure / Dynamics of training	Learning contents / Software	Use of Hardware
	Detect apps on the smartphone; Menus and settings within apps; Pop-up menus suggest confusing interaction; Confusion of subtitles / buttons; faded colors and interaction with baseboards; Navigate through windows and pop-up menus (eg outlook settings) Difficulty navigating menus with more than one level of navigation; File sharing via Google Drive; Move files between folders; Confusion between views (icon vs. list); Preferences for email clients due to the layout stability in the software; Edit, move or delete (the tendency is to redo (often redo without deleting what creates overlaps and conflicts of interaction); Distinguish mouse icons; Select text; Confusion between click and double click;	Aim with the mouse at the desired object. Tendency to want to keep the mouse centered on the screen after interactions (reference point).

Table 7 – Pain Points

Strengths:

Structure / Dynamics of training	Learning contents / Software	Use of Hardware
Interaction and questions actively asked by participants	Consult email; Autonomous navigation between sites; Bookmark bars in the browser facilitate navigation;	Write on the smartphone;

Table 8 – Strengths

Results:

Paused explanation and schematics on the board strongly help to understand the concepts (infographics - simplification of information). All participants take notes.

Class pacing is paused and takes into account the participants' questions. Participants seem to be at ease and interested in the trainer's considerations. The trainer first explains slowly, then illustrates and guides the participants.

Involvement of participants in the discussion and encouragement of knowledge sharing.

Explanation of the advantages and disadvantages of using a particular technology - finding points of interest in learning the software. Since explanations sometimes use concepts that are unknown (eg cookies, cache, etc.)

3.2.3 Interviews

One of the primary research methods for direct contact with users, are interviews, to gather first-hand personal reports of experience, attitudes, opinions, and perceptions.

(Martin B., Hanington B., *Universal Methods of Design*, 2012).

Interview scripts (Annex_2)

Results

Software

Dificulties	Overcoming points
Difficulty in dealing with menus with more than 1 level, hidden (ex. Right button), submenus, collapsing menus or pop-up elements; Loss of direction / little ability to recover when lost in the menus; Identify file types (ppt, doc, etc.) Log out / log out vs. to switch off; Identify text selections; Object overlays create fear of interacting; Edit, move or delete. The trend is to redo. Detect apps on the smartphone; Identify elements: captions / buttons; faded colors and interaction with baseboards; File sharing via Google Drive Move files between folders Confusion between views (icon vs. list) Preferences for email clients due to the layout stability in the software;	Consult email; Autonomous navigation between sites; Bookmark bars in the browser facilitate navigation; Easier to deal with static content or repetitive behavior / type of constant interaction;

Training structure (face-to-face classes)

Positive aspects	Negative aspects
Ease of learning in person and with guidance from the trainer; Peer-to-peer to clarify individual issues; Autonomous punctual experimentation with the mouse, when they feel they are in a controlled / reversible environment or after a long observation of the screen; Paused instructions and repetition of content already given; Need to take notes on paper and organize information linearly; Visual organization of information;	Non-personalized support (class for class), clarification of doubts when requested. Difficulty in keeping up with the collective pace of training;

Table 9 – General interview results

Issues detected

Designation	Use / description	Comments
Using the mouse	Difficulty distinguishing and executing commands (click, double click, drag); Preference for the trackpad after acquiring habit; Difficulty distinguishing mouse icons; Most used tool to interact with the computer	The mouse's dependence suggests a tactile deficiency and a complex sensory organization between the different components.
Using the keyboard	Less used tool; More comfortable writing on the smartphone (perhaps due to the operation of the software and the integration of the keyboard);	The little use of the keyboard suggests that there is a fear of interacting with it, lack of dexterity or lack of memory to execute commands.

Table 10 – General interview results

3.2.4 Focus Groups

Focus groups is a qualitative method used to measure opinions, feelings, and attitudes from a group of specifically recruited participants about a product, service, marketing campaign, or a brand (Martin B., Hanington B., *Universal Methods of Design*, 2012).

Focus Groups Sessions (Annex_3)

Devices - Results

Smartphone

Positive aspects	Negative aspects
very useful for specific tasks (payments, email, weather, etc.)	difficulty adapting to the small screen and the OS
most important and outstanding device	is not efficient as a work tool
minimizes loneliness and allows contact with families.	there are a lot of people who still don't use
Video calls and messaging are effective for contacting others	

Tablet

Positive aspects	Negative aspects
easier to use than the computer; simpler; more portable; less complex to achieve an end similar to tasks performed on PC; touch screen more intuitive than mouse	difficulty in adapting to the tablet's fluidity (feeling of loss and that the contents "run away") smaller screen and keyboard size.

Computer

Positive aspects	Negative aspects
best for organizing information best as a formal work tool generosity in keyboard and screen sizes Greater stability in controls;	a lot of hardware involved expense to keep hardware up to date fear of tampering given the apparent complexity and usage (due to excess hardware difficulty working with the mouse (those who are used to using a trackpad do no need a mouse)

Table 11 – General interview results

Results

All participants recognized the value of having digital skills, to keep up to date both at work and at a personal level, thus combating social exclusion.

Face-to-face learning is identified as the most advantageous and most sought after, regardless of the degree of knowledge: it is more effective and saves time, since alone it would take longer.

Little self-education. They denote that there is a strong sense of mutual assistance (peer-to-peer) that greatly facilitates knowledge sharing and learning. The biggest difficulties encountered by older adults were the need to review / update / learn knowledge systematically.

Older adults need to be alerted to the risks of contacting other people online; often seniors are victims of scams or share sensitive information (online security).

Online education: loss of notion of the real value of goods (to be purchased).

As a rule, old adults only propose to learn / adapt if they have a real reason and a feeling that they cannot be left behind. Need daily training.
Working memory to memorize passwords and access data.

3.3 Usability Tests

"Usability testing is an evaluative method that allows teams to observe an individual's experience with a digital application as he or she walks through the steps of a given task (or set of tasks). The method is designed to help teams identify the parts of an interface that most regularly frustrate and confuse people so that they can be prioritized, fixed, and retested prior to launch (Martin B., Hanington B., *Universal Methods of Design*, 2012)"

4 usability tests were carried out throughout the product development cycle.

3.3.1 Usability Test 1

This first usability test had a sample of 8 participants, aged between 55 and 80 years. The test was carried out at the Senior University Florbela Espanca, in Matosinhos, and served to test the navigation and functionality of the ICTskills4all platform on the various devices - laptops and tablets.

Participants were given several tasks to perform (Annex_4).

3.3.2 Usability Test 2

This second usability test had a sample of 7 participants, aged between 55 and 76 years. The test was carried out at the Senior University Florbela Espanca, in Matosinhos, served to test the navigation of the ICTskills4all platform on the various devices, laptops and tablets.

The tasks given to the participants were the same given in the prior test (Annex_5).

3.3.3 Usability Test 3

The third usability test had a sample of 6 participants, aged between 55 and 80 years. The test was carried out at the Senior University Florbela Espanca, in Matosinhos, and served to test the navigation, icons, colors and functionality of the ICTskills4all platform in the desktop computer.

We used the Think-aloud Protocol, that is one of the most common evaluative methods. It asks the participants to articulate what they are thinking, doing, or feeling as they complete a set of tasks.

Think-aloud Protocol (Annex_6).

- Performance results

Summary of results

Participants #	Total Unassisted task Effectiveness [(%) complete]	Total Assisted Task Effectiveness [(%) complete]	Total errors	Total Deviations	Total Assists
P1	100%	100%	0	1	1
P2	100%	100%	0	3	2
P3	100%	100%	0	1	5
P4	100%	100%	0	1	3
P5	100%	100%	0	1	3
P6	100%	100%	0	1	1
Mean	100%	100%	0	1,33	2,50
Standard Deviation	0%	0%	0	0,82	1,52
Min	100%	100%	0	1	1
Max	100%	100%	0	3	5

Table 12 – Summary of results 3rd usability test

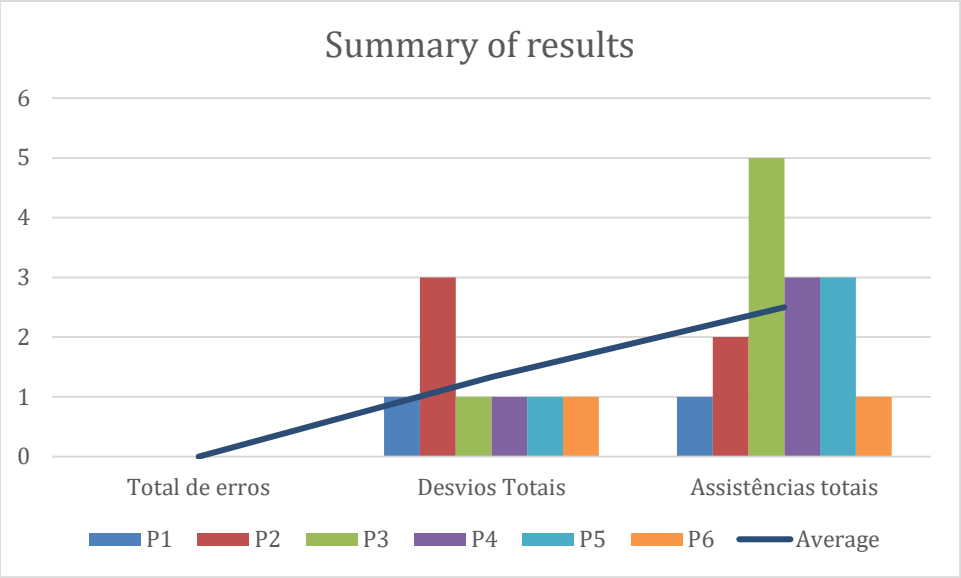

Figure 13 – Summary of results 3rd usability tests

Summary Charts

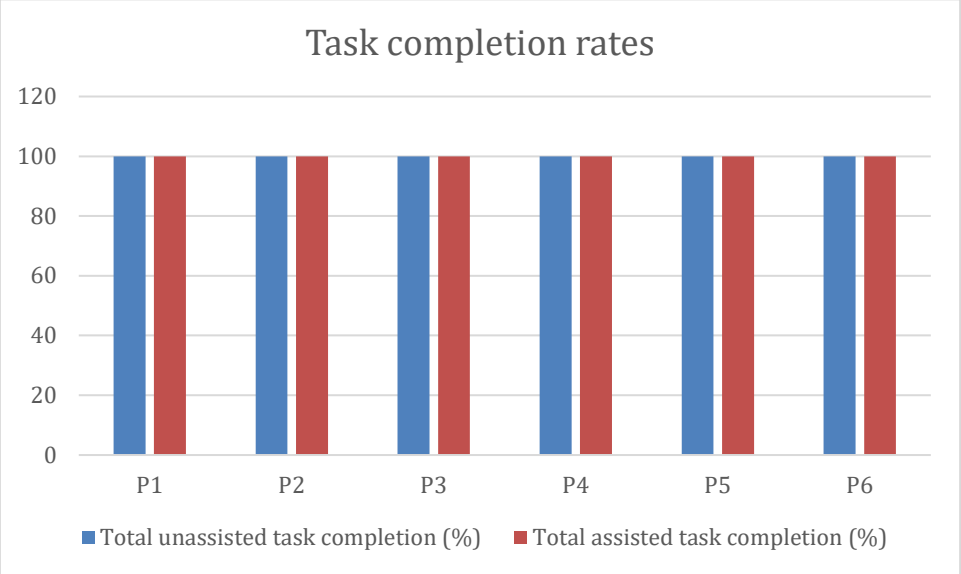

Figure 14 – Task completion rates

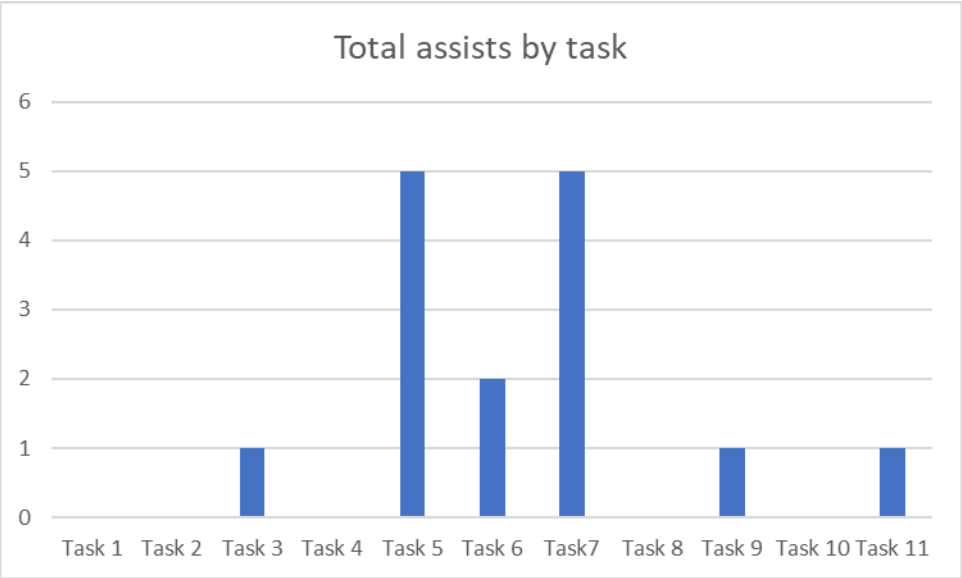

Figure 15 – Total assists by task.

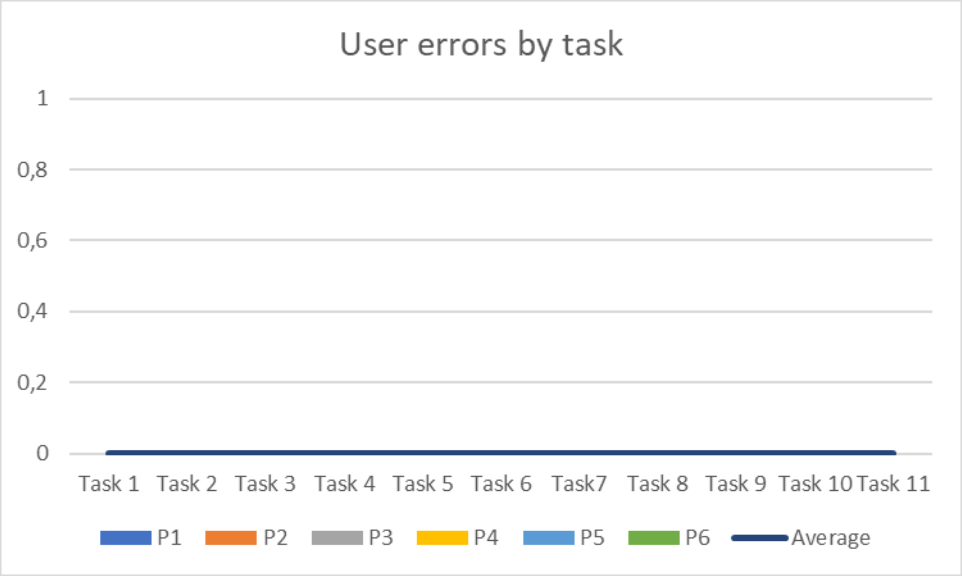

Figure 16 – User errors by task.

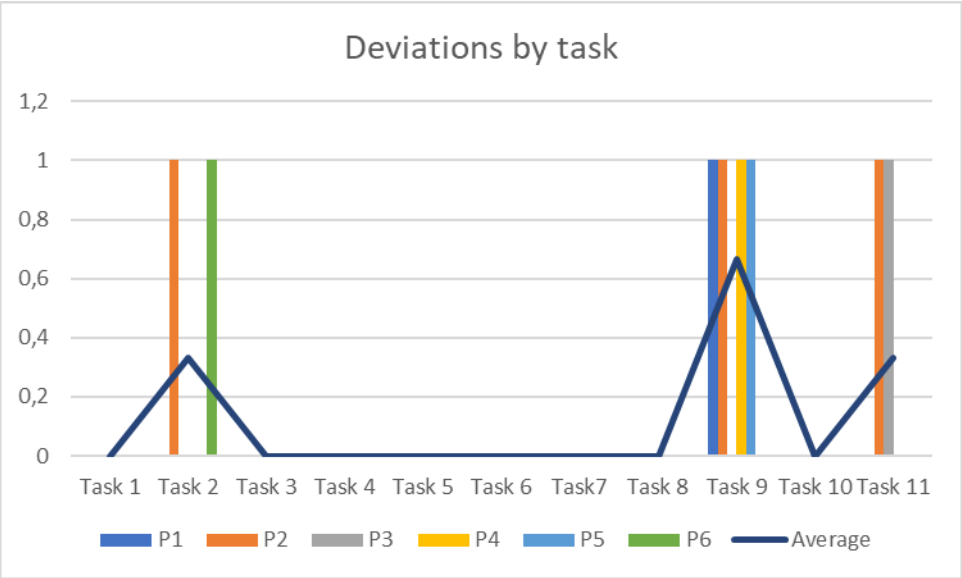

Figure 17 – Deviations by task.

These results, inform us about the effectiveness but also about efficiency, as the tasks 2, 9 and 11, are those in which the participants opted for alternative routes having therefore spent resources (+ time). As such, they are tasks whose User Interface - U.I can be further optimized to become more efficient.

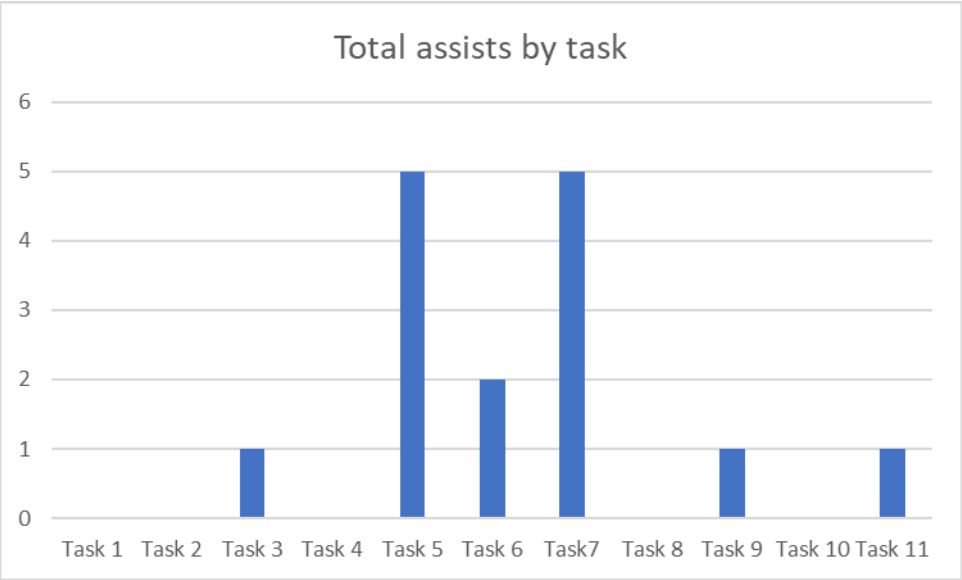

Figure 18 – Total assists by task.

It is interesting to observe that tasks 5 and 7 are notoriously the ones that motivate greater care in the U.I. This is directly related to Effectiveness as the ability and autonomy to perform a task without difficulty.

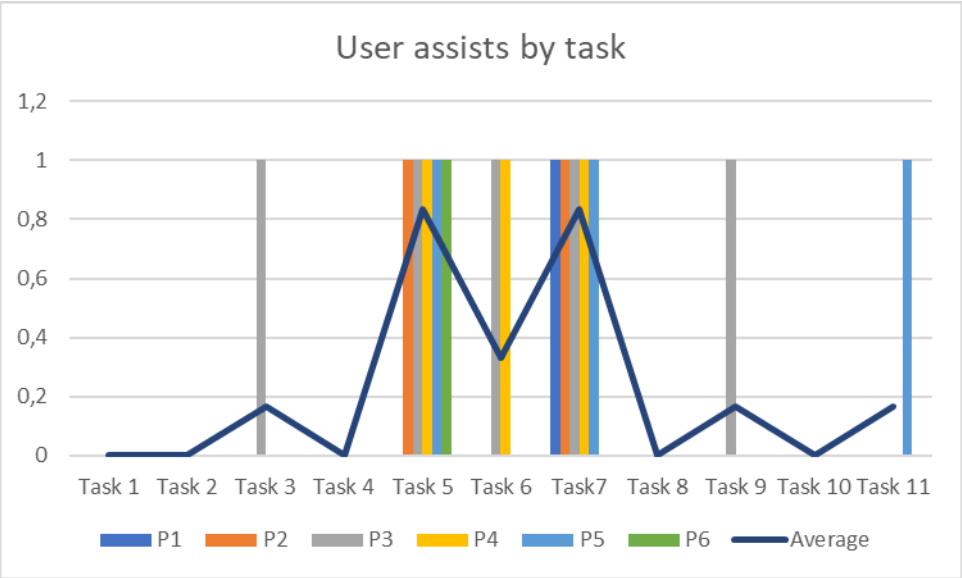

Figure 19 – User assists by task.

Satisfaction results – SUS - System Usability Scale scores and sub-scores

Participants #	SUS (out of 100)	SUS Learnability Sub-score (out of 20)
P1	93	8
P2	78	7
P3	45	4
P4	48	1
P5	70	7
P6	75	6
Mean	68,2	5,5
Standard Deviation	18,5	2,6
Min	45	1
Max	93	8

Table 13 – SUS – System Usability Scale scores and sub-scores

Satisfaction results – UEQ - User Experience Questionnaire scores and sub-scores

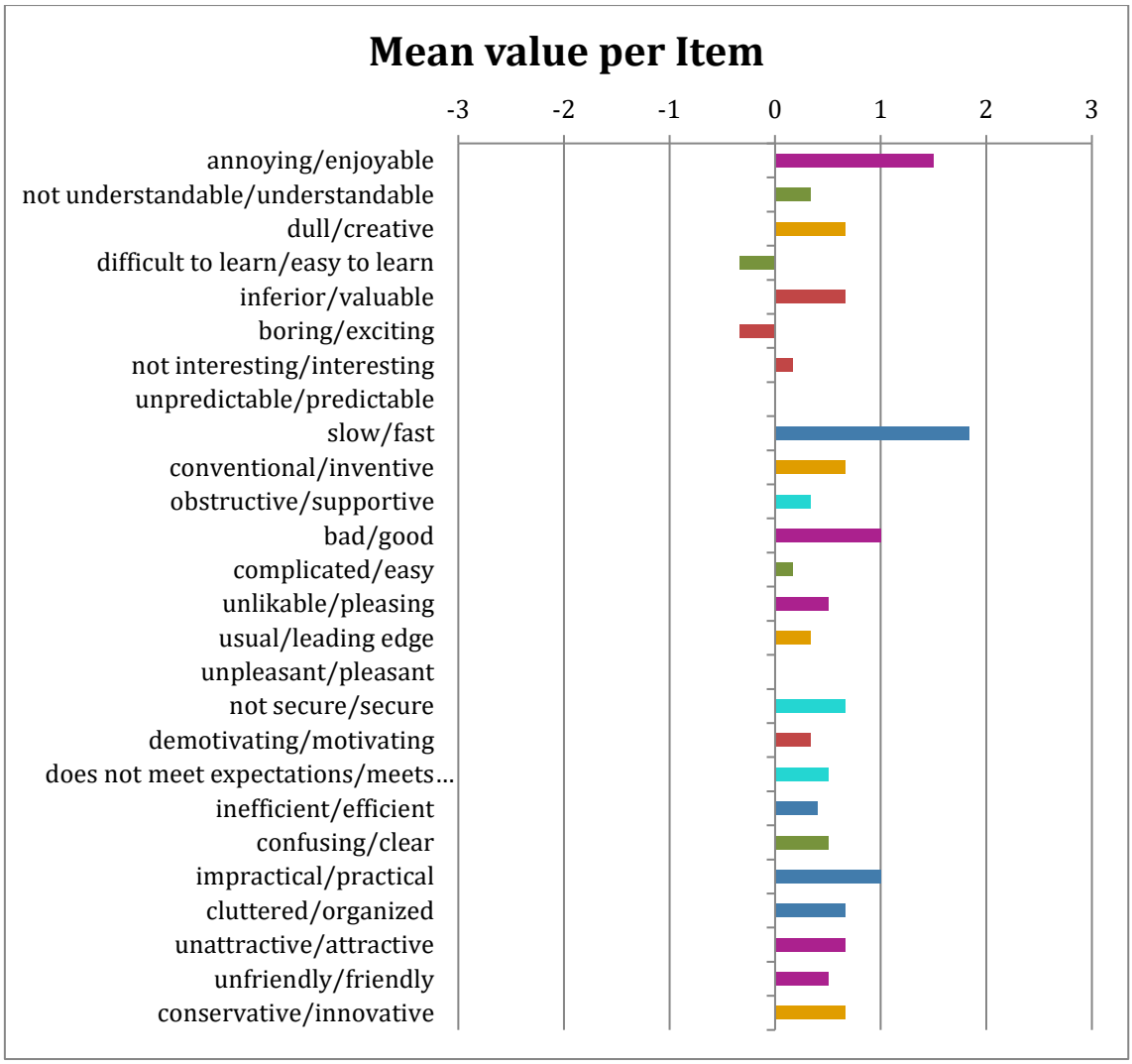

Figure 20 – UEQ – User Experience Questionnaire scores and sub-scores.

3.3.4 Usability Test 4

The fourth usability test had a sample of 6 participants, aged between 55 and 74 years. The test was carried out online, due to the pandemic, and recorded by screen share. Was tested the navigation, contents, colors and functionality of the ICTskills4all platform in the desktop computer.

The approach used in this usability test was the Think-aloud Protocol, that is one of the most common evaluative methods. Participants were asked to articulate what they are thinking, doing, or feeling as they complete a set of tasks.

Think-aloud Protocol (Annex_7).

Performance results

Participants #	Unassisted Task Effectiveness [(%) complete]	Assisted Task Effectiveness [(%) complete]	Total errors	Total Deviations	Total Assists
P1	69,23%	100%	1	2	1
P2	100%	100%	0	2	1
P3	83,33%	100%	0	0	2
P4	100%	100%	0	0	1
P5	100%	100%	0	0	1
P6	100%	100%	0	0	0
Mean	92,09%	100%	0,17	0,67	1,00
Standard Deviations	13,04%	0%	0,41	1,03	0,63
Min	69%	100%	0	0	0
Max	100%	100%	1	2	2

Table 14 – Summary of results 4th usability test

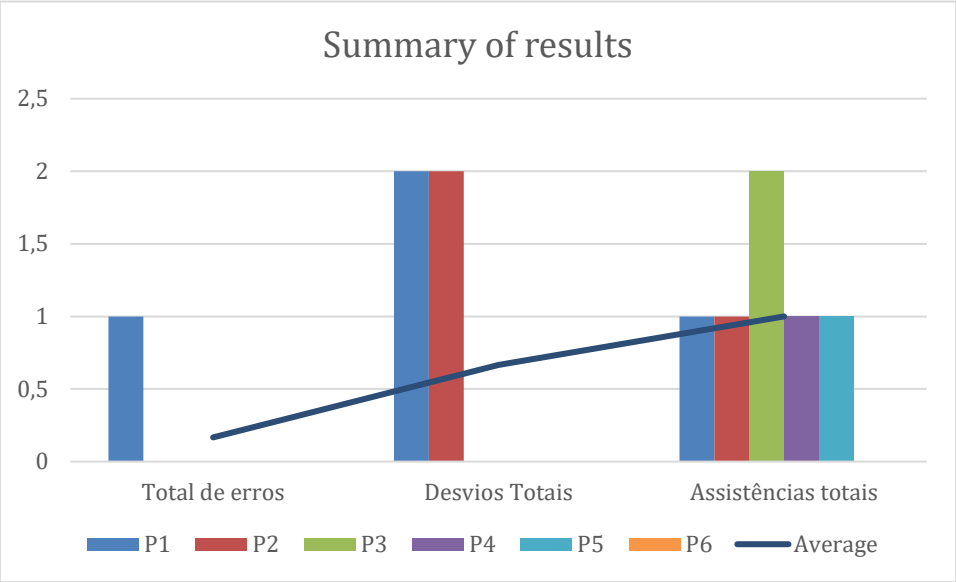

Figure 21 – Summary of results.

Summary charts

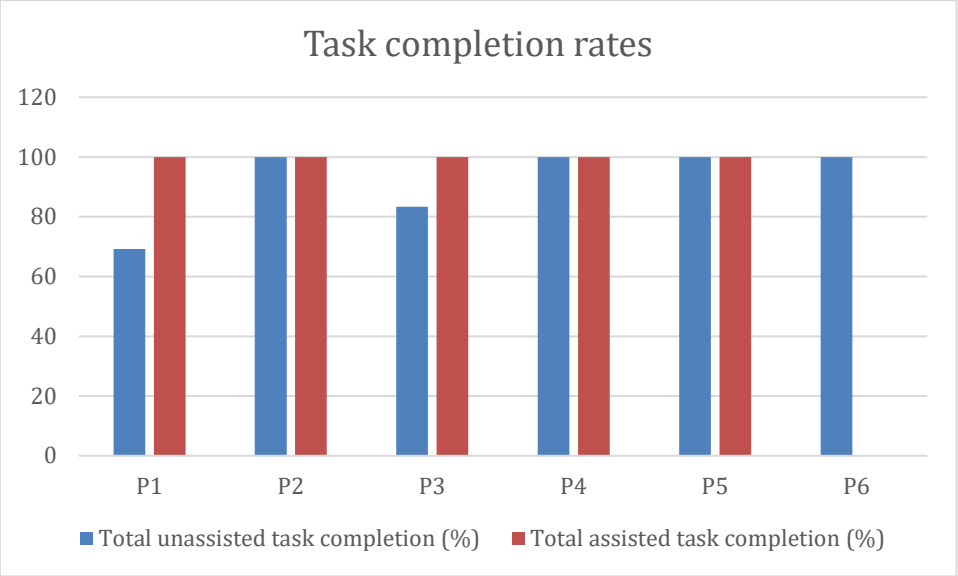

Figure 22 – Task completion rates.

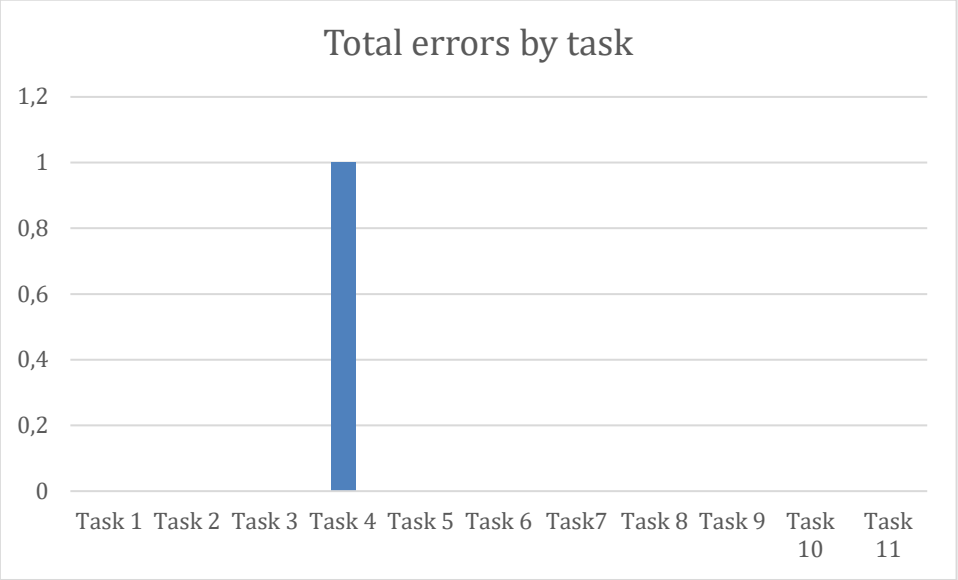

Figure 23 – Total errors by task.

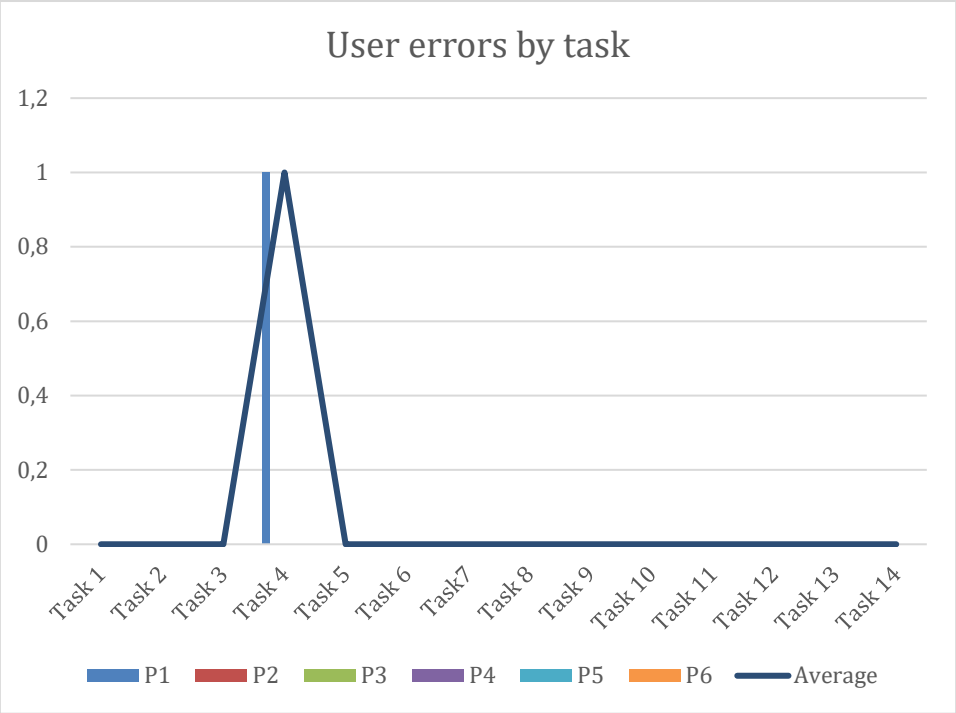

Figure 24 – User errors by task.

This chart tells us that task 4 and the respective UI features deserves to be revisited and improved in order to optimize the effectiveness in the Man-Machine dialogue.

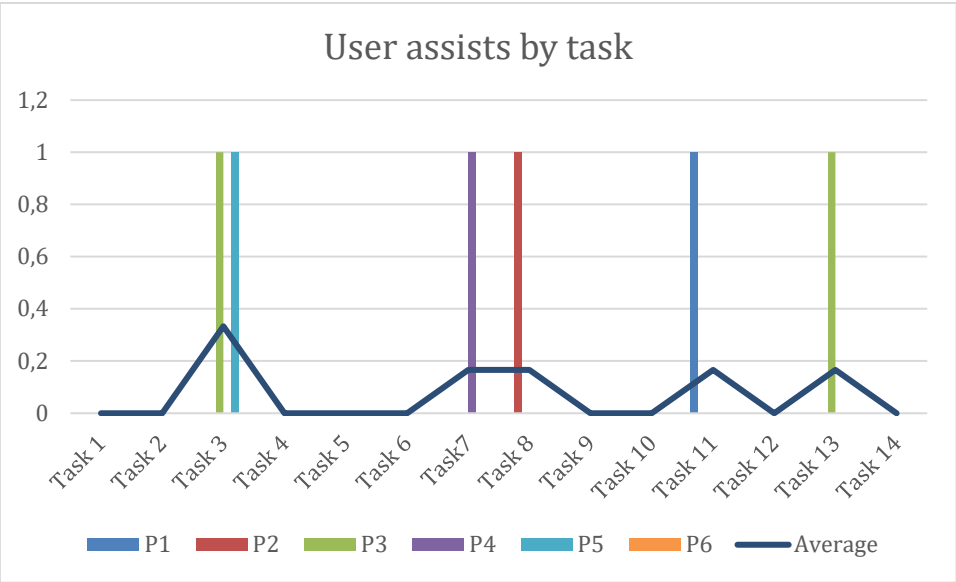

Figure 25 – User assists by task.

Once again, this chart informs us about the possibility of optimizing the effectiveness of the U.I in the 'features' that relate to tasks 3, 7, 8, 11 and 13. Assistance, tells us that it is not clear in the U.I. the execution of tasks enhancing the error (Effectiveness).

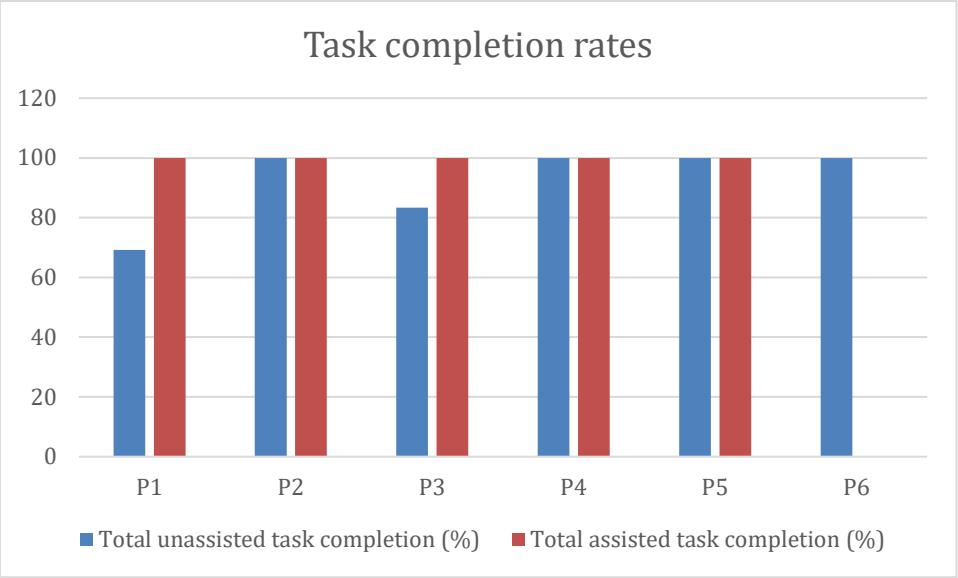

Figure 26 – Task completion rates.

Satisfaction results – SUS - System Usability Scale scores and sub-scores

Participants #	SUS (of 100)	SUS Learnability Sub-score (out of 20)
P1	80,00	12
P2	57,50	16
P3	42,50	0
P4	57,50	12
P5	55,00	8
P6	65,00	2
Mean	59,6	8,3
Standard Deviation	12,4	6,3
Min	42,5	0
Max	80	16

Table 15 – Satisfaction results - SUS – System Usability scores and sub-scores.

The results from the usability tests helped us to improve the effectiveness and efficiency of our learning website, according to the needs of the end user, in this case the older adults.

Conclusion

Global population is rapidly ageing, the pace of population ageing is much faster than in the past (World Health Organization*, Ageing and Health,* 2018), and most services are mainly offered online, especially now that humanity is facing a pandemic crisis. The most vulnerable population range are the older adults which increases the necessity to design accessible user interfaces (UI) that consider senior citizens' needs.

These needs are related to cognitive, perceptual, and psycho-motor changes that occur in the ageing process, which affect the way older people interact with digital devices.
Projecting for such a heterogeneous population, in its cultural references and digital literacy is a challenge to designers and developers. In order to achieve the goal that was aimed in this Intellectual Output (O3) of ICTskills4All project, the development of an inclusive and accessible learning platform, www.ictskills4all.eu, and learning tools, a strategy was designed taking into account a user-centered design methodology.

This methodology enshrined participatory design sessions, usability tests, thus involving all stakeholders during the development cycle of the website to ensure that the needs of older adults (several dimensions: age, gender, physical, mental, and cognitive skills, expectations, lifestyle, socioeconomic backgrounds) were met.

Some concepts are particularly relevant to safeguard the inclusiveness of an interactive artifact. This is the case of the Design framework in which details some of the most important interaction design principles as well as interaction patterns.

The development of all the intellectual outputs of this project had brought us very important outcomes that were used in the project, but that will facilitate future work not only for this consortium but also for other entities that develop or want to develop work, in the area of inclusion of older citizens through digitalisation.

The outcomes of intellectual outputs 1, 2, 4 and 5 were mainly important for the development of intellectual output 3 (O3) – Online platform and learning tools. Inherent to this Work Package is considered as a great asset the results of field observation of the older adults interacting with the electronic devices in the pilots and in the usability tests enabling a greater awareness of the needs of the target audience of the project along with the dissemination itself.

The main and collateral Intellectual Outcomes, as long as the formative experience of the university consortium's work, constitute therefore an underpinning stone to the future work in Human-Computer Interaction towards the empowerment of adult citizens.

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Annexes

Annex_1 – Survey

ICTskills4All: Digital skills in 55+ adults

ICTskills4All is an international project, funded by the European Commission under the Eramus + KA2 program and coordinated by the University of Porto. The main objective of this project is to empower and promote the acquisition of digital skills among the 55+ population. With this vision in mind, we are committed to develop educational materials for distance and online learning, as well as face-to-face teaching programs.

Understanding the opinion and profile of the eventual beneficiaries of these services is, for us, crucial, which is the reason that supports the realization of this study prior to the development of these materials. This questionnaire is anonymous and voluntary, so the data will only be used for the purposes of statistical and scientific analysis. We thank you in advance for your time and your cooperation.

Expected duration: 7 minutes

More information:
https://up.pt/ictskills4all

Follow us at Facebook:
www.facebook.com/ictskills4all

A. Personal Profile

In this section we will ask you some information (gender; age group place of residence; professional status) with the aim of performing statistical and scientific analysis:

A1. Please tell us your gender

A1.1	Female	
A1.2	Male	
A1.3	Prefer not to say	

A2. Please tell us your age group

A2.1	55-59	
A2.2	60-64	
A2.3	65-69	
A2.4	70-74	
A2.5	75-79	
A2.6	80-84	
A2.7	85+	

A3. City / area of residence (Write your answer below)

A4. What is your professional status?

A4.1	Employed	
A4.2	Retired	

User's Profile

In this section we will ask some questions in order to understand your user's profile concerning ICT (Information and Information Technologies). Please bear in mind the questions on which you can select more than one option.

B1. How would you rate your ICT skills?

B1.1	Beginner (I know how to turn on a device/computer and its basic functions and components)	
B1.2	Basic User (I know how to use simple programs, however I still need support and to learn how to solve problems)	
B1.3	Independent User (I know how to use a device and programs autonomously, even though I still need support occasionally)	
B1.4	Advanced User (I know how to use devices and software and I can solve most problems by myself)	

B2. What is your motivation to learn ICT skills?

(Please chose one or more options)

B2.1	Acquire competences for the labour market	
B2.2	Curiosity	
B2.3	Keep up to date with the latest techonological trends	

B2.4	Keep socially active	
B2.5	Keep in touch with other people	
B2.6	Acquire knowledge or gather information	
B2.7	None of the above	

B3. In your opinion, what are the advantages of learning ICT skills for people of your age group? (If you do not find advantages, please say it so using the option 'I do not find advantages')

(Please chose one or more options)

B3.1	Acquire competences for the labour market	
B3.2	Access goods and services	
B3.3	Keep up to date with the latest techonological trends	
B3.4	Maintain an autonomous lifestyle	
B3.5	It is a positive cognitive stimulus	
B3.6	Helps keeping socially active	
B3.7	Being in touch with other people	
B3.8	I do not find advantages	

B4. What do you believe are the main barriers for people of your age group to learn ICT skills?
(Please chose one or more options)

B4.1	Difficulty adapting to new technologies and their updates	
B4.2	Health issues (ex. lack of short-term memory, visual acuity, or fine motor skills)	
B4.3	Complexity of interacting with multiple components (screen, mouse, and keyboard)	
B4.4	Feeling of rejection towards an increasing technological society	
B4.5	Difficulty accessing training programs	
B4.6	Inherent costs of buying equipment or keeping devices updated	
B4.7	Other:	

B5. Do you have any task or computer program you are interested in learning or acquiring more knowledge about? If so, which program(s) or task(s)?

B6. Identify, if any, what content or programs you would like to learn or deepen your knowledge.

(Please write your answer below)

B7. What are the tools or computer programs you use more often or are more useful to you?
(Please write your answer below)

B8. Using the computer, which programs or tasks appear to be more difficult? Or which were the most challenging to learn? (Please chose one or more options)

B7.1	Starting session in the computer	
B7.2	Turning off the computer	
B7.3	Accessing and using email	
B7.4	Surf on the internet	
B7.5	Using social media	
B7.6	Microsoft PowerPoint (or similar programs)	
B7.7	Microsoft Word (or similar programs)	
B7.8	Microsoft Excel (or similar programs)	
B7.9	Finding files using Explorer (on Windows) or Finder (on Mac)	
B7.10	Using clouds or drive	
B7.11	Execute comands using the keyboard	
B7.12	Searching information online (using search engines)	
B7.13	Watch vídeos/movies	
B7.14	Watch vídeos/movies online	
B7.15	Accessing e-services (bank, finances, etc.)	
B7.16	Online shopping	
B7.17	Using Skype or other communication apps	
B7.18	Configuring the computer (Settings)	
B7.19	See/edit pictures	
B7.20	Listen to music	
B7.21	Edit videos	
B7.22	Playing games	
B7.23	Other:	

C. Mobile Devices

In this section we will be looking at your user's profile with special focus on mobile devices - mobile (smartphone) and tablet.

C1. Do you use smartphone regularly?

C1.1	Yes	
C1.2	No (please proceed to C3)	

C2. Which tasks do you usually perform on your smartphone?
(Please choose one or more options)

C2.1	Chamadas e mensagens	
C2.2	Take pictures and record video	
C2.3	Check the weather	
C2.4	Shopping	
C2.5	Be on social media	
C2.6	Make payments	
C2.7	Read the news	
C2.8	Surf online	
C2.9	Listen to music	
C2.10	Watch films or videos	
C2.11	Access e-services (bank, transports, health, etc.)	
C2.12	Use GPS and maps	
C2.13	Use communication apps (Messenger, WhatsApp, Skype, etc.)	
C2.14	Use PayPal	
C2.15	Play games	
C2.16	Using email	
C2.17	Other:	

C3. Have you used a tablet before?

C3.1	Yes	
C3.2	No (please proceed to C5)	

C4. Which tasks do you usually perform on a tablet?
(Please choose one or more options)

C4.1	Calls and messaging	
C4.2	Take pictures and record video	
C4.3	Check the weather	
C4.4	Shopping	
C4.5	Be on social media	
C4.6	Make payments	
C4.7	Read the news	
C4.8	Surf online	
C4.9	Read documents	
C4.10	Watch films or videos	
C4.11	Listen to music	
C4.12	Access e-services (bank, transports, health, etc.	
C4.13	Read e-books or e-magazines	
C4.14	Use communication apps (Messenger, WhatsApp, Skype, etc.)	
C4.15	Use MB Way or PayPal	
C4.16	Write documents	
C4.17	Play games	
C4.18	Using email	
C4.19	Other:	

C5. Do you see advantages using the tablet compared with the computer? If so, which ones? (In case you do not, select the option 'I do not identify advantages')
(Please choose one or more options)

C5.1	It is simpler because it has less components	
C5.2	The touch screen makes it easier to interact with	
C5.3	Keep up to date with the latest technological trends	
C5.4	The software is easier to understand	
C5.5	It is easier to surf online	
C5.6	I do not identify advantages	
C5.7	Other:	

D. Online Safety

This section is dedicated to online safety and how you use the internet.

D1. Do you usually surf online?

D1.1	Yes	
D1.2	No (please proceed to D3)	

D2. What do you usually do online?

_____

D3. Do you regard online safety as an important learning topic?
(Please choose one option)

D3.1	Yes	
D3.2	No	
D3.3	I do not have opinion on this matter	

E. Please rate the following statements according to the following scale: 1 - Strongly disagree; 2 - Disagree; 3 - I do not agree nor disagree/I have no opinion; 4 - Agree; 5 - Strongly agree.

(Select a number from 1 to 5)

E1. "Knowing how to use mobile devices is an important skill to have a more active lifestyle and to foster social inclusion amongst all generations."

1 **2** **3** **4** **5**

E2. "Acquiring digital skills is important to ensure professional inclusion amongst all generations professionally active."

1 **2** **3** **4** **5**

E3. "Knowing how to navigate online is an important skill for a more active lifestyle and to promote social inclusion of all generations."

1 **2** **3** **4** **5**

E4. "Using the internet contributes to minimizing family isolation."

1 **2** **3** **4** **5**

Annex_2 – Interview Scripts

Individual interviews with end users

- What are your motivations for learning ICT and using a computer?
- How do you think it is useful for people of your generation?

- What are the main difficulties for people of your age group in using the computer?
- And use programs, browse the internet, check e-mail, etc.?
- How do you feel most limited?
- And what challenges do you consider overcome? Or which tools do you know best, and which are useful to you?

- Already a smartphone user? And tablets?
- Do you think they are important devices today?
- Do you consider that tablets, because they are touch sensitive and have fewer components, are easier to use than computers?

- Starting from a level of knowledge 0, what is the best strategy, in your opinion, to start learning ICT?

- Can you imagine learning ICT on your own?

- In the event that you can learn ICT on your own, how would you like to feel supported? How would you like to ask for support and how would you like to be contacted?
- If you started from 0 and had a choice, would you choose a tablet or a computer?

Annex_3 – Focus Group sessions

Sessions Script

Moment 1 - Group dynamics - Presentation (15 min)

Adaptation without balloons: Paper with written name. We shuffled the papers and asked the person that name a question. we repeat 3 times and then introduce ourselves based on this information.

Moment 2 – Focus Group (30/40 min)

(Present the activity: explain that it is not a process to evaluate them, that we are trying to understand this audience and design optimized materials for them).

Questions to explore:

- What are your motivations for learning ICT and using a computer?
- How do you think it is useful for people of your generation?

- What are the main difficulties for people of your age group in using the computer?
- How do you feel most limited?
- And what challenges do you consider overcome? Or which tools do you know best, and which are useful to you?

- Already a smartphone user? And tablets?
- Do you think they are important devices today?
- Do you consider that tablets, because they are touch sensitive and have fewer components, are easier to use than computers?

- Starting from a level of knowledge 0, what is the best strategy, in your opinion, to start learning ICT?
- Can you imagine learning ICT on your own?
- In the event that you can learn ICT on your own, how would you like to feel supported? How would you like to ask for support and how would you like to be contacted?
- If you started from 0 and had a choice, would you choose a tablet or a computer?

(Coffee break – 10 min)

Moment 3 – Creative Process - Brainstorming (30 min)

(Present activity: creative process, let's do a brainstorming session)

Questions to explore:

- Which digital tools do you think are most important today?

- What are you most interested in learning?
- What would you like to learn that you have not yet learned?
- What do you think is most important to learn today, given the current social and technological outlook?
- And to be in the job market?
- Explore mobile and tablet usage.

Annex_4 – 1st Usability Test Tasks

Task 1

Find the instructional video to learn how to navigate on the website.

Task 2

Go to the Learning Themes section and enter the "Online Safety" theme.

2.1 Once inside the theme, look for content 2 - "How to detect a malicious website";

2.2 Then go to content 3 - "Online privacy";

2.3 Go to the next content, number 4.

Task 3

Go to the Learning Themes again and go to the "Mobile devices" theme.

Task 4

Go to the Help section, go to the frequently asked questions.

Select the first question.

Annex_5 – 2nd Usability Test Tasks

Task 1

Find the instructional video to learn how to use the website, according to the device you are on.

Task 2

Access the Learning Theme “Online Safety”.

Once inside the theme, look for content 5 - " How to download content or download it safely?";

Task 3

Skip to content 4 "Online Privacy".

Task 4

Go to the Help section. Look for the Frequently Asked Questions. Open the first question.

Annex_6 – 3rd Usability Test

Think Aloud Protocol

1.1 Participant general instructions

Participants should receive the following information regarding the project:

ICTskills4All is an international project, funded by the European Union under the Erasmus+ KA2 program, coordinated by the University of Porto and developed under the scope of the Competence Centre for Active and Healthy Ageing at the University of Porto – Porto4Ageing which aims to develop projects in the active and healthy aging area.

The ICTskills4All.eu website aims to develop digital skills through courses an educational content, developed specifically for the population over 55 whose skills in this field are reduced. ICTskills4All.eu represents a contribution to improve the quality of life and autonomy of senior citizens, aiming at a positive impact on the adult and senior education sector in digital environments and following the current trend in the educational sector and information society.

This test is confined to the desktop computer context, to test the usability of the website.

Regarding the prototypes:

You can then use the computer to browse the website and discover the information it contains. Do you have any question regarding the procedure?

Screener test:

I would like to start by asking you some questions:

- *How old are you?*
- *What is your schooling?*
- *What is your profession?* (If retired, ask what was the previous job)
- *Do you use a computer? Do you use a smartphone? If not, you have already used a smartphone or other touch device?*

Regarding the test:

First of all, I would like to ask for your permission to film the test under the compromise that these images are for research purposes only and will not be shown to anyone other than the researchers working on the results of this test. I would also like to ask you to read and please sign this informed consent form.

Our goal now is to evaluate the usability of this website and for that we will ask you to perform some tasks using the website in the computer. I will explain the task, you can ask me anything you

do not understand about it and then you can try to accomplish the task. Try to do it as if I was not here but if you feel that you are stuck you can ask me for assistance. You can also voice your opinions regarding any aspect of the prototypes. Remember that we are the website and not the user, and that there is no right or wrong way to perform a task. Also, we are looking for both good or bad feedbacks so do not refrain from expressing a bad opinion or point out any errors that you may encounter. They are expected and we appreciate if you let us know.

Regarding the website structure:

This website is translated into four languages and allows the user with few digital skills to learn how to use a desktop computer, laptop, tablet and smartphone to write, surf the internet, shop, contact social networks.

All the contents are fictional…

Any questions?

1.2 Participants task instructions

Participants were asked to try and complete the following tasks:

1. Change the language to English.
   Ideal Flow: [Click Portuguese button -> Click English button]
2. From the previous screen, return to the homepage.
   Ideal Flow [Click Back button]
3. On the Homepage, increase the font size to medium.
   Ideal Flow [Click accessibility menu - > (second letter)]
4. Increase the font size to large.
   [Click accessibility menu - > (third letter)]
5. Choose a vídeo on Online Safety.
   Ideal Flow: [Click the Learning Theme button -> Click Online Safety button / or icon / or View contents - > Click watch video]
6. From the previous screen, choose a video on Browse Online.
   Ideal Flow: [Click the Learning Themes button -> Click the Browse Online button / or icon / or View contents - > Click watch video]
7. Do a search on courses.
   Ideal Flow [Click the magnifying glass icon -> Write courses]
8. Open the Facebook connection.
   Ideal Flow: [Click one of the Facebook icons]
9. Access to Help and Contacts through the Site Map.
   Ideal Flow: [Click Site Map button -> Click Help and Contacts button]

10. Fill out and submit Help form.
    Ideal Flow: [Click Help and Contacts -> Click icon / or Send Email -> Click Send button]
11. From the previous screen access the Frequently Asked Questions.
    Ideal Flow: [Click back button to Help and Contacts - > Click icon / or frequently Asked Questions]

After the test and questionnaires:

Do you have any questions or comments? Thank you very much for your participation in this test, your opinion is very valuable to us.

References

National Institute of Standards and Technology, *NISTIR 7432 – Common Industry Specification for Usability – Requirements*, 2007

Annex_7 – 4th Usability Test

Think Aloud Protocol

1.1 Participant general instructions

Participants should receive the following information regarding the project:

ICTskills4All is an international project, funded by the European Union under the Erasmus+ KA2 program, coordinated by the University of Porto and developed under the scope of the Competence Centre for Active and Healthy Ageing at the University of Porto – Porto4Ageing which aims to develop projects in the active and healthy aging area.

The ICTskills4All.eu website aims to develop digital skills through courses an educational content, developed specifically for the population over 55 whose skills in this field are reduced. ICTskills4All.eu represents a contribution to improve the quality of life and autonomy of senior citizens, aiming at a positive impact on the adult and senior education sector in digital environments and following the current trend in the educational sector and information society.

This test is confined to the desktop computer context, to test the usability of the website.

Regarding the prototypes:

You can then use the computer to browse the website and discover the information it contains. Do you have any question regarding the procedure?

Screener test:

I would like to start by asking you some questions:

- *How old are you?*
- *What is your schooling?*
- *What is your profession?* (If retired, ask what was the previous job)
- *Do you use a computer? Do you use a smartphone? If not, you have already used a smartphone or other touch device?*

Regarding the test:

First of all, I would like to ask for your permission to film the test under the compromise that these images are for research purposes only and will not be shown to anyone other than the researchers working on the results of this test. I would also like to ask you to read and please sign this informed consent form.

Our goal now is to evaluate the usability of this website and for that we will ask you to perform some tasks using the website in the computer. I will explain the task, you can ask me anything you

do not understand about it and then you can try to accomplish the task. Try to do it as if I was not here but if you feel that you are stuck you can ask me for assistance. You can also voice your opinions regarding any aspect of the prototypes. Remember that we are the website and not the user, and that there is no right or wrong way to perform a task. Also, we are looking for both good or bad feedbacks so do not refrain from expressing a bad opinion or point out any errors that you may encounter. They are expected and we appreciate if you let us know.

Regarding the website structure:

This website is translated into four languages and allows the user with few digital skills to learn how to use a desktop computer, laptop, tablet and smartphone to write, surf the internet, shop, contact social networks.

You will find various types of contents: text, images, illustrations and video.

Any questions?

1.2 Participants task instructions

Participants were asked to try and complete the following tasks:

1. Change the language to English.
   Ideal Flow: [Click Portuguese button -> Click English button]
2. From the previous screen, return to the homepage.
   Ideal Flow [Click Back button]
3. On the Homepage, increase the font size to large.
   Ideal Flow [Click accessibility menu - > (third letter)]
4. Access the menu How to navigate the website and start the introduction video.
   [Click How to navigate the website menu - > click the Play button on the video]
5. In the same video, enlarge the screen.
   Ideal Flow: [Click the Full screen video]
6. In the same video, download the video to the computer.
   Ideal Flow: [Click the download button]
7. Access a learning content about the Monitor.
   Ideal Flow [Click on Learning Topics -> Click ob Basic/ or icon/ or View Contents - > Click on What is a computer?/ or icon/ or View Contents - > Click on Monitor/or icon / or View Contents]
8. Access content How to create an email account.
   Ideal Flow: [Click on Learning Topics in the main menu/ or in the upper path - > Click on Use email/ or icon/ or View Contents -> Click Create an email account/ or icon/ or View Contents -> Click Play button]

9. Access printable support material How to use the mouse.
   Ideal Flow: [Click on Learning Topics in the main menu -> Click on Support material for printing/ or icon/ or View Contents -> Click How to use the mouse/ or View Contents]
10. Doing a search on ergonomics.
    Ideal Flow: [Click the magnifying glass icon -> Type ergonomics]
11. Open the Facebook connection.
    Ideal Flow: [Click the Facebook icon]
12. Access to Help and Contacts through the Site Map.
    Ideal Flow: [Click Site Map button -> Click Help and Contacts button]
13. Fill out and submit Help form.
    Ideal Flow: [Click Help and Contacts -> Click icon / or Send Email -> Click Send button]
14. From the previous screen access the Frequently Asked Questions.
    Ideal Flow: [Click back button to Help and Contacts - > Click icon / or frequently Asked Questions]

<u>After the test and questionnaires:</u>

Do you have any questions or comments? Thank you very much for your participation in this test, your opinion is very valuable to us.

References

National Institute of Standards and Technology, *NISTIR 7432 – Common Industry Specification for Usability – Requirements*, 2007

Annex_8 – UEQ – User Experience Questionnaire

Please make your evaluation now.

For the assessment of the product, please fill out the following questionnaire. The questionnaire consists of pairs of contrasting attributes that may apply to the product. The circles between the attributes represent gradations between the opposites. You can express your agreement with the attributes by ticking the circle that most closely reflects your impression.

Example:

attractive	○	⊗	○	○	○	○	○	unattractive

Please assess the product now by ticking one circle per line.

	1	2	3	4	5	6	7		
annoying	○	○	○	○	○	○	○	enjoyable	1
not understandable	○	○	○	○	○	○	○	understandable	2
creative	○	○	○	○	○	○	○	dull	3
easy to learn	○	○	○	○	○	○	○	difficult to learn	4
valuable	○	○	○	○	○	○	○	inferior	5
boring	○	○	○	○	○	○	○	exciting	6
not interesting	○	○	○	○	○	○	○	interesting	7
unpredictable	○	○	○	○	○	○	○	predictable	8
fast	○	○	○	○	○	○	○	slow	9
inventive	○	○	○	○	○	○	○	conventional	10
obstructive	○	○	○	○	○	○	○	supportive	11
good	○	○	○	○	○	○	○	bad	12
complicated	○	○	○	○	○	○	○	easy	13
unlikable	○	○	○	○	○	○	○	pleasing	14
usual	○	○	○	○	○	○	○	leading edge	15
unpleasant	○	○	○	○	○	○	○	pleasant	16
secure	○	○	○	○	○	○	○	not secure	17

motivating	○	○	○	○	○	○	○	demotivating	18
meets expectations	○	○	○	○	○	○	○	does not meet expectations	19
inefficient	○	○	○	○	○	○	○	efficient	20
clear	○	○	○	○	○	○	○	confusing	21
impractical	○	○	○	○	○	○	○	practical	22
organized	○	○	○	○	○	○	○	cluttered	23
attractive	○	○	○	○	○	○	○	unattractive	24
friendly	○	○	○	○	○	○	○	unfriendly	25
conservative	○	○	○	○	○	○	○	innovative	26

SUS – System Usability Scale Questionnaire

TABLE OF CONTENTS

1. SUS – System Usability Scale

The System Usability Scale (SUS) is a Likert scale type questionnaire that was developed in the UK in 1986 by John Brooke at Digital Equipment Corporation. It is one of the most used questionnaires to assess the perception of usability. In a comparative study about usability questionnaires, SUS "yielded among the most reliable results across sample sizes" [3, p. 7].
SUS has become an industry standard with references in over 600 publications [2].
SUS is also freely available, being the only condition to use it the acknowledgement of its source in any published report.
With small sample sizes, like with 6 participants, SUS (like other questionnaires) is not particularly accurate. 12 participants or more is the recommended sample size for correct results [3, p. 6].

2. SUS Questionnaire

Using the rating sheet below, please circle the number nearest the term that most closely matches your feelings about the product/web site.

1. I think that I would like to use this system frequently.

Strongly disagree	1	2	3	4	5	Strongly agree

2. I found the system unnecessarily complex.

Strongly disagree	1	2	3	4	5	Strongly agree

3. I thought the system was easy to use.

Strongly disagree	1	2	3	4	5	Strongly agree

4. I think that I would need the support of a technical person to be able to use this system.

Strongly disagree	1	2	3	4	5	Strongly agree

5. I found the various functions in the system were well integrated.

Strongly disagree	1	2	3	4	5	Strongly agree

6. I thought there was too much inconsistency in this system.

Strongly disagree	1	2	3	4	5	Strongly agree

7. I would imagine that most people would learn to use this system very quickly.

Strongly disagree	1	2	3	4	5	Strongly agree

8. I found the system very awkward to use.

Strongly disagree	1	2	3	4	5	Strongly agree

9. I felt very confident using the system.

Strongly disagree	1	2	3	4	5	Strongly agree

10. I needed to learn a lot of things before I could get going with this system.

Strongly disagree	1	2	3	4	5	Strongly agree

Portuguese translation

Usando a escala abaixo, por favor coloque um círculo no número mais próximo da palavra que mais se aproxima aos seus sentimentos acerca do produto/website.

1. Penso que gostaria de usar este sistema frequentemente.

Discordo fortemente	1	2	3	4	5	Concordo fortemente

2. Achei o sistema desnecessariamente complexo.

Discordo fortemente	1	2	3	4	5	Concordo fortemente

3. Achei o sistema fácil de usar.

Discordo fortemente	1	2	3	4	5	Concordo fortemente

4. Penso que precisaria do apoio técnico para conseguir usar o sistema.

Discordo fortemente	1	2	3	4	5	Concordo fortemente

5. Achei que as várias funções do sistema estavam bem integradas.

Discordo fortemente	1	2	3	4	5	Concordo fortemente

6. Achei que havia demasiadas inconsistências neste sistema.

Discordo fortemente	1	2	3	4	5	Concordo fortemente

7. Imagino que a maioria das pessoas consegue aprender a usar este sistema muito rapidamente.

Discordo fortemente	1	2	3	4	5	Concordo fortemente

8. Achei o sistema muito incómodo de usar.

Discordo fortemente	1	2	3	4	5	Concordo fortemente

9. Senti-me muito confiante ao usar o sistema.

Discordo fortemente	1	2	3	4	5	Concordo fortemente

10. Precisei de aprender muitas coisas antes de conseguir começar a usar o sistema.

Discordo fortemente	1	2	3	4	5	Concordo fortemente

3. Calculating the score

SUS scores range from 0 to 100. Each item's score contribution ranges from 0 to 4. For odd items (1, 3, 5, 7 and 9), the contribution is the scale position minus 1. For even items (2, 4, 6, 8 and 10), the contribution is 5 minus the scale position. The SUS score is obtained by multiplying the sum of the scores of all items by 2,5.

SUS was only intended to measure a single dimension. However, there's research [2] showing that it can also assess the system's learnability, provided by items 4 and 10, and usability, provided by the remaining items. As such, in this example we'll also score those sub-scales.

Example

1. I think that I would like to use this system frequently.

Strongly disagree	1	2	3	4	5	Strongly agree

2. I found the system unnecessarily complex.

Strongly disagree	1	2	3	4	5	Strongly agree

3. I thought the system was easy to use.

Strongly disagree	1	2	3	4	5	Strongly agree

4. I think that I would need the support of a technical person to be able to use this system.

Strongly disagree	1	2	3	4	5	Strongly agree

5. I found the various functions in the system were well integrated.

Strongly disagree	1	2	3	4	5	Strongly agree

6. I thought there was too much inconsistency in this system.

Strongly disagree	1	2	3	4	5	Strongly agree

7. I would imagine that most people would learn to use this system very quickly.

Strongly disagree	1	2	3	4	5	Strongly agree

8. I found the system very awkward to use.

Strongly disagree					Strongly agree
	1	2	3	4	5	

9. I felt very confident using the system.

Strongly disagree					Strongly agree
	1	2	3	4	5	

10. I needed to learn a lot of things before I could get going with this system.

Strongly disagree					Strongly agree
	1	2	3	4	5	

Score from example

1. 3 points (4-1 (scale position -1))
2. 3 points (5-2 (5-scale position))
3. 3 points (4-1 (scale position -1))
4. 4 points (5-1 (5-scale position))
5. 3 points (4-1 (scale position -1))
6. 3 points (5-2 (5-scale position))
7. 3 points (4-1 (scale position -1))
8. 4 points (5-1 (5-scale position))
9. 3 points (4-1 (scale position -1))
10. 3 points (5-2 (5-scale position))

Total score = 32

SUS Global Score = 32 * 2,5 = 80

Learnability Sub score = 7 * 2,5 = 17,5

Usability Sub score = 25 * 2,5 = 62,5

Notes

We changed the wording of item 8, replacing the word “cumbersome” with “awkward”, as it can cause confusion to some non-native English speakers [4, p. 9].

You should change the wording (“system”/ “product”/ ”website”), depending on which seems more appropriate for the test, but keep consistency and use the same term on all items for any given test or across a related series of tests [idem].

4. References

[1] Brooke J. *SUS – A quick and dirty usability scale*. 1986

[2] Measuring Usability with the System Usability Scale (SUS), in http://www.measuringusability.com/sus.php

[3] http://home.comcast.net/~tomtullis/publications/UPA2004TullisStetson.pdf

[4] Lewis J. and Sauro J. *The Factor Structure of the System Usability Scale.* 2009

[5] SUS: a good enough usability questionnaire, in http://rosenfeldmedia.com/books/survey-design/blog/sus_a_good_enough_usability_qu/

[6] Dumas J. and Tullis T., Rating Scales: What the Research Says, 2009, in http://www.measuringux.com/Mini_UPA-Dumas-Tullis.ppt

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