



Universidade de Aveiro

Ano 2021

**INÊS SANTOS  
ALMEIDA DIAS**

**CO-CRIAÇÃO COM ADULTOS 55+ PARA O  
DESENVOLVIMENTO DE CONTEÚDO AUDIOVISUAL  
EDUCATIVO TIC**

**CO-CREATING WITH ADULTS 55+ TO DEVELOP ICT  
AUDIOVISUAL LEARNING CONTENT**



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Dissertação apresentada à Universidade de Aveiro para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Comunicação Multimédia, realizada sob a orientação científica do Doutor Óscar Mealha, Professor Catedrático do Departamento de Comunicação e Arte da Universidade de Aveiro, e coorientação do Doutor Elísio Costa, Professor Auxiliar do Departamento de Ciências Biológicas da Faculdade de Farmácia da Universidade do Porto.

Trabalho realizado no âmbito do projecto europeu ICTskills4All – *Empowering old adults Citizens for a Digital world*. Financiado pelo programa ERASMUS+ KA2.

Bolsa de Investigação (BI) (Referência ICETA 2020-12), na Unidade de Ciências Biomoleculares Aplicadas - UIDB/04378/2020, financiado por Fundos Nacionais através da FCT/MCTES, na instituição ICETA.

*“Bernard of Chartres used to compare us to dwarfs perched on the shoulders of giants. He pointed out that we see more and farther than our predecessors, not because we have keener vision or greater height, but because we are lifted up and borne aloft on their gigantic stature.”<sup>1</sup>*

Para os gigantes que são a minha família.

<sup>1</sup> MacGarry, Daniel Doyle, ed. (1955). *The Metalogicon of John Salisbury: A Twelfth-century Defense of the Verbal and Logical Arts of the Trivium.*

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## **agradecimentos**

It takes a village to write a dissertation, and I have received a great deal of support and assistance during this dissertation. For that I have a lot of people to thank for.

To my supervisor Professor Óscar Mealha, I can't imagine this process without his encouragement, guidance and enthusiasm. To Professor Elísio Costa, my co-advisor, for the opportunity to have such a unique experience of developing a dissertation inside a European Project.

I would like to express my deepest gratitude to the APRe! Association, for the support to this study and all the 25 participants, involved volunteers with their time and experience. Without them, I would have never been able to conduct this study. They are truly co-authors of this dissertation.

In addition, I would like to thank my family. To my parents, Rui e Rosário, for their unconditional support, who never got the chance to achieve this far in their Academic careers, and the least I can do is write their names on this page. To my sister Maria, who encourages me to set a good example as a big sister. And to Ana, the centre of my support system, for her love and unparalleled patience.

I am also grateful to my friends and colleagues who lent an ear, I hope you know how those moments were precious to me.

## palavras-chave

Adultos 55+, Aprendizagem Audiovisual, Co-Criação, Co-Design, *Design Thinking*, Literacia Digital, Competências Digitais, TIC, *Human-Centric Design*, Percepções do Utilizador

## resumo

A aprovação de um produto depende da experiência que este proporciona aos seus utilizadores - o produto deve satisfazer as necessidades específicas no contexto do utilizador. Uma forma de compreender e considerar essas necessidades é através de um processo de *human-centred design*. O *human-centred design* considera as opiniões dos utilizadores como uma prioridade do design, o elemento no "centro" do processo de design iterativo. Para manter o foco no utilizador, o processo de *human-centred design* deste trabalho desdobra-se em quatro etapas: compreender, especificar, desenhar e avaliar.

Explorar de que forma o envolvimento dos *end-users* no ciclo de vida do desenvolvimento do produto pode contribuir para o processo de design é objeto de estudo desta dissertação, cuja estrutura se divide em duas partes: investigação e desenvolvimento. A investigação estabelece um estado da arte; o desenvolvimento consiste num estudo empírico, com uma metodologia de co-criação baseada em *design thinking*, para o desenvolvimento de conteúdos de aprendizagem audiovisual TIC adaptados aos adultos 55+.

Este estudo está incorporado no ICTskills4All, um projeto de apoio ao desenvolvimento de competências digitais entre cidadãos com mais de 55 anos de idade. Os participantes foram recrutados com a ajuda da APRe!, um parceiro associado. Os participantes dispunham de uma ligação segura à Internet, em casa, que lhes permitiu participar livremente e em segurança, especialmente durante a pandemia COVID-19. Esta amostra integra 25 participantes, 16 (64%) do sexo feminino e 9 (36%) do sexo masculino, com idades compreendidas entre os 55 e os 81 anos de idade (mediana=72), 88% (22/25) dos quais já reformados. Os critérios de inclusão dos participantes foram os seguintes: 55 anos ou mais, competências tecnológicas mínimas para participar online, e com disponibilidade para a partilha das suas opiniões e interações relacionadas com a tecnologia.

A partir da co-criação e validação de conteúdos audiovisuais para a plataforma ICTskills4All, parceria com os *end-users*, este trabalho pretende melhorar as competências de literacia digital e contribuir para o *human-centred design*, com um estudo qualitativo baseado na abordagem do *design thinking*.

Os resultados indicam que o envolvimento dos utilizadores finais no processo de design pode conduzir a produtos visualmente diferentes mas com avaliações semelhantes. A combinação da formação especializada de um designer profissional com a experiência pessoal dos participantes pode enriquecer a experiência de ambas as partes, mesmo com uma pequena amostra.

**keywords**

Adults 55+, Audiovisual Learning, Co-Creation, Co-Design, Design Thinking, Digital Literacy, Digital skills, ICT, Human-Centric Design, User Perceptions

**abstract**

A product's acceptance depends on the experience that it provides to its users. The product must meet the contextualized specific needs of the users, and one way to understand and consider those needs is through a human-centred design process. Human-centric design collects users' opinions as a design priority, the element in the "centre" of the iterative design process. To keep our focus on the user, the human-centred design process of this work has four steps: understand, specify, design, and evaluate.

This dissertation explores how end-users' involvement in the product development life cycle can contribute to the design process. This document comprises two parts: research and development. The research establishes a State of the Art, and the development reports an empirical study with a co-creation methodology based on design thinking for developing ICT audiovisual learning content adapted to the adults 55+.

This study is incorporated in the ICTskills4All project that aims to support the acquisition of digital skills among 55+ aged citizens. Participants were recruited with the help of APRe! an ICTskills4All associated partner. The participants had a reliable internet connection at home which enabled them to participate freely and safely, especially during the COVID-19 pandemic. The respondents were between the age range of 55 - 81 years old (median=72). This sample integrates 25 participants, 16 (64%) female and 9 (36%) male, 88% (22/25) are already retired. The inclusion criteria for participants were as follows: 55 years or older, minimum technology skills to participate online, and open to sharing their personal opinions and interactions related to technology.

This study aims to contribute with audiovisual artefacts for the online platform ICTskills4All, co-designed and validated with end-users, improve digital literacy skills, and to the human-centred design field with a qualitative study based on design thinking approach.

The results indicate that involving end-users in the design process can lead to different visual results but similar rating values. Combining the expert quality of a professional designer with the participants' expertise can enrich the experience of both parts, even with a small sample.



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# Introduction

The latest population projection report from the United Nations (2019), *The World Population Prospects 2019*, indicates that the world's population will continue to grow until the end of the 21st century, approaching 11 billion inhabitants. Increased average life expectancy is the main phenomenon responsible for this growth rate. In 2019, about 9% of the world population was 65 or older. According to the report, this proportion of older people worldwide will reach 16% in 2050, meaning 1 in 6 people in the world will be over 65 years old. In turn, the number of people over 80 appears to be growing at an even faster rate. In 1990, the number of people aged 80 and over was 54 million. By 2019 (143 million), this number almost tripled and will do so again by 2050, approaching 426 million (United Nations, 2019).

Population ageing represents a severe challenge in the face of a society undergoing constant technological innovation. More than 35% of adults 55+ (adults aged 55 or over) in the European Union have never used a computer (Midão et al., 2020). This group's low skill level in information and communication technologies (ICT) serves as a significant source of social isolation and exclusion from accessing information and services, such as managing tax obligations, banking transactions, online shopping, or even telecommuting (Coelho, 2017). Older people are more hesitant to adopt new technologies than younger ones but will do so if they perceive the benefits of their use (Czaja et al., 2012; Ferreira & Veloso, 2019). Access to digital instruction adapted to their characteristics and needs (age, geographical area, level of education, digital experience) constitutes a strong barrier in the learning process (Calisto, 2015). The digital inclusion of adults 55+ can mitigate these inequalities, contributing to greater autonomy, social participation and access to information. Another added value is the direct and positive impact on mental health and the cognitive domain (Damant et al., 2016).

Understanding the preferences and user experience of adults 55+ towards the digital world, with consequent content adaptation, is crucial for the digital inclusion of this population (Vaportzis et al., 2017). In this context, the ICTskills4All—a European project co-funded by the Erasmus+ programme—was launched in 2018 to address adults 55+ with little to no ICT knowledge (ICTskills4All, 2018). In this project, I collaborated as a visual

designer and helped create an educational platform by exploring and testing pedagogical practices to design and develop courses and ICT educational content.

ICTskills4All focused on teaching its users with reduced skills to learn about ICT skills through educational modules and increase their level of digital literacy, defined as "the ability to use information and communication technologies to find, evaluate, create, and communicate information, requiring both cognitive and technical skills" (American Library Association [ALA], 2011, p.1). Each module resorted to the use of text, images, and videos as a way of teaching. As the visual designer of the ICTskills4All project, I was responsible for producing and editing the platform's ICT audiovisual learning content, which uses sound (auditory stimuli) and sight (visual stimuli) for teaching ICT (Podolskiy, 2012). The design approach resulted from time and resource constraints and entirely relied on the designer's perspective. The design process started with a brief state of the art of the user's needs and capabilities. It quickly advanced to the script, storyboarding and production phase. The project was successfully implemented and ended on the last day of February of 2021.

Although satisfied, I questioned if involving the end-users in the design process could lead to different results. As "digital immigrants" (a person raised before the digital age) (Prensky, 2001, p. 2), they learned to adapt to ICT instead of being born with it. Bringing unique user perspectives into the creative process can be very powerful in thinking differently and avoiding tunnel vision and dangerous bias.

Hence, this study explores how end-users' involvement in the product development life cycle can contribute to the design process. I implemented a human-centric design framework with a qualitative study based on a design thinking approach (Interaction Design Foundation [IxDF], 2016). "Design thinking is an iterative process and a user-centred approach for problem-solving" (Stickdorn & Schneider, 2012, p. 40). It helps designers create functional and affordable solutions that address real user problems.

Thus, the central purpose of this research is to test a co-creation method based on design thinking with adults 55+ to develop ICT audiovisual learning content. Next, we break this objective into sub-objectives.

The fundamental objective branches into four points:

1. Understand the user experience of adults 55+ - end-users- concerning technology. Understand how the user experiences digital products and engages with similar designs and the environment or context they experience the product.
2. Based on research, specify the user's needs and determine which user problems are the most important to solve.
3. Design solutions to those user problems. Brainstorm ideas for designs that can address the user problems identified. Then, start to design those ideas.
4. Evaluate the new solutions against the previous developed (without co-creation) through A/B testing with the participants and collect feedback.

## Methodological Approach

Based on constructivism (Gray, 2014) as an epistemological thesis, wherein the subject is the constructor of reality, this project focuses on the interaction between the target audience (adults 55+) and the phenomenon (ICT audiovisual learning content), collecting their subjective experience and rating that information above prejudices.

This study will be using a phenomenological approach because it considers each user as a unit of analysis, and their individual experience will be the main object of study. It also departs from this theoretical perspective by starting from the singular to a social construct of a common good. The intention is to identify meanings, preferences, and feelings that construct the reality of their experience to improve it.

Embracing qualitative and quantitative methods as inquiry techniques to absorb the multiplicity of the 'real user experience', this action-research (Greenwood & Levin, 2006) study can be divided into research and development. The first follows an inductive approach: the information is collected and analysed for patterns so that knowledge about the problem can build from there. The latter follows a deductive approach: the knowledge gathered is the foundation for prototyping and testing solutions.

## Development Model

Model development is a mental framework for the analysis of real-world phenomena. It assists in relating more accurately to reality. The development model built (See Appendix A) breaks down the key dimensions of this study into variables and

indicators. The concepts presented in the model as dimensions - Adults 55+, Multimedia, Education and Learning, ICT Audiovisual Learning - emerge from the research problem, whereas the variables and indicators unfold directly from the related concepts (Quivy et al., 2008).

## Expected Outcomes

This research and development project will result in:

- ICT audiovisual learning content supported by a co-creation method based on design thinking - made available on the ICTskills4All educational platform.
- A scientific article reporting the empirical study present in this work.
- A comparative study (white paper) of active ICT learning websites for older users in 2020 from the benchmarking analysis.

## Dissertation Structure

The structure of this document is comprised of two parts: research (chapter 1 & 2) and development (chapter 3-5). The research is subdivided into theoretical (literature review) and technical (benchmarking and comparative study of ICT learning websites) components to establish a State of the Art. The second part reports an empirical study with a co-creation method based on design thinking for the development of ICT audiovisual learning content adapted to the target audience.

This dissertation follows American Psychological Association [APA] (2021) style and grammar guidelines according to APA 7th edition. When referring to herself, the researcher will use active voice in the first person for a clearer identification of the subject performing the action.

# Part 1: State of Art

This section will include an analysis of theoretical and technical inputs from research and products in similar scenarios and will be considered recommendations. The literature review explores the concepts of *Aging and Technology*, *Digital Literacy*, and *Human-centric Design*. The comparative study benchmarks active ICT learning websites for older users in 2020 for the technical analysis.

# Chapter 1: Literature Review

## Ageing and Technology

Designations such as 'older adult' and 'senior' correspond to categories starting at the age of 65 (World Health Organization [WHO], 2001). Likewise, the concept of adults 55+ emerges as a quantitative marker, targeting the study of behaviours, skills and recommendations in a specific population. Designing digital products for the adults 55+ requires an understanding of the capacity losses consequent to ageing, such as senses (vision, hearing, perception and balance), mobility (strength and reaction time), and cognition (forgetfulness and memorisation) (Lourenço, 2018).

Vision is one of the senses that allows us to perceive our surroundings, but with ageing, its capacity decreases (Lourenço, 2018). As we age, people often lose the ability to focus on images at close range; the perception and distinction of colours (namely green, blue and violet) (Daré, 2010); reduced visual acuity, and consequently reduced visual adaptation to lighting changes (Derungs, 2016). These losses may reduce the individual's ability to perceive non-verbal information in communication (Lister et al., 2014).

The auditory system also contributes to the person's balance in their movements and understanding the outside world (Hendry et al., 2012, p.38). Its significant loss in ageing lies in the sensitivity and resistance to high-pitched sounds, preferring lower sound so as not to cause discomfort in hearing (Isle et al., 1992, p.16). The autonomy in controlling the volume and the decrease in sounds may contribute to a better experience (Sales & Cybis, 2003).

The loss of cognitive ability is directly related to the decrease in learning time and memory, as ageing adults have a decreased ability to retain information (Glisky, 2007). The main changes in the cognitive system are: difficulty in understanding long and complex messages to remember specific terms and to carry out reasoning activities involving unfamiliar material; reduced ability to perform new tasks and rapid psychomotor skills; memory impairment, especially memory related to the acquisition of new information; decreased attention span in multiple tasks (multitasking); difficulties in inductive behaviour, spatial orientation, in perception and numerical and verbal skills (Czaja et al., 2012). According to Vaz Serra (2006), there is a decline in intelligence from

the age of 70 onwards. In this sense, functions that require the manipulation of new information are more problematic than those that require only the use of acquired knowledge.

The ageing process is also responsible for a decline in certain motor functions: slower response time to actions, decreased capacity to maintain continuous movement, disturbances in coordination and variability of movements and loss of flexibility. A clear understanding of these changes contributes to identifying elements that can turn technological development services more appropriate to older users (Ferreira, 2013). Usability studies show that newly designed technology such as mobile applications and smartphones are not meeting the expectations of older users (Wong et al., 2018).

Some older adults perceive technology to be difficult to learn and follow. As a result, they tend to lose interest, not make the necessary efforts to improve their ICT skills and avoid new technology that they are not familiar with, relying on the support of younger family members or friends when they must. These barriers hinder them from fully taking advantage of their functions and services. It is imperative to know these biased perceptions to make an informed decision when designing a new technology product and get a different perspective by putting ourselves in the user's shoes. Readiness and willingness to adapt to new technology can sometimes be more challenging to overcome than physical or mental limitations. By designing more inclusively, we can consider the needs and capabilities of the whole population to decrease the gap between the user and the technology (Patrick. & Hollenbeck, 2021).

To increase older adults' engagement in technology, specific requirements and design interventions must be met. Some older adults have specific cognitive and physical limitations that prevent them from using numerous technology-based solutions; however, their perceptions of technology are generally similar. By addressing the standard sets of perceptions regarding the benefits and usage of technology, we can ensure that older adults can interact with digital technologies with more trust and confidence. The appropriate design can include many users and facilitate access and use (Vaportzis et al., 2017).

## Digital Literacy

Technology is present in almost every aspect of our daily lives. It offers many advantages for improved quality of life: rapid access to information, products, services and communication; social, political and economic inclusion (Abad-Alcalá, 2014). Europe is undergoing a digital revolution, but the lack of digital knowledge in adults 55+ can create barriers, excluding older adults from availing themselves of new digital products and services. The difficult access to digital instruction adapted to their characteristics and needs (age, geographical area, education level, digital experience) constitutes a solid barrier for learning and motivation (Calisto, 2015).

Adults 55+ represent 33% of the population in Europe (Eurostat, 2019); however, according to the *Survey of Health, Ageing and Retirement in Europe* (SHARE) database, an average of 35.9% of participants have never used a computer (Börsch-Supan, 2019).

In Portugal, adults 55+ represent 36% of the population (Pordata, 2020), with only 18% of adults having good digital skills (Börsch-Supan, 2019). The percentage of digitally-skilled adults trends downward as age increases. Comparing prevalence by gender, both in Europe as a whole and Portugal specifically, women tend to have fewer digital skills. These skills are often related to better-paid jobs or more significant opportunities and are crucial to promoting social and professional inclusion. Women have historically been less present in the labour market than men in the European context, which may justify the differences in computer skills by gender found in this paper. In addition, maternal, familial, and cultural stereotypes may also contribute to these differences. According to the European Commission (2018), it is common for older women to be partially or wholly absent from the labour market, thus lacking a pivotal motivation to learn or improve computer skills in their lifestyle.

In Portugal, ICT education for adults 55+ appears almost exclusively in senior university projects/programs, representing a social response to local or regional realities. This subsection identifies three relevant projects in Portugal that focus on helping seniors operate and use digital platforms.

First is RUTIS<sup>1</sup>—Associação Rede de Universidades da Terceira Idade (2017)—a Private Institution of Social Solidarity (IPSS) and Public Utility supporting the community and seniors, with a national and international scope. According to RUTIS, as of June 30,

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<sup>1</sup> RUTIS: <http://www.rutis.pt/> (Date accessed: 27-10-2021)

2020, 359 Senior Universities were registered in Portugal. However, there is a shortage of online training for this target audience. On April 20, 2020, RUTIS presented its first online training project: the Virtual Senior University (VSU), which uses Zoom videoconferencing to establish contact between teachers and students.

Before this initiative, the only reference identified in Portugal was the MUDA project<sup>2</sup> (2017), which promotes the digital integration of Portuguese citizens, specifically through the use of online services (such as online banking, health services, communications, shopping, public services, and more). The project relies on the collaboration of several partners, including the Portuguese State and several companies from different market sectors, and is co-financed by the European Commission and public funds. Participation in the project is open to the general population; however, the suggested target audience and intergenerational learning strategies focus on the senior population as the primary target. MUDA develops two approaches to training adults in using digital services and improving digital skills: training in an intergenerational context and online resources. The content available appears mainly in the form of instructional videos and tips on how to be and communicate online, use digital services, or surf online safely. This project was the most developed case of online ICT training content for adults 55+ in Portugal.

The last project identified was the miOne platform<sup>3</sup> (2020), developed in co-creation with four social institutions in Aveiro, integrated into the SEDUCE 2.0<sup>4</sup> project. Access to the miOne platform is restricted, requiring user registration. This project was used to conduct two studies on audiovisual content to support the miOne community by seniors. The results focus on recommendations when producing audiovisual content for seniors. Like the MUDA project, this project was funded by national funds through FCT - Foundation for Science and Technology, I.P., COMPETE 2020, Portugal 2020 and the European Union through the European Regional Development Fund. With the collaboration of partners Altice Foundation<sup>5</sup> and DigiMedia<sup>6</sup>.

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<sup>2</sup> MUDA: <https://www.muda.pt/> (Date accessed: 27-10-2021)

<sup>3</sup> miOne: <https://mione.altice.pt/> (Date accessed: 27-10-2021)

<sup>4</sup> SEDUCE 2.0: [http://www.seduc.pt/?page\\_id=6984&lang=en](http://www.seduc.pt/?page_id=6984&lang=en) (Date accessed: 27-10-2021)

<sup>5</sup> Altice Foundation: <https://fundacao.telecom.pt/> (Date accessed: 27-10-2021)

<sup>6</sup> DigiMedia: Digital Media and Interaction is an interdisciplinary research centre of the University of Aveiro focusing on innovation in the design of new interaction approaches for human-centered digital media applications. Available at: <https://digimedia.web.ua.pt/> (Date accessed: 27-10-2021)

## Human-Centric Design

A product's acceptance depends on the experience that it provides to its users (IxDF, 2015). The product must meet the contextualised, specific needs of the users, and one way to understand and consider those needs is through a user-centred design process. Human-centric design collects users' opinions as a design priority, the element in the "centre" of the iterative design process. Focusing on the user means considering in the design process their story, opinions, behaviours, emotions, and the insights gathered from them. To keep the focus on the user, the user-centred design process of this work has four steps: understand, specify, design, and evaluate (W3C - Web Accessibility Initiative, 2004). This framework helps designers build products people want to use. Larry Page (2021) highlighted just how vital user-centred design is when he said, "There is no substitute for personally watching and listening to real people".

### *Design Thinking*

According to the IxDF (2016, para. 1), design thinking is a "non-linear, iterative process that teams use to understand users, challenge assumptions, redefine problems and create innovative solutions to prototype and test." There are five phases in this design process: empathise, define, ideate, prototype, and test.

### *Empathise*

Empathy (Wight, 2012) is fundamental to a human-centred design process such as design thinking; it helps avoid personal biases and gain insight into the user's world. Human-centred designers consciously draw upon people's real-world experiences to inform and inspire their designs, conducting interviews, surveys, focus group and observation sessions (IxDF, 2016). These instruments help the designer understand the problem's context better, increasing the so-called field-dependent thinking (Battarbee et al., 2014).

Interviews are the most common qualitative research method to collect in-depth information on people's experiences and thoughts. While time-consuming, and very difficult to perform in large samples, it gives the interviewer more control over the information received (Quivy et al., 2008).

Surveys are a quantitative research method where participants are asked the same questions. They can be beneficial for a larger sample, since they can be quicker for

processing data or validating solutions. In interviews, opinions can sometimes be biased to 'appeal' to the interviewer (Quivy et al., 2008).

### *Define*

The process of analysing and synthesising the data collected in the previous step is called define. In human-centred design, empathy maps and personas are two of the most common instruments designers use (IxDF, 2016). Empathy allows for a deep emotional understanding of our users, while empathy maps help to visualise it. The map helps designers consider things from the user's perspective when making decisions for problem-solving (Gibbons, 2018).

*Personas* are abstract representations of a cluster of participants who exhibit similar attitudes, goals, and behaviours. They are well-defined and unambiguous, easy to distinguish from each other and memorable so that we can easily recall and empathise with them (Salazar, 2018).

While empathy maps are powerful tools to understand and prioritise users' needs, personas humanise and provide insights about the users that are impractical to get from analytics data, frequency tables, demographic info, or assumptions alone. Understanding users' motivations and expectations can direct the decision-making process to meet these goals (Gibbons, 2018).

### *Ideate*

Once established, the guidelines in the previous step, the main focus is to brainstorm as many ideas as possible and write them down - ideate. To stimulate new ideas, a lateral thinking technique can be used to explore new solutions (IxDF, 2016). The SCAMPER method, first introduced by Bob Eberle (2008), is an acronym for Substitute, Combine, Adapt, Modify/Magnify, Purpose, Eliminate/Minimise and Rearrange/Reverse. SCAMPER's main idea postulates that what is "new" is a modification of the "old"; overall, it promotes creative thinking through the challenge of assumptions (Dam & Siang, 2020a).

SCAMPER asks questions like: "What can be *substituted* in my product for something else?"; "What ideas can be *combined* to achieve a more innovative product?"; "What can I *adapt* from my product to solve the problem?"; "What can I *minify* or

*emphasise* in my product for a more appealing solution?"; "How would this product behave in another setting?"; "How can I simplify this product?"; "What roles could I reverse in this design process?" It is not essential to answer every question; one of the benefits of SCAMPER is how adaptable it is to fit any circumstance it is applied to (Dam & Siang, 2020).

An effective ideate phase is both time-bound and imagination-free. While no idea is too absurd to be written down, limiting the time of this step is essential to set the tone and keep everyone involved focused. Depending on the team and project, this could be hours, days or even weeks long (Dam & Siang, 2020).

### *Prototype*

Once the brainstorm is over, the designer has to evaluate the ideas and decide which solutions have the greatest chance of success. In the prototype phase, those ideas are used to draw the storyboards and scripts of the new product (pre-production). These are great instruments to pre-visualise the product. Afterwards, the designer starts producing the model based on those instruments. The goal is to create a low to high-fidelity simulation of the product (IxDF, 2020). Once done, the prototype is ready for review.

### *Test*

Once the prototype is ready, the validation phase starts. Testing is an essential step in the design process, it can feed into most stages of the process: increase empathy, redefine the problem, reimagine solutions and lead to an iteration of the prototype (IxDF, 2020). When done correctly, testing can generate feedback from the users to correct and improve the designs, before launching into a bigger audience. For a good experience, the designer must control the quality of the prototype, context in which it is presented, how it interacts with the user, and how it receives feedback (Moran, 2019).

According to Dam and Siang (2020) the user finds it more manageable when presented with comparison A or B, instead of being presented with only one version. Another way to encourage feedback is using a scale. The User Experience Questionnaire (UEQ) is a validated scale that uses a 7-point Likert scale to measure: efficiency, perspicuity, dependability, originality, and simulation. It is divided into 26 items keeping

hedonic concepts on the right while keeping pragmatic on the left, allowing for a more intuitive and fast assessment (Laugwitz et al., 2008).

Participants' time and availability should be treated with the utmost respect, in an testing settings where a participant needs to judge several products, the EUQ-S may be a more appropriate tool. The short version of the EUQ (UEQ-S) allows downsizing the number of items, to eight instead of twenty-six, without sacrificing the quality of the answer and stressing the participant (Schrepp, 2016).

### *Universal, Inclusive, and Equity-Focused Design*

When designing for a broader range of people, it is crucial to avoid the impulse to find one-size-fits-all solution; when the designer focuses on creating a solution for everyone, the design loses its effectiveness. It is better to search for solutions that solve one and extend to many. Inclusive design provides equal access to everyone, regardless of identifiers like ability, race, economic status, language, age, and gender. The design process includes researchers and designers from traditionally excluded populations to provide their unique perspectives during all phases of the design process. Equity-focused design takes this idea one step further. It asks designers to focus on designing for groups that have been historically underrepresented or ignored when building products, like adults 55+ and technology (Frigola, 2021).

## Chapter 2: Comparative Study

The technical dimension of this research consists of a comparative study of active ICT learning websites for older users in 2020. The information collected will be analysed through benchmarking.

The benchmarking theory believes that we can improve our performance by comparing and adopting others' best practices (Camp, 1989). The resulting benchmarking instrument focuses on comparing ICT educational websites to ICTskills4All. Through the analysis of the following independent variables: the approach available (online versus online and on-site), the literacy level of the content available, the type of interaction, the characteristics of the audiovisual content, the feedback they allow their users and their dissemination through the networks. Not being possible, in many cases, to decipher the age range of the target audience, all ICT educational websites intended for a senior audience were considered. Given the target audience—adults 55+—these aspects are considered before developing digital content - in this case, ICT audiovisual learning, as it should be developed according to the cognitive, visual and motor needs of that audience.

The criteria for inclusion in the study is as follows:

- Website as the main platform.
- ICT e-learning educational content.
- Target audience: older adults (not necessarily exclusive).
- Content in English (not necessarily exclusive).
- Open access websites or via user registration.

Exclusion criteria include:

- Paid websites.
- Websites created before January 1, 2015.
- Websites that do not create their own audiovisual content.

To find relevant examples that responded to the selection criteria, I opted to do a keyword search in the Google<sup>7</sup> search engine using the concepts: ICT Help Tutorial, ICT Video Tutorial, ICT Learning Tutorial, ICT Learning Older Adults, ICT Learning Elderly. The seven websites found eligible for this comparative study are identified in the next section.

## Participating Websites

The ICTskills4All (2018) project arises with the aim of creating an educational platform, through exploring and testing pedagogical practices, for the design and development of courses and educational content. The platform is open, active and updated for 2021. The content is translated into four languages: Portuguese, English, Polish, and Latvian. It is within the scope of this platform that this master's project is being developed.

The Australian Government's initiative, Be Connected (2017), aims to increase seniors' confidence, skills and online safety through the educational content provided on its platform. The platform is open, with the option to register, and is active and updated for 2021. The content is exclusively in English.

The Canadian Cyber-seniors (2015) project aims to increase the digital literacy of seniors through the development and dissemination of resources for technological training. To do so, it relies on a model of intergenerational volunteering, where younger people are trained to be digital mentors to their elders. The teaching platform, which is closed and requires registration, is updated to 2021. The content is translated into three languages: English, Spanish and French.

CGFGlobal - Goodwill Community Foundation (1998) is a repository of text, images, and video tutorials aimed at empowering digital literacy. This virtual space is used by individual users, schools and organisations. Over 20 years old, the platform is open and is active and updated for 2020. The content is translated into three languages: English, Portuguese (BR) and Spanish.

The European project Digital Access (2017) - DIGITAL ACCESS: Digital Skills for People Living in the 3rd Age - Effective Digital Access to Public Services, has the specific objective of teaching seniors how to access and navigate public services websites. The project funded by the Erasmus+ programme ran from 2017 to 2019.

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<sup>7</sup> Google: <https://www.google.com/> (Date accessed: 27-10-2021)

The platform, which is still active, is open. The content is translated into five languages: English, Greek, Spanish, Bulgarian and Czech.

The Tech Boomers (2018) education website aims to increase the quality of life of seniors, and other audiences, with low digital literacy by empowering them to learn how to access and navigate websites and other internet applications. The platform is open and is active and updated for 2018. The content is in English.

The Skillful Senior website aims to teach seniors basic digital activities through practical exercises. Its interactive format is designed for individual or group use in a classroom context. The teaching website is open, with the last update made in 2017. Sadly, its flash content is no longer supported in 2021.

Table 1 shows all the participating websites included in the comparative study and languages available in descending order of year it was last updated.

**Table 1**

*Participating Websites*

Name	Address	Year*	Languages
ICTskills4All	<a href="https://up.pt/ictskills4alleu/">https://up.pt/ictskills4alleu/</a>	2021	EN (UK), PT, PL, LAT
Be Connected	<a href="https://beconnected.esafety.gov.au/">https://beconnected.esafety.gov.au/</a>	2021	EN (AUS)
Cyber-Seniors	<a href="https://www.cyberseniors.org/">https://www.cyberseniors.org/</a>	2021	EN (CAN)
GCF	<a href="https://gcflearnfree.org">https://gcflearnfree.org</a>	2020	EN (USA), ES, PT (BR)
Digital Access	<a href="http://digital-3rd-age.eu/">http://digital-3rd-age.eu/</a>	2019	EN (UK), GRE, ES, BGR, CZ
Tech Boomers	<a href="https://techboomers.com/">https://techboomers.com/</a>	2018	EN (CAN)
Skillful Senior	<a href="http://www.skillfulsenior.com/">http://www.skillfulsenior.com/</a>	2017	EN

\*Year the website was last updated.

This revision of existing online resources dedicated to improving digital skills amongst older adults at an international level proved very satisfactory. If you are a native

English speaker looking to learn ICT, there are plenty of free online information tailored to older adults, although most free courses online are not solely focused on older learners. The websites mentioned above present their learning material in a simple and easy to understand way. Unfortunately, it was not possible to identify the efficacy of the training on the learners since there are few publicly available evaluations.

## Benchmarking

Studies show that older people use the Internet the least (Berner et al., 2011). The now Internet-connected adults may be more likely to adapt to technology when older in the future. Offering a flexible online format for learning should provide more opportunities to fit user needs better. Although compulsory online (inclusion criterion), 5 of the 7 projects also take place on-site. This dual approach in most cases means that the contents are developed for the user's individual use and for an organisation or institution to use as a teaching tool.

As shown in Table 2, the websites were assessed for their digital literacy level according to the European Digital Competence Framework for Citizens (2017). All the websites presented courses for beginners that users can follow alone or with little supervision. 5 out of 7 of the platforms were found to contain intermediate-level content, although this only applies to some content and not across the board. No content addressed more advanced ICT skills for older adults; typically, these are directed to people interested in a certificate and are not free.

**Table 2**

*Websites Learning Approach and Literacy Level Required*

Name	Approach		Literacy level		
	Online	On-site	Beginner	Intermediate	Advanced
ICTskills4All	x	x	x		
Be Connected	x	x	x	x	
Cyber-Seniors	x	x	x	x	
GCF	x		x	x	
Digital Access	x	x	x	x	
Tech Boomers	x	x	x	x	
Skillful Senior	x		x		

The visual content (Table 3) emerges as an essential pillar to the composition of the website. In a deeper analysis, one could subdivide the composition of its structure on the page into percentages, however, this study focuses only on informing its typology. All platforms opt for text and illustration, 6 out of 7 also use photography (picture made using a camera) and screenshots (data displayed on the screen). Only one opts for the use of infographics. The GCF platform is the one that presents the most variety in the use of visual content.

**Table 3***Visual Content*

Name	Visual Content				
	Text	Illustration	Photography	Screenshot	Infographics
ICTskills4All	x	x	x	x	
Be Connected	x	x	x	x	
Cyber-Seniors	x	x	x	x	
GCF	x	x	x	x	x
Digital Access	x	x	x	x	
Tech Boomers	x	x	x	x	
Skillful Senior	x	x			

Regarding video content (Table 4), 6 out of 7 websites use the medium. There are differences in preferences: 4 out of 7 choose to use 2D animation, 4 out of 7 choose to use video capture of the screen (screencast), 3 out of 7 use a speaker talking directly to the camera (live action). The Digital Access website uses only animation in its videos, with the remaining tending to use a combination of two or more types of videos. The ICTskills4All platform has the most variety in the use of video.

**Table 4***Video Content*

Name	Video				
	2D	3D	Screencast	Whiteboard	Live action
ICTskills4All	x		x		x
Be Connected	x				x
Cyber-Seniors			x		x
GCF	x		x		
Digital Access	x				
Tech Boomers			x		
Skillful Senior					

Concerning audio (Table 5), 5 out of 7, most audiovisual content found uses voice-over instead of live-action narration or closed captions. The Be Connected and Cyber-Senior platforms use narration in their videos with interlocutors or interview formats. The Skillful Senior platform uses narration as an option to read the text. It is considered closed captioning when an audience cannot hear the audio and needs a text description of what they would otherwise be hearing. 3 out of 7 of the platforms close caption their content. Music was only noticeable in 4 out of 7 platforms, in the same 2D animation contents. The Be Connected platform is the one that presents more variety in the use of audio.

**Table 5***Audio*

Name	Audio			
	Voice-over	Narration	Closed Captions	Music
ICTskills4All			x	x
Be Connected	x	x	x	x
Cyber-Seniors	x	x		
GCF	x			x
Digital Access	x			x
Tech Boomers	x			
Skillful Senior		x	x	

As previously mentioned in the introduction of this chapter, it is not easy to analyse potential feedback and interaction of these websites with the user; As shown in Table 6, only 3 out of 7 have a space for interaction. Two of them require mandatory registration to activate this functionality (Be Connected and Cyber-Seniors).

**Table 6**

*Feedback*

Name	Feedback		
	Rate	Comment	Share
ICTskills4All			
Be Connected		x	
Cyber-Seniors		x	
GCF			
Digital Access			
Tech Boomers		x	
Skillful Senior			

As shown in Table 7, most of the websites (6 out of 7), concentrate their content dissemination on Facebook. 3 out of 7 use Facebook, Twitter and Youtube. Only 2 out of 7 are active on Instagram. Tech Boomers is the learning platform with the most spread, using all 6 of the social media presented.

**Table 7***Social Media*

Name	Social Media					
	Facebook	Youtube	Twitter	Instagram	Linkedin	Pinterest
ICTskills4All	x					
Be Connected	x					
Cyber-Seniors	x	x	x	x		
GCF	x	x	x	x		x
Digital Access	x					
Tech Boomers	x	x	x		x	x
Skillful Senior						

Online learning often loses ground compared to on-site learning, considering that social interaction with peers and trainers assumes an essential role in motivating and guiding seniors in the learning process, helping and supporting them in real-time when the user has some difficulty. These are the main shortcomings of online and stand-alone training. Online resources are often partially funded to promote the migration of senior citizens from analogue/presence services to digital ones and thus interact with government institutions and other services. This reduces investment in government services but, at the same time, this can be a problem for adults who value direct contact and interaction to carry out their transactions and solve their problems (ICTskills4All, 2019).

Content design emerges as essential to the success of the training offer provided on these websites and may even determine the sustainability and longevity of online resources. Regarding the analysis, it should be noted that several websites are directed to the senior public but do not show a clear construction according to specific guidelines for

the intended audience. Text, illustration, photography, and screenshots prevail as the means of transmitting knowledge and information in ICT teaching platforms, free/open access, with audiovisual content not being a popular choice. However, video, perhaps because it is more expensive in both time and budget, is not as common. When it is, it does not always offer a closed captions option. Half of the platforms do not prioritise digital interaction with the user, limiting themselves to a passive teaching approach, without the possibility of rating, commenting and sharing that is so common on social media and in a classroom environment.

This review considered a starting point, suggests the need to implement and develop denser processes in designing ICT educational content for seniors.

## Part 2: Empirical Study

Development, the second section of the project, comprises the creative and validation processes. The creative process adopts a co-creation method based on design thinking. In this sense, the document presents the following structure: questionnaire, interview data, construction of empathy maps and personas, brainstorm, storyboard, prototyping and testing. Participants were recruited with the help of Aposentados, Pensionistas e Reformados [APRe!] (2021), an ICTskills4All associated partner. The participants had a reliable internet connection at home which enabled them to participate freely and safely, especially during the COVID-19 pandemic. The validation process uses the same sample to evaluate the co-created content against the previously created (without co-creation methodology).

## Chapter 3: Methodological Approach

This study follows the design thinking method previously reported - in chapter 1 of this document - to co-create new ICT audiovisual learning content with end-users and evaluate it against the ICT audiovisual learning developed without co-creation.

As mentioned before, this process starts with empathy. The empathise phase involved user research, such as interviews, to understand users' different dimensions regarding the digital world. This first contact with the participants aimed to:

- Open a communication channel between the researcher and end-users.
- Understand the user experience of adults 55+ (end-users) concerning technology.
- Gather vital information to specify the end-users needs.
- Acquire participants for the testing phase.

The interview process started with building a questionnaire supported by the previously made development model (See Appendix A: Development Model). This questionnaire instrument worked as a guide to the interview moment. The interview followed a semi-structured model and was used as a research method to collect in-depth information on people's opinions, thoughts, experiences, and feelings. In this first contact, the priority was to get the interviewee to open and share as much as possible. The value of the answer lay in the information disclosed and the unique way each participant spoke about the topic. The semi-structured format aimed to respect the participants' freedom of expression, leaving the responsibility of managing and adapting the questions to the interviewer. This method allowed for a better understanding of what the user thinks and why, follow-up questions and clarifications of the statements insured, adjust questions to refocus and specify on the subject and receive direct suggestions from the users.

These interviews took place virtually on a video conference platform the participants chose for their comfort and familiarity. Most of the questions were presented in hypothetical scenarios, inserted in the conversation, adapted to each user. Each interview was between 30 minutes and 3 hours depending on the participant and the interview flow; participants were encouraged to speak freely with a brief mediation. In the

end, all the participants were acknowledged and asked for a follow-up contact to the validation phase. At the time, all the participants agreed to it.

I emailed several national institutions with an engaging role in active ageing and improving digital literacy to gather a sample. The email appealed to the contribution of this study and explicitly limited it to people:

- 55 years or older;
- minimum technology skills to participate online;
- open to sharing their personal opinions and interactions related to technology;

This first contact occurred in March 2021, but because of COVID-19 quarantine, most of the institutions contacted were closed or not available for contributing. APRe!, an ICTskills4All associated partner, was the only institution available and meeting all the conditions to participate. APRe! is a well-known association for older adults in Portugal, civic, secular, non-partisan, non-profit and nationwide association. *"APRe! stands as an active voice representing retired citizens, raising awareness, promoting justice and solidarity amongst the Portuguese society, being an advocate regarding the rights of the older population."* (2021).

The spokesperson of APRe! (2021) kindly agreed to help and unite a contact list with 25 participants. I contacted every person who decided to participate through a phone call. The purpose of this contact was to:

- Confirm and acknowledge their availability.
- Clarify the purpose of this study and its contribution.
- Request permission to record the interview (audio & video).
- Ensure their anonymity.

If agreed, the person would receive an email with an online informed consent form (Appendix B) to fill in - modelled after the Declaration of Helsinki (1964) principles (World Medical Association, 2013). Once approved, the document also asked the participant to choose a date, hour, and video call platform to perform the interview. These interviews occurred in the last two weeks of March 2021.

After the interviews, the audio and video data were collected and transcribed into a spreadsheet. The qualitative analysis tabulated all answers, and seven categories were

created (digital experience, devices, interaction & multimedia, online shopping & safety, advantages & disadvantages, education & learning, digital literacy) to group participants and find similarities between the answers - clustering (Quivy et al., 2008). For example, many participants admitted spending their time online watching exercise videos. This information was categorised as "online videos", under the major grouping of "multimedia and interaction" (Appendix C: Interview Transcripts). For a holistic representation of the results, a quantitative table shows the frequency of a specific opinion of the participants in each category's sub-comments/ opinion, keeping the detail of each category (Appendix D). This information was crucial for the next step: the define phase.

Based on the research findings, the empathy maps and personas created address users' needs in the define phase. While interviews provide much insight, empathy mapping helps to understand and prioritise users' needs. Both the process and the finished artefact are relevant points for this research.

The empathy mapping process helped categorise and organise the qualitative research (in this case, interviews-transcripts). Whilst the empathy maps that resulted from it are powerful and straightforward illustrations of that information. Once finished, they were considered a source of truth protected from bias and used for advanced steps, like personas and brainstorming.

Three personas were assembled for this research: the conservative, the moderate, and the liberal user. Based on the qualitative, ethnographic user research done in the previous steps, these user archetypes reflect the sample's behaviours, attitudes, and needs towards ICT.

Personas were used as a complementary tool with empathy maps to understand and synthesise participants experiences and communicate our findings.

Once the problems established in the define phase were clear, the goal was to develop as many design solutions as possible in the ideation phase. The SCAMPER method was applied to create as many design solutions as possible, using the "without co-creation content previously built" as a starting point. The only constraint was the time limit of a week to keep the schedule moving forward. The new ideas focused on the content and improving the context where the users experienced the videos — for example, adapting the player to be more accessible for older adults' needs. This freedom of ideas was later moderated in the prototype phase.

The prototype phase started with the script. According to the results gathered with the SCAMPER instrument, two drastic changes were needed: a first POV for a more personal and direct approach; and a 'fill in the blanks' fashion for more narrator autonomy in the speech. Also, other sections were added: an introduction, the narrators' personal experience and motivational farewell. For a fair comparison, the digital literacy information is the same in both scripts. Two scripts were re-created, "The Desktop Computer" and "The Laptop Computer". Next, it was the storyboard. The visuals followed the recommendations gathered in the previous steps, in these new prototypes focused on: the narrator presence, minimal animations and realistic representations of technology.

The last step of this process - testing, let the users provide feedback about the designs built based on their participation. The test of reception and perception of information, inspired by what is usually indicated by the A/B type usability test (Young 2014), aimed to assess which content was favoured by what is the constitution of this sample - video A or B - created with or without a co-creation process (Moran, 2019).

The test in the form of an online questionnaire evaluated the audiovisual contents created during the ICTskills4All project - without co-creation, and the audiovisual content co-created during this study. The questionnaire, composed of four similar sections, starts each paragraph with visualising a video, followed by two questions: "What most liked" and "What least liked" to reflect on what they have seen. After, the participant must fill a short version of the UEQ (Schrepp, 2016) concerning the video content (Appendix E). In this step, they are encouraged to follow their intuition and respond according to their first inclination.

I contacted the same sample by email to fill an online questionnaire and later through phone call. However, illness, changes of residency and internet problems meant that only 15 of the 25 participants responded to the questionnaire at the time of finishing this dissertation.

The data analyses of this questionnaire are divided into qualitative and quantitative; the first supports the latter. The data collected was transcribed into a spreadsheet and grouped into four sections, one for each video. Using the data analyses tool of the UEQ-S for the quantitative analyses, I entered the data obtained from the respondents, and all was automatically calculated, including the statistics necessary to interpret the result (Schrepp, 2016). For the qualitative analyses, I used an inductive approach. Each participant

response, already divided into two categories for each video - "What most liked" and "What least liked" - was open coded and presented in a frequency distribution (Lavrakas, 2008).

# Chapter 4: Co-Design Process and Analyses

## Empathise

The first stage of the design thinking process (Gibbons, 2016) - empathise- is the first contact between the researcher and the participants. The empathise section presents the questionnaire structure built for the interview collected data in the form of graphs.

### *Questionnaire*

The questionnaire underling the (semi-structured) interview can be consulted in Appendix F. The questionnaire presented comprises four parts:

1. First, I, as the interviewer, state my intentions to the interviewee. This step was fundamental to communicate expectations from the interviewee participation and clarify any doubts.
2. The second part comprises 45 questions, divided into three dimensions: the Sociodemographic Profile, Information Consumption Habits and Audiovisual Content. It is important to reinforce that the questions only served as guides for the semi-structured interview. As predicted, many answers were given freely without intervention, reducing the number of questions.
3. The construction of the third part based its structure on the European digital literacy framework table (Carretero et al., 2017). At the end of the second part, if the participants' literacy level in each category was not obvious, this was the time to clarify.
4. Acknowledgements were made in the fourth and final part and intentions to establish a contact in the future. Each question has its very concrete framework of need and guided me as the researcher and audiovisual content designer.

The dimension 'Sociodemographic Profile' aimed to help build the identity of the participant. To this end, this section introduces seven questions. The answers were essential for understanding the user and the usage scenarios. It was idealised that in this moment of the video call, the camera of both parts is in 'full screen' to establish the most personal contact possible. Based on the differences presented in SHARE, when comparing the prevalence by gender, both in Portugal and in Europe, women tend to have fewer

digital skills. These skills are often related to better-paid jobs or more significant opportunities and are crucial to promoting social and professional inclusion. In addition, maternal, family, and cultural stereotypes can also contribute to these differences (Börsch-Supan, A., 2019). According to the European Commission (2018), it is common for older women to seem partially or wholly absent from the labour market, thus lacking a pivotal motivation to learn or improve computer skills in their lifestyle. It was intended with question 1 to analyse whether gender is an independent variable that significantly influences the participants' answers. Adults 55+ belong to two generations - The silent generation and Baby boomers (Cambiano et al., 2001) - it is relevant to analyse convergences and divergences in the answers of the same age group to create an identity free of prejudices. According to Börsch-Supan (2019), there is a marked difference in computer skills with increasing age. It would be pertinent to analyse this hypothesis in this sample. Question 2, distinguished the ages of the participants and sought to understand the influence of this component on the results. Questions 3 and 4 both had the same objective: to find out the dimension of companionship or isolation, family context and its influence. According to the pilot tests conducted during the ICTskills4All (2018) project, the participants' low educational literacy caused major hindrances in their learning progress. Question 5 aimed to understand whether there was a relationship between low educational accomplishment and low digital literacy. It is essential to situate the technological presence in fulfilling these functions and whether they are in an active professional life (Midão et al., 2020). Question 6 aimed to address the level of online activity. The last question of this dimension, question 7, aimed to get a sense of the economic investment the participant is willing to make for the devices they own. It is not about necessity but rather acquisition priority.

Next, and continuing on the subject of the devices, a new dimension begins 'Information consumption habits' to understand the participants' access to ICT devices and the internet. To this end, this section introduces 20 questions. The first section (questions 8-16) sought to understand participants' access to ICT devices. Question 8 sought to explore the motivation and the situation that allowed this first contact with the devices, referring to the feelings of need/curiosity and others that participants can explore in their response (Norman, 2005). Question 9 directly asked their preference with an open question (question 10, 11). It was essential to understand the source of this preference as it may

influence the format of the content. There was also room for the participant to interpret the question in the negative and elaborate their answer - 'what do you use less/what do you like less?' Question 12 allowed to frame the devices with which this sample has the most contact. Question 13 sought to identify whether there is motivation to expand usage to new devices. Question 14 and 15 inquired about situating the user spatially and temporally when they contact their device. The last question in this section, question 16, attempted to locate the user in the digital space. The second section (questions 17-22) sought to understand participants' access to the internet and in what terms. Question 17, focused on whether or not the user has unlimited access to the internet. Question 18 intended to question the participant's interest in the internet, followed with 'where?' (question 18) 'with whom?' (question 19) and 'why?' (question 20). This section ends with two questions (question 21,22) directed at preferences: "what you like most? and what you like least?". The following section consists of only one question (question 23), which addresses for the first time the reasons/motivations or scenarios that led to learning ICT. The last section of this dimension consists of 4 questions (questions 24-27) to uncover participants' expectations and pain points regarding ICT. Respondents' answers create a realistic usage scenario and contribute to the participant's sociodemographic profile (Norman, 2005).

The dimension 'Audiovisual content' aimed to understand the users' interaction and behaviours with their devices. To this end, this section introduces 18 questions. Interaction is the first section, with four questions (questions 28-31). It intended to understand the user's contact with his device in terms of activities and his awareness regarding his digital footprint. In the following section, the conversation is towards learning (questions 32,33). To understand if the respondents perceived their digital devices as didactic and in which situations. These answers will be relevant in understanding whether e-learning content is an innovation for this sample. The following sections (questions 34-45) elicit specific formal responses about the technical aspects of the multimedia content that the participants have access to.

### *Interview Data*

This section reports a summarised representation of the interview data for a more in-depth format see Appendix D – Qualitative Analyses of the Interview Data.

As shown in Table 8, the respondents were between the age range of 55 - 81 years old (median=72). This sample integrates 25 participants, 16 (64%) female and 9 (36%) male, 88% (22/25) are already retired. Regarding the level of education, most of the respondents had at least a bachelor's degree (n=12; 48%). A few of them possessed masters (n= 3; 12%).

**Table 8**

#### *Sociodemographic Characteristics of Participants*

		Woman	Man	Total
N (%)		16 (64.0)	9 (36.0)	25 (100)
Age (mean ± SD)		69.6 ± 6.0	72.6 ± 7.7	70.6 ± 6.7
Marital Status	Married	11 (68.8)	9 (100)	20 (80)
N (%)	Divorced	4 (25)		4 (16)
	Widowed	1 (6.3)		1(4)
Education	High School	4 (25)	1 (11.1)	5 (20)
N (%)	Technical Course	2 (12.5)	3 (33.3)	5 (20)
	Bachelor	8 (37.5)	4 (44.4)	12 (48)
	Master	2 (12.5)	1 (11.1)	3 (12)
Employment	Working	3 (18.8)		3 (12)
N (%)	Retired	13 (81.3)	9 (100)	22 (88)

As shown in Table 9, all participants own a smartphone (n= 25; 100%). Most respondents own a laptop (n= 24; 96%) and a tablet (n= 13; 52%). Interestingly only a small number of respondents own a desktop computer (n=7; 28%), with some commenting how old fashioned it is compared to the laptop. A few had access to a smartwatch (n=3, 12%), most did not know the device.

**Table 9***Devices Owned by Participants*

Participants	N (%)			
Smartphone	Laptop Computer	Tablet	Desktop Computer	Smartwatch
25 (100)	24 (96)	13 (52)	7 (28)	3 (12)

Regarding their digital experience, as shown in Table 10, all participants remember having their first contact with ICT in the latter half of their adult life (n= 25; 100%). Their first memory is usually associated with their professional experience (n= 21; 84%). Another popular place is in ICT courses (n=14; 56%), especially when the desktop computer first appeared. According to the participants, the help of family and friends is the most valuable method to keep up to date with technological advances (n= 15; 60%), followed by daily use (n= 10; 40%). All of the respondents have an email (n= 25; 100%), with some mentioning that they use social media and communication tools such as Facebook (n= 21; 84%), Whatsapp (n= 11; 44%), Zoom (n= 11; 44%), Instagram (n= 10; 40%) and Skype (n= 10; 40%) to keep in touch with family and friends. Another practical use they see in technology is to gain knowledge by keeping informed with news websites (n= 16; 64%), and they frequently compare search engines like Google and Bing (n= 13; 52%) to the Encyclopedia. Very few reported having limitations regarding their digital experience, with the most pronounced being insecurity to explore new features that they are not familiar with (n= 6; 24%).

**Table 10***Digital Experience*

		Participants N (%)
First contact with ICT	Occurs in the workplace	21 (84)
	Occurs in ICT classes/training	14 (56)
Keeps up to date	With the help of family and/ or friends	15 (60)
	By using ICT devices daily	10 (40)
Digital Consumer Habits	Email	25 (100)
	Facebook	21 (84)
	News	16 (64)
	Google / Bing	13 (52)
	WhatsApp	11 (44)
	Zoom	11 (44)
	Instagram	10 (40)
Limitations	Skype	10 (40)
	Insecurities regarding owns' capabilities	6 (24)

As shown in Table 11, a little more than half of the participants are comfortable with commenting and interacting with online content (n= 14; 56%), while the other half admitted to rarely (n= 7; 28%) or never doing it (n= 4; 16%). The participants reported having very little interest in non-educational/informative video content, mostly watching it for music (n= 10; 40%) or exercise purposes (n= 8; 32%). On the other hand, more than half of the participants actively play games on their devices (n= 14; 56%).

**Table 11***Interaction & Multimedia*

		Participants N (%)
Content interaction	Frequently likes, comments and shares content online	14 (56)
	Rarely likes, comments and shares content online	7 (28)
	Never likes, comments and shares content online	4 (16)
Online videos	Enjoys short or/ and music videos	10 (40)
	Enjoys exercise videos	8 (32)
	Enjoys videos sent by friends	7 (28)
Online games	Frequently plays	14 (56)
	Never plays	10 (40)

As shown in Table 12, a big part of the participants rarely (n= 8; 32%) or never (n= 10; 40%) shop online, mentioning how little benefit they see in it and most of them (n= 18; 72%) revealing safety concerns, like hackers/scams/phishing, as the main reason. Even though the same number of participants (n= 18; 72%) trusts their devices to consult and manage important personal documentation such as health and finances related. Other main safety concerns are privacy (n= 14; 56%) and fake news (n= 12; 48%).

**Table 12***Online shopping & Safety*

		Participants N (%)
Online Shopping	Never	10 (40)
	Rarely	8 (32)
	Frequently	7 (28)
Safety	Comfortable with managing personal information online	18 (72)
	Mentions concerns regarding hacking/ phishing/ scams	18 (72)
	Mentions concerns regarding data privacy	14 (56)
	Mentions concerns regarding fake news	12 (48)
	Mentions concerns regarding publishing own content online	10 (40)

As shown in Table 13, almost all the participants listed knowledge (n= 22; 88%) and communication (n= 21; 84%) as the main advantages of technology, followed by facilitates (n= 14; 56%) and giving more options (n= 12; 48%). The technology disadvantages are more divided with hackers/ scams / phishing (n= 18; 72%) and lack of respect online (n= 14; 56%) being the most mentioned. Also time & dependency (n= 13; 52%), worries about shared content (n= 10; 40%), lack of control (n= 5; 20%) and human connection (n= 5; 20%), promoting the grey divide (n= 4; 16%) and excess of notifications (n= 4; 16%) are some of the participants' concerns.

**Table 13***Advantages and Disadvantages*

		Participants N (%)
Advantages	Knowledge openly available	22 (88)
	Enables and improves communication	21 (84)
	It makes certain aspects of life easier	14 (56)
	Provides with more options	12 (48)
Disadvantages	Mentions concerns regarding hacking/ phishing/ scams	18 (72)
	Lack of respect online	14 (56)
	Time-consuming and dependency	13 (52)
	Mentions concerns regarding publishing own content online	10 (40)

As shown in Table 14, when questioned about adult education institutions like senior universities, most reported not being a student in one (n= 20; 80%), even though half of the participants (n= 14; 56%) have frequent adult learning at some point in the past. Less than half of the participants (n= 11; 44%) had a positive review about the subject.

One of the most interesting moments of the interview was asking about recommendations on how to teach ICT, like the others, this question was often asked in a hypothetical scenario “If you had to teach someone ICT/ how to use their ICT device, how would you do it?”. The recommendations were varied, and even if some were more repeated than others, there is a lot of value in all of them. The main answer was to “talk slowly and show step-by-step” (n= 14; 56%), followed by “explaining how to communicate with friends and family” (n= 9; 36%). Other recommendations were: “interact with students” (n= 6; 24%), “create a need/ be very clear with the benefits” (n= 5; 20%), “teach how to organise the information” (n= 3; 12%), “understand what they already know and build from there” (n= 3; 12%), “congratulate and encourage a lot”(n= 3; 12%), “explain how difficult is to make real damage to the devices” (n= 3; 12%), “teach enough

that the person knows what it really needs to buy” (n= 2; 8%) and last “be careful with font size” (n= 1; 4%).

**Table 14***Education and Learning*

		Participants N (%)
Senior University	Does not attend	20 (80)
	Attends	4 (16)
	Has a positive opinion about it	11 (44)
	Has a negative opinion about it	8 (32)
Online /On-site Courses	Has attended/ is attending	14 (56)
	Does not show interest	7 (28)
	Shows interest	3 (12)
Teaching ICT suggestions	Articulate slowly and explain step-by-step	14 (56)
	Start by teaching how to communicate with family and friends	9 (36)
	Interact with the students and give feedback	6 (24)
	Create the need (describe clearly the benefits)	5 (20)
	Congratulate regularly and insist	3 (12)
	Understand what the user already knows and build from it	3 (12)
	Explain how difficult it is to damage the device	3 (12)
	Explain how to organise information	3 (12)

The last category of the interview sought to understand the level of digital literacy of the participants, which mainly was revealed organically during the conversation. Based on the European digital literacy board, the participants were rated A (foundation) / B (intermediate) / C (advanced) on their knowledge in five different subjects: information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving (Carretero et al., 2017). As shown in Table 15, most of the participants rated A/ B in all subjects, with very few rating C.

**Table 15***Digital Literacy*

	Literacy Level	Participants N (%)
Information and data literacy	A	4 (16)
	B	11 (44)
	C	10 (40)
Communication and collaboration	A	9 (36)
	B	13 (52)
	C	3 (12)
Digital content creation	A	19 (76)
	B	5 (20)
	C	1 (4)
Safety	A	16 (64)
	B	9 (36)
	C	0 (0)
Problem solving	A	21 (84)
	B	3 (12)
	C	1 (4)

## Define

The define section is split into two sections: the first presents five empathy maps, and the second presents the three personas built based on the data collected in the previous section.

### *Empathy Maps Data*

An empathy map is an easily understood chart divided into four squares, showing what the user says, does, thinks, and feels. Instead of a single user, I opted to create multiple-users/ aggregated empathy maps that cluster similar thoughts, opinions, or qualities inside each central theme. That way, I can identify groups with similar tendencies.

I used the interview data collected and transcribed it into a spreadsheet, and tabulated all the answers into categories and sub-categories (coding). Similar answers were grouped and quantified. For example, many participants remember their first contact with ICT in their workplace. I created the category 'First contact with ICT' under the major grouping of 'Digital Experience'. In front of 'First contact with ICT', I show the frequency of this specific answer, in this case (n=21; 84%). This way, I can quickly summarise and identify similar comments or opinions per the total sample's population and correspondent percentage.

These empathy maps break down all the points needed inside each dimension to determine how our new product can meet our sample's actual needs. The Says quadrant contains direct quotes from our users' interviews. The Thinks quadrant reflects what the users were thinking about the subject, mostly concealed from the dialogue but revealed in the way they share the information - body language, tone and other noticeable indicators. The Does quadrant focuses on how the user took or takes action when in contact with the subject. The Feels is the emotional quadrant; it exposes the true feelings about a subject or situation.

Our sample is made of complex humans, and some opinions can seem ambiguous or overlapping. The focus of this process was to cover every quadrant in all the dimensions with the researcher observations and collected documentation.

The primary purpose of these empathy maps was to analyse the transcript of the 25 user interviews collected in the previous step. Since it was a single-person process, I opted

for a tabulated system - in a spreadsheet, that does not compromise shareability. Once finished, the results were presented in the traditional graphic format. The interview data were collected and transcribed into a spreadsheet. The answers were aggregated in eight significant groups and 25 sub-categories. Six groups were relevant for the empathy mapping process: 'Digital experience', 'Devices', 'Interaction and Multimedia', 'Online Shopping and Safety', 'Advantages/ Disadvantages' and 'Education and Learning'. Excluding 'Demographics' and 'Digital Literacy', which are not opinion-based data, therefore not relevant for this process. Every answer shows their frequency, per total sample's population and correspondent percentage. According to the frequency shown in the previous Tables [8-15], 'Sticky notes' were generated for each quadrant of the six empathy maps, accompanied by a transcript reading. At this moment, the researcher decided to adapt the amount of relevant information to the process. Six empathy maps were created for a more detailed approach, corresponding to the relevant groups, instead of everything into one.

**Table 16***Empathy Map 1: Digital Literacy*

<ul style="list-style-type: none"> <li>· <i>"My first contact with ICT happened at work."</i></li> <li>· <i>"The company I worked for supported/ encouraged ICT learning through classes/ courses."</i></li> <li>· <i>"I keep up to date by using my devices on a day-to-day basis."</i></li> <li>· <i>"I ask my family and younger friends for help when I do not understand the device."</i></li> <li>· <i>"When I do not know something, I ask Google."</i></li> </ul> <p style="text-align: right;">Says</p>	<ul style="list-style-type: none"> <li>· There was a professional need to learn ICT The need for digital literacy was the biggest motivation to learn.</li> <li>· To learn ICT after retirement, you need time to sit down and experiment. Younger people adapted better to new technology than older ones.</li> <li>· ICT is resourceful. Is very aware of the amount of screen time he/she spends per day.</li> </ul> <p style="text-align: right;">Thinks</p>
<p style="text-align: right;">Does</p> <ul style="list-style-type: none"> <li>· Uses their devices to communicate every day.</li> <li>· Uses Google as an encyclopedia/ dictionary.</li> <li>· Reads news online.</li> <li>· Uses Facebook as the main social media network.</li> </ul>	<p style="text-align: right;">Feels</p> <ul style="list-style-type: none"> <li>· Empowered.</li> <li>· Satisfaction.</li> <li>· Pride.</li> <li>· Suspicious.</li> </ul>

**Table 17***Empathy Map 2: Devices*

<ul style="list-style-type: none"> <li>· "I mainly use the smartphone for communication purposes and laptop for the rest."</li> <li>· "If there is an attachment to the email, I have to use the laptop."</li> <li>· "I have to update my devices every five years because the devices cannot handle the new programs."</li> </ul> <p style="text-align: right;">Says</p>	<ul style="list-style-type: none"> <li>· Tablets are not helpful when already owning a smartphone and a laptop.</li> <li>· Devices should suit their needs.</li> <li>· The large number of possibilities their devices provides is a good thing.</li> <li>· Technology moves fast and can be overwhelming.</li> </ul> <p style="text-align: right;">Thinks</p>
<p style="text-align: right;">Does</p> <ul style="list-style-type: none"> <li>· Uses a smartphone as the main device, and laptop as a second.</li> <li>· Updates their devices every five years.</li> </ul>	<p style="text-align: right;">Feels</p> <ul style="list-style-type: none"> <li>· Grateful.</li> <li>· Pleased.</li> <li>· A little dependent.</li> <li>· Overwhelming (notifications).</li> </ul>

**Table 18***Empathy Map 3: Interaction and Multimedia*

<ul style="list-style-type: none"> <li>· "My first contact with ICT happened at work."</li> <li>· "The company I worked for supported/ encouraged ICT learning through classes/ courses."</li> <li>· "I keep up to date by using my devices on a day-to-day basis."</li> <li>· "I ask my family and younger friends for help when I do not understand the device."</li> <li>· "When I do not know something, I ask Google."</li> </ul> <p style="text-align: right;">Says</p>	<ul style="list-style-type: none"> <li>· A Big Brother is constantly observing and controlling every online behaviour.</li> <li>· It is not worth it to interact with online content unless it has a relevant contribution.</li> <li>· Online games can help improve their mental health.</li> <li>· The tablet format is perfect for playing games.</li> </ul> <p style="text-align: right;">Thinks</p>
<p style="text-align: right;">Does</p> <ul style="list-style-type: none"> <li>· Watches online videos with specific goals.</li> <li>· Prefers people talking and active voice in videos.</li> <li>· Trusts videos sent by friends.</li> <li>· Mainly uses Youtube for watching short or/ and music videos and exercising.</li> <li>· Trusts knowledge from educational videos.</li> </ul>	<p style="text-align: right;">Feels</p> <ul style="list-style-type: none"> <li>· Cautious</li> <li>· Vulnerable</li> <li>· Not in control of every action.</li> <li>· Overwhelmed (with choices).</li> <li>· More comfortable when the content is more humanised.</li> </ul>

**Table 19***Empathy Map 4: Online Shopping and Safety*

<ul style="list-style-type: none"> <li>· "I prefer buying products in physical stores rather than online ones."</li> <li>· "I feel more secure when I can associate a person (face) to the shop I am buying from."</li> <li>· "I like to use it as an excuse to go outside."</li> <li>· "I do not feel secure inserting my personal bank information online to buy things."</li> <li>· "I am comfortable using government platforms and home banking."</li> <li>· "I have some concerns with my privacy. I do not understand how my data is being used."</li> <li>· "I trust the ATM completely."</li> <li>· "I save my information in pens. I do not use the cloud."</li> </ul>	<ul style="list-style-type: none"> <li>· Online shops are not transparent with their location, owner, details and quality of the products they sell.</li> <li>· A certain degree of digital literacy is needed to perform an online purchase.</li> <li>· Hackers/ phishing/ scams are the worst outcome that can happen.</li> <li>· The cloud is difficult to understand.</li> <li>· Products always look better in pictures online.</li> <li>· Hotels, plane tickets and holiday-related bookings do not count as online shopping.</li> <li>· Inserting personal data in government websites/ platforms is safe.</li> </ul>
Says	Thinks
Does	Feels
<ul style="list-style-type: none"> <li>· Uses PayPal as a mediator for online shopping security.</li> <li>· Bends their beliefs if they find a good deal online.</li> <li>· Prefers to save the same information in several physical devices rather than use the cloud.</li> </ul>	<ul style="list-style-type: none"> <li>· Insecure.</li> <li>· Impersonal.</li> <li>· Cautious.</li> <li>· Exposed.</li> <li>· Stress.</li> <li>· Sceptical.</li> </ul>

**Table 20***Empathy Map 5: Advantages/ Disadvantages*

<ul style="list-style-type: none"> <li>· “Thanks to technology, knowledge is much greater, and it is no longer possible to hide things.”</li> <li>· "I live alone, and the internet is my help for everything."</li> <li>· "Technology has allowed us to have more freedom in the choices we make. It gives many options."</li> </ul> <p style="text-align: right;">Says</p>	<ul style="list-style-type: none"> <li>· Knowledge and communication are the most potent tools that ICT provides.</li> <li>· The ability to facilitate tasks that are harder without ICT is also a positive aspect. Living with ICT gives more options.</li> <li>· ICT brings transparency to the world and empowers its users.</li> </ul> <p style="text-align: right;">Thinks</p>
<p style="text-align: right;">Does</p> <ul style="list-style-type: none"> <li>· Does not share pictures/ videos or personal information.</li> <li>· Uses a third party when paying, like PayPal.</li> <li>· Has defensive behaviour when asked for personal information.</li> <li>· Controls the time and consumption of technology.</li> <li>· Uses technology to improve their quality of life as long as technology serves its needs, not the other way around. (user has to feel in control).</li> <li>· Uses technology as a facilitator for knowledge and communication.</li> <li>· Relies on technology in their day to day routine.</li> </ul>	<p style="text-align: right;">Feels</p> <ul style="list-style-type: none"> <li>· Knowledge, communication are the main positive aspects for the users, followed by 'facilitating' and 'more options'.</li> <li>· Hackers/ phishing/ scams and lack of respect online are the main negative for the users, followed by privacy concerns (data sharing) and dependency.</li> <li>· Fearful about losing control and technology taking over.</li> </ul>

**Table 21***Empathy Map 6: Education and Learning*

<ul style="list-style-type: none"> <li>· "Senior University is directed to a particular elderly public."</li> <li>· "No one goes to a Senior University to learn about an academic subject."</li> <li>· "The courses' hybrid regime (online and on-site) are very advantageous."</li> <li>· "It is not easy to learn about ICT."</li> <li>· "I like when my cousin explains to me, she is younger."</li> </ul> <p style="text-align: right;">Says</p>	<ul style="list-style-type: none"> <li>· (about Senior University) The principal praises are about the diversity of activities, social gatherings and organised visits outside the institution.</li> <li>· (about Senior University) The main complaints are related to the lack of learning and evaluation like an academic institution.</li> <li>· (about Courses) They like the online ones, some have frequented some, they consider a great alternative to the on-site ones, but they prefer the latter.</li> <li>· (about Courses) A few participants think they are too busy/ too tired mentally to attend a course and learn a new skill.</li> <li>· (about learning ICT) The main recommendation focuses on explaining slowly and step by step, approaching the communication subject first.</li> </ul> <p style="text-align: right;">Thinks</p>
<p style="text-align: right;">Does</p> <ul style="list-style-type: none"> <li>· Most of the participants do not attend a senior university.</li> <li>· Most of the participants that attend a senior university do it for</li> </ul>	<p style="text-align: right;">Feels</p> <ul style="list-style-type: none"> <li>· Senior Universities can be a good activity if your main goal is social engagement.</li> <li>· Senior Universities are not a</li> </ul>

social engagement.	good place for learning good skills at an academic level.
· Most of the participants are or were in a course to learn a new skill.	· Learning about technology is challenging.
	· Motivation is hard to find, but it can be driven by necessity.
	· Communication is the top motivation for a 55+ adult.

### *Personas Data*

The previously built empathy maps served as a first step in the creation of personas. Second, the analysis focused on looking for broad patterns in the transcript, interviewees opinions that had significant overlap with other interviewees in most of the critical themes (but not necessarily all). The most noticeable distinguishable characteristic was the participant's relation with ICT and how they incorporated technology daily. The participants were clustered into three comfort levels:

1. is very comfortable and interacts with it regularly,
2. is not very comfortable only interacts with it rarely,
3. is not comfortable, so it never interacts with it;

To cluster 1, I call them the liberals, the unafraid of technologies that keep a positive attitude. To represent the liberals, I created Lili (Figure 1). To cluster 2, I call them the moderates. This group has their reservations but makes an effort to use technologies when it sees fit. To represent the moderates, I created Mateus, the moderator (Figure 2). To cluster 3, I call them the conservatives. This group actively avoids using technology and makes an effort to keep it analogue. To represent the conservatives, I created Cora, the conservator (Figure 3).

## Figure 1

### User Persona 1: Liberal Lily

#### USER PERSONA

## Liberal Lily

*"When I don't know something, I ask Google."*

Lili is a 65-year-old newly retired nurse who lives with her husband and two cats in Porto, Portugal. She was already working for a few years when the hospital she was at made it mandatory for every professional to learn to use a computer. Being one of the youngest, Lili found it easy enough to adapt to the new technology quickly. She attended all the ICT courses that the hospital offered, and once she got over the insecurity of damaging the device, she decided to buy herself a desktop computer. She still uses it, but prefers her brand-new laptop to check her email, social networks and watch the news. As an active user of all her social accounts, she frequently likes, leaves comments and shares the content she finds attractive. She's currently taking a photography course at the senior university and learning how to publish her experiments on Instagram. During quarantine, her son taught her how to do online shopping, and now she uses it often with minimal reservations. She also enjoys listening to music, playing candy crush and Duolingo on her tablet and smartphone. She's planning to buy a smartwatch next to keep better track of her health status.



**Gender** Female

**Age** 65

**Marital Status** Married

**Household** 2

**Professional Status** Retired

**Academic Degree** Master's

#### Advantages of ICT usage

- Knowledge openly available;
- Enables and improves communication;
- Provides with more options;
- It makes certain aspects of life easier;
- Easy of 'resetting the device and starting over;

#### Disadvantages of ICT usage

- Mentions concerns regarding hacking/ phishing/ scams;
- Fake News;
- Mentions concerns regarding data privacy;

## Figure 2

### User Persona 2: Moderate Mateus

#### USER PERSONA

## Moderator Mateus

*"I have some concerns regarding my privacy. I don't understand how my data is being used."*

Mateus is a 70-year-old retired secondary school teacher who lives with his wife in Lisbon, Portugal. When the school where he worked abandoned paper and started digitizing information, Mateus attended several ICT courses to adapt and learn how to use a computer, but he could never completely overcome his insecurities regarding the device. Today he uses a laptop to check his email, social networks and watch the news. Mateus completely trusts government websites but would never do any online shopping. Afraid someone would steal his bank details. Sometimes, he also uses his wife's tablet to see educational, music and exercise videos. Mateus never likes, comments or shares the videos and is happy with his devices' short and passive use. He doesn't want to and could never use them for more than a few hours straight because of his tired eyesight. He doesn't hesitate to ask his family and younger friends for help with any ICT-related difficulties.



**Gender** Male

**Age** 70

**Marital Status** Married

**Household** 2

**Professional Status** Retired

**Academic Degree** Bachelor's

#### Advantages of ICT usage

- Knowledge openly available;
- Enables and improves communication;
- Provides with more options;
- It makes certain aspects of life easier;

#### Disadvantages of ICT usage

- Mentions concerns regarding hacking/ phishing/ scams;
- Time-consuming and dependency;
- Mentions concerns regarding publishing own content online;
- Mentions concerns regarding data privacy;
- Lack of respect online;

**Figure 3***User Persona 3: Conservator Cora***USER PERSONA****Conservator Cora**

*"It is not easy to learn about ICT."*

Cora is a 75-year-old retired nanny who lives alone in Algarve, Portugal. She was the oldest of five sisters and started working very early in life. At 52, a health problem sent her to early retirement. Cora never interacted much with ICT devices and first touched a computer while caring for a 10-year-old who needed help with her school homework. She always preferred the "old" way of doing things and never made a real effort to understand technology. Cora doesn't remember how old her cellphone is and claims to prefer her landline anyway. She has an email that she rarely uses and learned how to use WhatsApp with the help of a younger friend to video call her children during quarantine. When she doesn't have any other option, she trusts her daughter to use government or bank websites on her behalf. Cora is not interested in Senior Universities or adult education and thinks of herself as too old. If the weather allows it, she spends her days outside, taking care of her garden or walking on the beach.



**Gender** Female

**Age** 75

**Marital Status** Widow

**Household** 1

**Professional Status** Retired

**Academic Degree** 12th Grade

**Advantages of ICT usage**

- Enables and improves communication;
- Provides with more options;

**Disadvantages of ICT usage**

- Mentions concerns regarding hacking/ phishing/ scams;
- Time-consuming and dependency;
- Mentions concerns regarding publishing own content online;
- Mentions concerns regarding data privacy;

## Ideate

The Ideate section presents the brainstorming stage where the SCAMPER method is used.

### *Brainstorm*

The following Table 22 presents an excerpt of the most relevant ideas of the brainstorming stage. For a more in-depth representation, please consult Appendix G.

**Table 22**

*SCAMPER Instrument*

SCAMPER	Previous solutions	New solutions
Substitute	Fixed script.	Fill in script adaptable to each narrator.
Combine	Animation.	Live-action and minimal animation.
	Based on secondary research.	Based on primary and secondary research.
	Original script.	Original Script with narrator introduction and farewell.
Adapt	Superficial visualisation of similar products.	Benchmarking and comparative study.
Modify	No narrator.	Connecting with the user through the narrator.
Put another use	Inform the user about ICT.	Inspire users to participate as narrators in the following videos.
Eliminate	Subtitles in the video.	Optional subtitles.
	Music.	No music.
Reverse	One screen.	Split-screen.
	Bright colour palette.	Sober colour palette.
	No narrator.	Visible narrator.

Simplified illustrations.

Realistic illustrations.

No voice narrating the  
content.

Voice narrating the content.

---

## Prototype

In this stage, I developed two prototypes. For the pre-production phase, I created two scripts and three storyboards based on the previous steps. The scripts corresponded to the “What is a desktop computer?” and “What is a laptop?”, the first two lessons of the project ICTskills4All.

Once completed, I advanced to the casting phase. Because of COVID-19 and to keep the filming set safe for everyone involved, the narrators chosen are both adults 55+ from my close circle.

The production phase lasted a day, with the first hours serving for preparing and rehearsing. Both narrators were naturally talented communicators, and the filming stage went by smoothly. The material used was a Nikon 3100 camera supported on filming tripe and a fireball USB microphone. I also opted to use natural light with reflectors to balance harsh shadows for a more natural look.

After collecting all the material, I used Adobe Suite software to edit, enhance and correct the content.

### *Script*

The previously established script served as a base for the creation of the new script. To be evaluated against each other, both scripts needed to contain the same information. The new script focused on a more empathetic approach, with the narrator revealing bits about oneself. The main differences of the new script are:

1. Narrator's introduction.
2. Narrator's first memory with the technology.
3. Narrator's learning story with the device.
4. Narrator's opinion on “why should a person learn more about technology?”
5. Narrator's opinion on “what advantages and benefits does it bring?”
6. [Original script]
7. Narrator's final recommendations to the audience.
8. Narrator's farewell.

Except for point 6, all the points are freely conducted and only scripted by the narrator. For a more in-depth visualisation of both scripts, consult Appendix H.

### *Storyboard*

During this stage, I developed the concepts and experimented on different ideas based on the brainstorming results, user feedback and secondary research. The storyboard's end goal was to reflect the findings and decide on an adequate look for the ICT audiovisual learning content. Based on the rule of thirds, with an occidental reading from left to right, the layout structure high contrast is meant to create a visual division between the narrator and the text and imagery, just like a book. The narrator's white frame seems to overlap the dark background, giving it more importance. The circle frame around the narrator centres the person in the space. The type font used is Poppins, an easy to read sans-serif font with an adequate size proportional to the screen. The layout and sober colour palette are used consistently during the video, with minimal animation for a more natural look. The illustration style is realistic for a more pragmatic reading of the devices. The end screen puts the narrator on the front and centre of the layout to connect more with the audience.

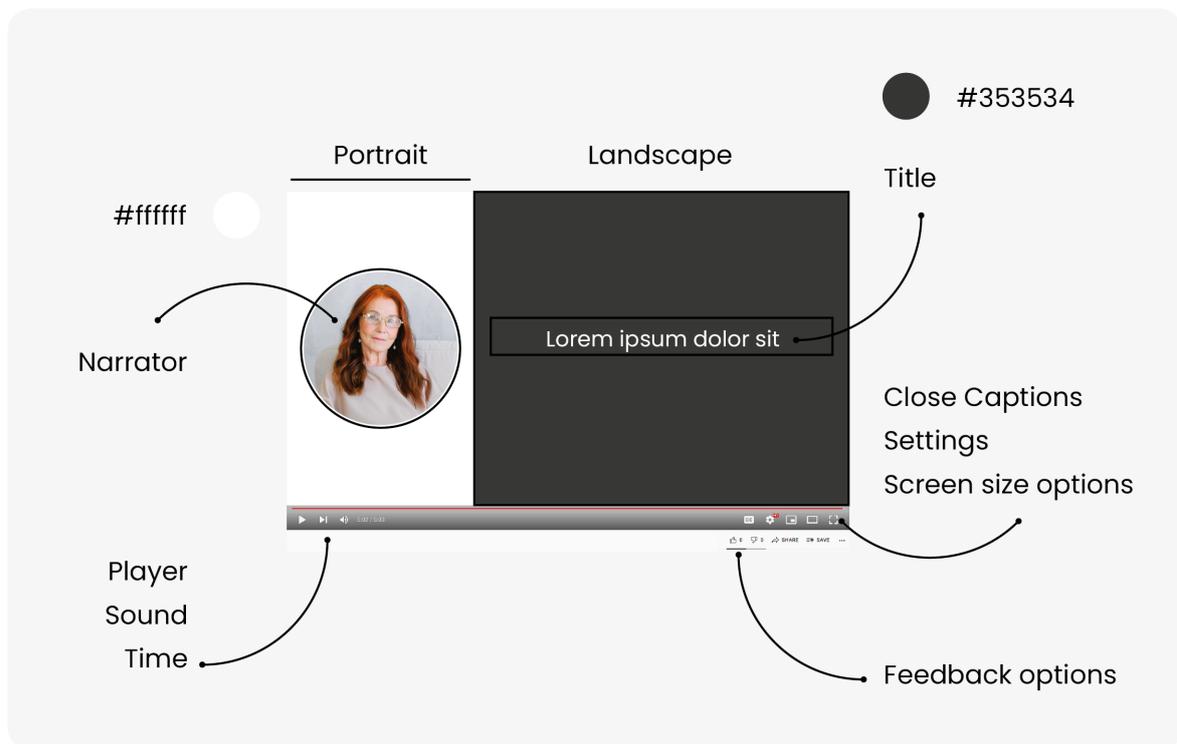
This project only focuses on the design of the content itself, not on the player, but for a more realistic experience, I decided to use Youtube player tools for a more in-context approach since it is a well designed and complete set. Nowadays, video players offer more controls than ever before that can aid the user to personalise their visualisation experience. Some of those tools are:

- Play/Pause button.
- Timeline.
- Skip to the following video.
- Adjust volume.
- Toggle for subtitles or closed captions.
- Adjust screen size.
- Change video quality.
- Adjust video player speed.
- Toggle to enable autoplay functionality.
- Rewind and fast-forward.
- The feedback system of the player is also impressive, allowing users to share easily, comment and rate the content.

The following figures show the last version of the storyboards. Figure 4 shows the final version of the styles frames for the title screen. It can be used for the introduction accompanied with the title and topics without figure complements. Figure 5 presents how the figure complements can be used in this layout. Lastly, figure 6 is designed for the end screen, clean background with the user in the centre.

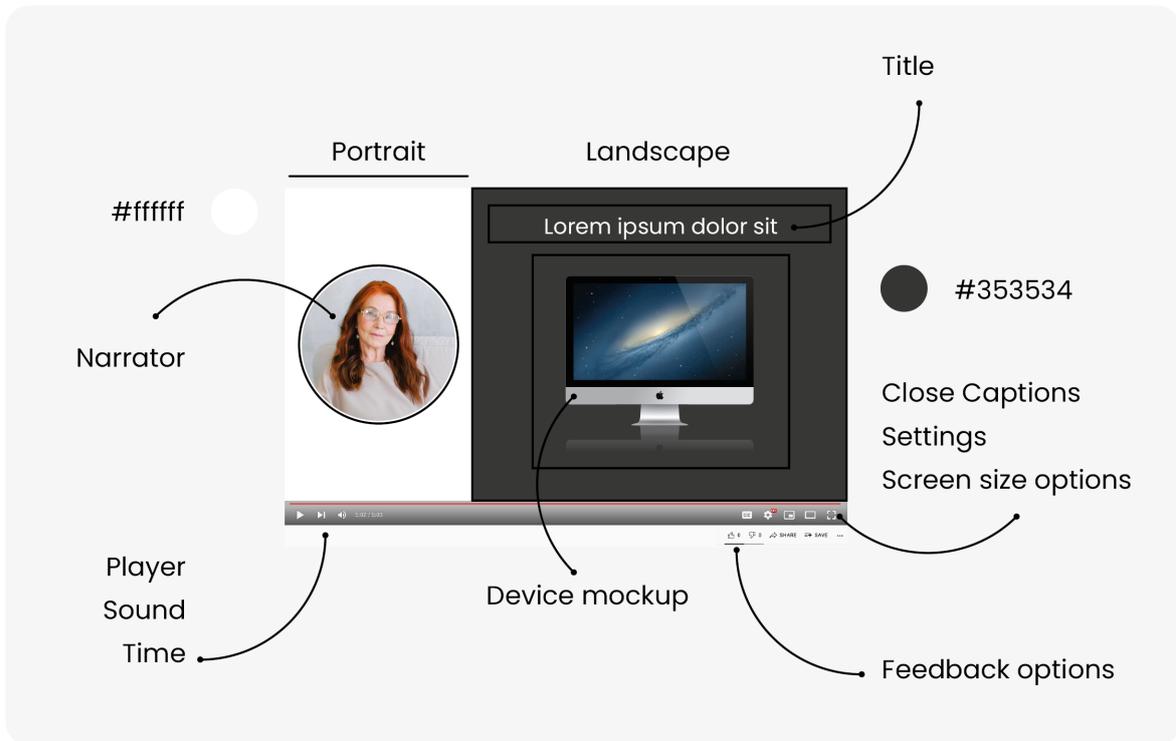
#### Figure 4

*Storyboard 1: Title screen for introduction and topics without figure complements*



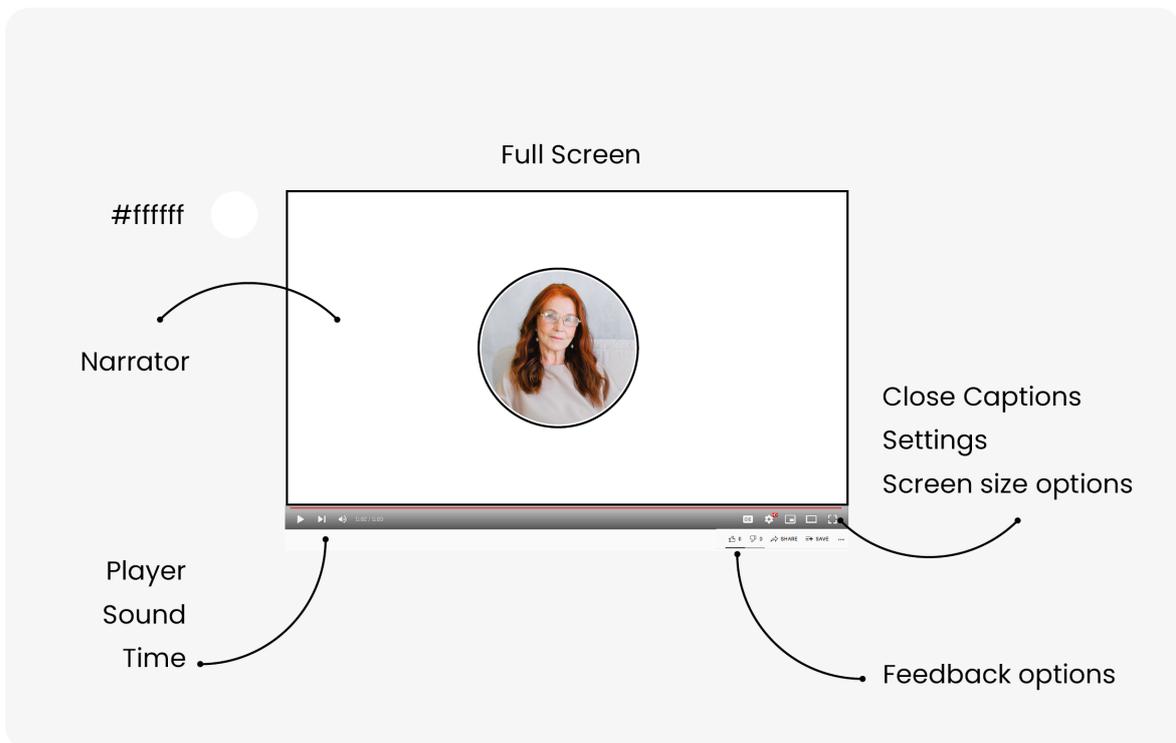
**Figure 5**

*Storyboard 2: Title screen for topics with figure complements*



**Figure 6**

*Storyboard 3: End screen*



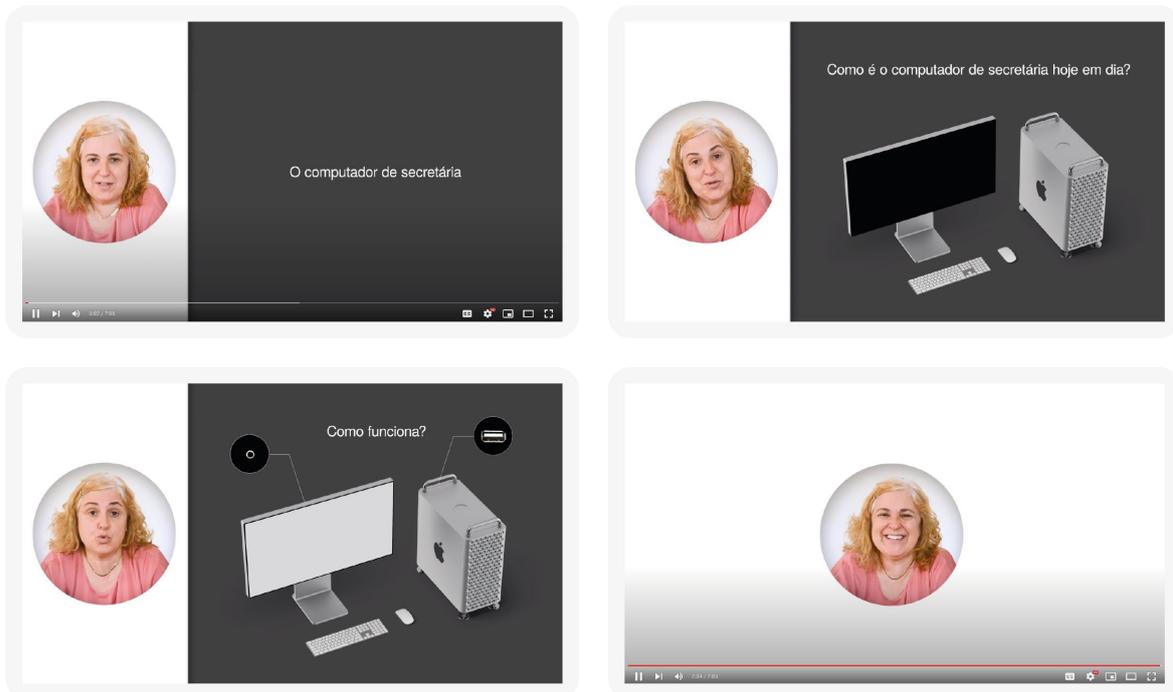
The final prototypes were uploaded to Youtube and can be accessed at the following links:

- Prototype 1: <https://www.youtube.com/watch?v=S8b97tKknQc>
- Prototype 2: <https://www.youtube.com/watch?v=pSIkEH73ukE>

Figures 7 & 8 show frames of the final prototypes.

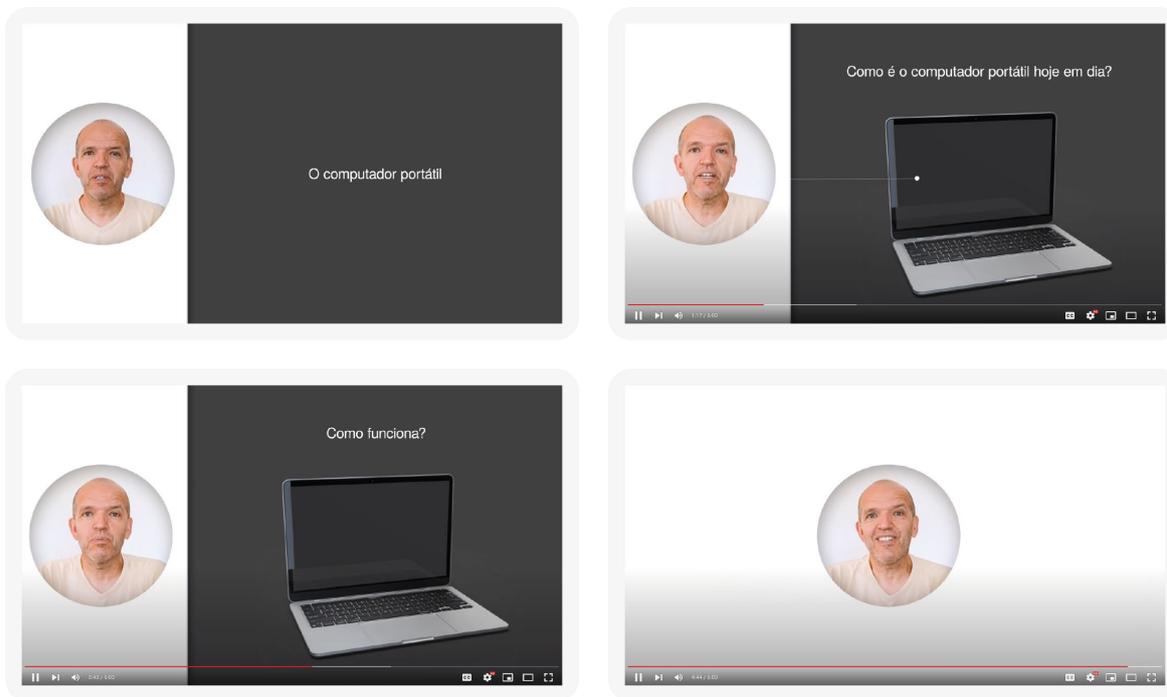
### Figure 7

#### *Prototype 1 – video A*



**Figure 8**

*Prototype 2 – video C*



## Test

For clarity and for an easier to follow reading, I'll be coding the videos developed with the co-creation process as video A[co] and C[co], and the previous created without the co-creation process as video B[n-co] and D[n-co].

The tests conducted used the prototypes built in the previous phase videos A[co] and C[co] and the previous created videos B[n-co] and D[n-co]. The previous sample was sent a link to an online questionnaire of four sections to collect feedback on each content to determine the preferred model (see Appendix E).

### *Survey*

The structure that underlies the online questionnaire can be consulted in Appendix E. As described in chapter 3, the questionnaire presented to the sample is an instrument of evaluation for videos A[co], B[n-co], C[co] and D[n-co]. Video A[co] and B both correspond to the theme “What is a desktop computer?”. Video C[co] and D[n-co] both correspond to the theme “What is a laptop?”.

### *Results*

The same 25 participants of the previous steps were asked to fill in the questionnaire. Of these, 15 participants (six males and nine females) completed the task. A table of the sociodemographic characteristics of the participants is presented in Table 23.

**Table 23***Sociodemographic Characteristics of Participants*

		Woman	Man	Total
N (%)		9 (60.0)	6 (40.0)	15 (100)
Age (mean ± SD)		69.6 ± 6.0	72.6 ± 7.7	70.6 ± 6.7
Marital Status	Married	7 (46.6)	6 (40.0)	13 (86.6)
N (%)	Divorced	2 (13.3)		2 (13.3)
	Widowed			
Education	High School	2 (13.3)	1 (6.6)	3 (20)
N (%)	Technical Course	2 (13.3)	3 (20)	5 (33.3)
	Bachelor	3 (20)	1 (44.4)	4 (16.6)
	Master	2 (13.3)	1 (11.1)	3 (20)
Employment	Working	2 (13.3)		2 (13.3)
N (%)	Retired	7 (46.6)	6 (40.0)	13 (86.6)

*Quantitative Analysis*

The UEQ-S (Schrepp, 2016) scale can be split into the pragmatic quality and hedonic quality. Values between -0.8 and 0.8 represent a neutral evaluation of the corresponding scale, values > 0,8 represent a positive evaluation and values < -0,8 represent a negative evaluation. The range of the scales is between -3 (horribly bad) and +3 (extremely good). Due to calculations of means is extremely unlikely to observe extreme values such as above +2 or below -2 (Laugwitz et al., 2008).

The responses from the completed questionnaires are summarised in Tables 24-27, one for each video. Table 28 shows the overall results of each video for comparison purposes.

Concerning video A[co], most evaluations are positive, with the highest being in the pragmatic quality scale, with “easy” (2.5) and “clear” (2.5) getting the highest values, closely followed by “supportive” (2.2). In contrast, the lowest but still neutral evaluations are “leading edge” (0.1) and “inventive” (0.2) inside the hedonic quality scale (Table 23).

**Table 24***Results Video A[co]*

Item	Mean	Variance	Std. Dev.	No.	Negative	Positive	Scale
1	2.2	0.6	0.8	15	obstructive	supportive	Pragmatic Quality
2	2.5	0.7	0.8	15	complicated	easy	Pragmatic Quality
3	1.9	1.7	1.3	15	inefficient	efficient	Pragmatic Quality
4	2.5	0.7	0.8	15	confusing	clear	Pragmatic Quality
5	0.8	2.7	1.7	15	boring	exciting	Hedonic Quality
6	1.3	3.2	1.8	15	not interesting	interesting	Hedonic Quality
7	0.2	4.0	2.0	15	conventional	inventive	Hedonic Quality
8	0.1	3.8	2.0	15	usual	leading edge	Hedonic Quality

Concerning video B[n-co], all the evaluations are positive, with the highest being in the pragmatic quality scale, with “easy” (2.3) and “supportive” (2.0) getting the highest values. In contrast, the lowest but still neutral evaluations are “leading edge” (0.5) and “inventive” (0.9) inside the hedonic quality scale (Table 24). Compared to video A[co] 's results, the results of video B[n-co] are more homogeneous but very similar.

**Table 25***Results Video B[n-co]*

Item	Mean	Variance	Std. Dev.	No.	Negative	Positive	Scale
1	2.0	0.9	0.9	15	obstructive	supportive	Pragmatic Quality
2	2.3	1.1	1.0	15	complicated	easy	Pragmatic Quality
3	1.7	3.0	1.7	15	inefficient	efficient	Pragmatic Quality
4	1.8	2.7	1.7	15	confusing	clear	Pragmatic Quality
5	1.1	2.2	1.5	15	boring	exciting	Hedonic Quality
6	1.3	2.6	1.6	15	not interesting	interesting	Hedonic Quality
7	0.9	2.5	1.6	15	conventional	inventive	Hedonic Quality
8	0.5	2.6	1.6	15	usual	leading edge	Hedonic Quality

Concerning video C[co], all the evaluations are positive, with the highest being in the pragmatic quality scale, with “clear” (2.2) and “supportive” (2.1) getting the highest values, closely followed by “easy” (2.0) and “efficient” (1.9). A bit lower but still in the positive spectrum, “leading edge” (1.0) and “inventive” (0.9) inside the hedonic quality scale (Table 25).

**Table 26***Results Video C[co]*

Item	Mean	Variance	Std. Dev.	No.	Negative	Positive	Scale
1	2.1	0.8	0.9	15	obstructive	supportive	Pragmatic Quality
2	2.0	0.7	0.8	15	complicated	easy	Pragmatic Quality
3	1.9	1.1	1.0	15	inefficient	efficient	Pragmatic Quality
4	2.2	1.9	1.4	15	confusing	clear	Pragmatic Quality
5	1.0	2.6	1.6	15	boring	exciting	Hedonic Quality
6	1.3	2.2	1.5	15	not interesting	interesting	Hedonic Quality
7	1.1	2.1	1.4	15	conventional	inventive	Hedonic Quality
8	1.0	1.9	1.4	15	usual	leading edge	Hedonic Quality

Concerning video C[co], all the evaluations are positive with values very close to each other, with the highest being in the pragmatic quality scale, with “clear” (2.1) and “easy” (2.0) getting the highest values, closely followed by “supportive” (1.9). A bit lower but still in the positive spectrum, “interesting” (0.8) and “exciting” (0.9) inside the hedonic quality scale (Table 26). Compared to video C[co]’s results, the results of video D[n-co] are more homogeneous but very similar.

**Table 27***Results Video D[n-co]*

Item	Mean	Variance	Std. Dev.	No.	Negative	Positive	Scale
1	1.9	1.1	1.1	15	obstructive	supportive	Pragmatic Quality
2	2.0	1.1	1.1	15	complicated	easy	Pragmatic Quality
3	1.3	2.6	1.6	15	inefficient	efficient	Pragmatic Quality
4	2.1	1.8	1.4	15	confusing	clear	Pragmatic Quality
5	0.9	2.0	1.4	15	boring	exciting	Hedonic Quality
6	0.8	2.2	1.5	15	not interesting	interesting	Hedonic Quality
7	1.1	1.4	1.2	15	conventional	inventive	Hedonic Quality
8	1.1	1.6	1.3	15	usual	leading edge	Hedonic Quality

Overall the results are all positive and very similar, with video C[co] having the highest value of 1.567, second by video B[n-co] (1.450), followed by A (1.433) and D (1.383). The results vary when comparing the videos A[co] & C[co] with videos B[n-co] & D[n-co]. In the “what is a desktop computer?” theme, video A[co] has a slightly lower value (1.433) than video B[n-co] (1.450), but looking into the qualities of the video, video A[co] has a superior value in pragmatic qualities. In contrast, video B[n-co] has a superior value in hedonic qualities. In the “what is a laptop?” theme, video C[co] has a higher value (1.567) than video D[n-co] (1.383), with both qualities of the video – pragmatic and hedonic - with superior values.

**Table 28***Overall Results of Videos A, B, C, D*

	Video A[co]	Video B[n-co]	Video C[co]	Video D[n-co]
Pragmatic				
Quality	2.267	1.950	2.050	1.817
Hedonic				
Quality	0.600	0.950	1.083	0.950
Overall	1.433	1.450	1.567	1.383

*Qualitative Analysis*

Two open-ended questions followed the visualisation of the videos of each section: “What most liked?” and “What least liked”, the questions were not mandatory, and not all the participants answered them. The codes created are split into two categories positive and negative feedback.

In the positive feedback, the codes are as follows:

- Aesthetics – meaning the visuals, animations, movement.
- Clear communication – the communication is presented in a clear and concise format.
- Connection – the viewer mentions empathy towards the narrator.
- Easy to follow – the feedback mentions how understandable it can be for a person with limited to no digital skills.
- Engaging – the feedback encourages and motivates the viewer
- Informative – the feedback mentions educative purposes.
- Narrator appreciation – the feedback is related to the narrator interventions.
- Theme appreciation – the feedback mentions the importance of the video theme.

In the negative feedback, the codes are as follows:

- Basic – too easy.
- Distractive – too much clutter.
- Inappropriate music – loud or disturbing music.

- Limited information – incomplete explanation on the subject.
- Missing narrator – missing a human explainer on camera.
- Nothing – no negative feedback.
- Outdated theme – the theme is no longer relevant.
- Repetitive – the information is repeating itself.
- Speed (too fast) – not enough pauses to assimilate.
- Too informal – concerning the language.

Table 29 shows the frequency of the sample's opinion, with the number of similar opinions/ total number of answers to a specific open-ended question, to each video. According to the respondents, video A[co] strengths are "clear communication" (8/15) and "easy to follow" (6/15), and weaknesses are "basic" (2/12) and "limited information" (2/12). Video B[n-co] strengths are "aesthetics" (7/14) and "clear communication" (5/14), and weakness are "basic" (3/14) and "missing narrator" (2/14). Video C[co] strengths are "clear communication" (10/15) and "theme and narrator appreciation" (3/15), and weaknesses are "limited information" (3/13) and "basic" (2/13). Video D[n-co] strengths are "clear communication" (7/13) and "easy to follow" (5/13), and weaknesses are "limited information" (3/13), "inappropriate music" (2/13) and "repetitive" (2/13).

**Table 29***Results of Videos A, B, C, D Qualitative Analysis*

		Video	Video	Video	Video
	Codes	A[co]	B[n-co]	C[co]	D[n-co]
Positive	Aesthetics	1/15	7/14		2/13
	Clear				
	communication	8/15	5/14	10/15	7/13
	Connection	1/15			
	Easy to follow	6/15	2/14	2/15	5/13
	Engaging	1/15		1/15	
	Informative		1/14		
	Narrator				
	appreciation	4/15		3/15	
	Theme				
appreciation	1/15		3/15	2/13	
Negative	Basic	2/12	3/14	2/13	
	Distractive				1/13
	Inappropriate				
	music		1/14		2/13
	Limited				
	information	2/12	1/14	3/13	4/13
	Missing narrator		2/14		1/13
	Nothing	6/12	6/14	7/13	4/13
	Outdated theme	1/12	1/14		
	Repetitive	1/12		1/13	2/13
	Speed (too fast)		1/14		
	Too informal	1/12			

## Chapter 5: Discussion and Findings

According to the test results, the prototypes built for ICT audiovisual learning can be a valuable tool for adults 55+ looking for entering the digital world. Overall, the participants found the final version of the prototypes positive; nevertheless, there are comments about deficiencies in the layout, content, and script. The group varied in their preference, sometimes creating antagonistic opinions, but the final ratings were very similar, even if visually they are very far apart. Co-creation content did get better results, but with a minimal difference in values from the content developed without co-creation.

In general, when digital education is not introduced early as a part of the person's work functions, it becomes much harder to incorporate and adapt to ICT and consequently find ICT audiovisual learning. Limitations such as insecurities regarding own' capabilities, lack of accessibility to the devices or Internet and learning without family/ friend's support can prevent adults 55+ from connecting in web-based education. Our sample was mostly made of beginners to intermediate level users and no experts, who were happy to access ICT education at their own pace, but they also mentioned how vital a traditional classroom is for learning support. Also, sociodemographic variables such as: gender, age and academic degree did not reveal relevant differences in the users' perceptions.

Most agreed that the content created was beneficial for new users and had a favourable opinion overall. The results indicate that the choices made during the design process respected and comprehended the user's preferences. There are some points where opinions vary among participants. While some considered the content "easy to follow", others perceived it as too "basic". Because of this, it was not easy to judge which of the two was the most appropriate. It is not possible to develop a product that suits everybody learning requirements, but at this phase is not feasible to include detailed information in an introductory beginner video. It may be possible to direct the introductory information towards specific levels of digital literacy in the future.

This study also revealed that all the participants have access to a smartphone and use it as the primary communication tool. They firmly believe that this device is essential because it has multiple functionalities yet is small enough to be carried to many places. Our respondents would like the devices to work for them, make their lives better by

helping them to complete and manage daily activities. They do not want technology to interfere with their daily lives, and they do not want to make too much effort to keep up with the constant changes in technology. While specific physical or mental barriers exist, the fact is that the majority is willing to use technology. Despite the positive results, many are reluctant to use technology to its fullest potential due to fear that they can fall victim to phishing scams, hackers, and data breaches, resulting in loss of money, personal information, as well as cause other potential problems. In addition, they believe that technology can be time-consuming, and they are concerned with being too dependent on technology to do certain things. Participants enjoy activities facilitated by technology such as entertainment, communicating with their loved ones, exercising, and keeping up with the news.

Educating and helping adults 55+ on digital literacy can make them feel more secure and empowered as they use technology and improve their quality of life. Having said this, some adults still reveal difficulties in accessing good ICT education due to poor opportunities, costs and physical or mental barriers. According to the opinions collected, senior universities have not yet uniformized their users' perception ranging from learning institutions to social meeting points. And other more rigorous learning courses are aimed at professionals who are still active, not retired adults. This can be very discouraging for someone who is looking to start their digital literacy path. Because of that is important to create safe online spaces with professional revised content and proper safety measures, for adults 55+ can have more options and feel secure to use technology.

At this point of technological progress, adults 55+ should not need to adapt to new technology; technology should already be accessible, flexible, and reliable for people of all ages, including them. For that to happen is essential to study processes of creation and co-creation to produce solutions for more inclusive products. As this study results suggest, human-centric approaches can be a great way to produce content and a more meaningful experience for the designer and users, even with a small sample.

The small sample and the unequal distribution of gender, age and level of education among the participants might have biased the results. It would have been preferable to gather more participants and a more even distribution. This was direct consequence of its context, this study was developed inside the European Project ICTskills4All with an associated partner. For this reason, these results cannot be extrapolated to larger groups.

The respondents were all connected through the association APRE! with common hobbies and social habits, which probably limited the information gathered and the generalizability of the results.

Another relevant limitation concerns the data analyses. The data processing was performed by only one person, which can significantly influence the treatment of information. Therefore, it is crucial to read the transcripts of the interviews in the appendices for a broader view of the participants.

Based on these findings, a scientific article reporting the design thinking process was written and presented at the miOne world conference to contribute to human-centric design studies, and will later be published in IxD&A<sup>8</sup> (Interaction Design and Architecture) Journal. Also, the comparative study of active ICT learning websites for older users in 2020 from the benchmarking analysis – white paper- will be made available to guide future products. Moreover, ICT audiovisual learning content developed with a co-creation methodology based on design thinking will be available on the ICTskills4All educational platform.

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<sup>8</sup> IxD&A: IxD&A aims to offer an interdisciplinary arena where everybody can present top level researches and discuss ideas on the future of technology mediated experiences in the field of communication, learning, working, entertainment, healthcare, etc...) a future that can be made possible by a joint effort in research and education. Available at:

<http://interfacce.mifav.uniroma2.it/inevent/events/idea2010/index.php?s=102> (Date accessed: 27-10-2021)

# Conclusion

The results of this exploratory study contain evidence that involving end-users in the design process can lead to different visual results but similar rating values. The benefits of this action include a more understanding, specific and innovative experience for the designer, and hopefully to the participants as well. I found that combining the expert quality of a professional designer with the participants' expertise can enrich the quality of the solutions. Stepping back in certain stages of the process and acting as a facilitator can be very beneficial, especially if the goal is to comprehend the user's environment, opinions and behaviours like letting the users talk freely and use their opinions as valid recommendations. Also, sometimes it is essential to take charge as a professional designer, organise the collected data and act on the decision-making stages.

In analysis, this spectrum can be considered a guide, where the designer can study the advantages and disadvantages of its positioning and its participants concerning the project. The fact that one task tends towards one side does not negate that the next one may tend towards its opposite. In the case of this empirical study, there was a strong leaning towards a liberal approach, and therefore a semi-structured interview was conducted. The prototype was built with the narrators and evaluated by the users. However, as the designer, only I had access to the postproduction phase in the prototyping phase, leaning more towards a conservative approach. Involved users can be beneficial but they cannot replace the job of designers (Parsons, 2009). Maintaining this reflection during the different phases of the process extends the expectation about the autonomy of each contribution, nurturing new ways of looking at the authorship of a project.

This study aimed to contribute with audiovisual artefacts for the online platform ICTskills4All, co-designed and validated with end-users, improved digital literacy skills; and to the human-centred design field, with a qualitative study based on design thinking approach. One of the most important lessons learned about co-design is related to the value of open communication. I encourage all the creators to consider involving end-users in designing more inclusive and accessible products, even when presented with a small sample.

In the near future, I would like to test the designs with end-users non-participants in the product development cycle to gather more feedback and compare to the already

processed, understand biases, and collect recommendations for improving the product before launching it to a bigger audience.

When ending a project, there is a feeling of chronic incompleteness and finding items that could be enhanced. The project did not end because it was over. As an iterative process, there can be never-ending problem-solving solutions that grow and adapt to the world as it evolves. The project ended because it was time and responded to the problems it was set to solve, even if there could be more solutions. In this spirit, I hope to have an opportunity to elevate this process to a bigger scale, such as working on the whole platform, with a more extended timeframe, such as a Doctoral program can proportionate.

# References

- Abad-Alcalá, L. (2014). Media literacy for older people facing the digital divide: The e-inclusion programmes design. *Comunicar*, 21(42), 173–180.  
<https://doi.org/10.3916/c42-2014-17>
- American Psychological Association. (2021). *[Official guide to APA style][Publication Manual of the American Psychological Association: 7th Edition](9781433832161)* (17th ed.). hyun-am.
- Aposentados, Pensionistas e Reformados [APRe!]. (2021). *APRe! - Aposentados, Pensionistas e Reformados*. APRe! <https://www.apre-associaocivica.pt/>
- Battarbee, K., Suri, J. F., Howard, S. G., & IDEO. (2014). Empathy on the Edge, Scaling and Sustaining a Human-Centered Approach. *IDEO*. [https://new-ideo-com.s3.amazonaws.com/assets/files/pdfs/news/Empathy\\_on\\_the\\_Edge.pdf](https://new-ideo-com.s3.amazonaws.com/assets/files/pdfs/news/Empathy_on_the_Edge.pdf)
- Be Connected. (2017). *Be Connected - Every Australian online*. Retrieved October 2021, from <https://beconnected.esafety.gov.au/>
- Berner, J., Rennemark, M., Jogréus, C., & Berglund, J. (2011). Distribution of personality, individual characteristics and internet usage in Swedish older adults. *Aging & Mental Health*, 16(1), 119–126. <https://doi.org/10.1080/13607863.2011.602958>
- Börsch-Supan, A. (2019). *The Survey of Health, Ageing and Retirement in Europe (SHARE): Wave 6 (7.1.0) [Dataset]*. SHARE-ERIC.  
<https://doi.org/10.6103/SHARE.w6.710>
- Calisto, J. (2015). *Universidades da terceira idade e envelhecimento ativo: a Academia dos Saberes de Aveiro e a Universidade Sénior de Cacia: construção de pontes*. (Master's dissertation). Universidade de Aveiro.  
<https://ria.ua.pt/handle/10773/15531>
- Cambiano, R. L., Vore, J. B., & Harvey, R. L. (2001). Learning Style Preferences of the Cohorts: Generation X, Baby Boomers, and the Silent Generation. *PAACE Journal of Lifelong Learning*, Vol. 10. Published.  
<https://www.semanticscholar.org/paper/Learning-Style-Preferences-of-the-Cohorts%3A-X%2C-Baby-Cambiano-Vore/0ddc0313d10daf0356ae5a3ecfb3e2915a511b8>

- Camp, R. C. (2006). *Benchmarking: The Search for Industry Best Practices that Lead to Superior Performance* (1st ed.). Productivity Press.
- Carretero, S., Vuorikari, R., & Punie, Y. (2017). *DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use* (EUR 28558 EN). <https://doi.org/10.2760/38842>
- Coelho, A. R. (2017). Os seniores na sociedade em rede: dinâmicas de promoção da inclusão e da literacia digitais em Portugal. *ISCTE-Instituto Universitário de Lisboa*. Published. [http://cies.iscte-iul.pt/np4/?newsId=1309&fileName=CIES\\_WP213\\_AnaRitaCoelho.pdf](http://cies.iscte-iul.pt/np4/?newsId=1309&fileName=CIES_WP213_AnaRitaCoelho.pdf)
- Czaja, S. J., Lee, C. C., Branham, J., & Remis, P. (2012). OASIS Connections: Results From an Evaluation Study. *The Gerontologist*, 52(5), 712–721. <https://doi.org/10.1093/geront/gns004>
- Czaja, S. J., & Sharit, J. (2012). *Designing Training and Instructional Programs for Older Adults (Human Factors and Aging)* (1st ed.). CRC Press.
- Dam, R. F., & Siang, T. Y. (2019). *Stage 3 in the Design Thinking Process: Ideate*. The Interaction Design Foundation. Retrieved October 2021, from <https://www.interaction-design.org/literature/article/stage-3-in-the-design-thinking-process-ideate>
- Dam, R. F., & Siang, T. Y. (2020a). *Learn How to Use the Best Ideation Methods: SCAMPER*. The Interaction Design Foundation. Retrieved October 2021, from <https://www.interaction-design.org/literature/article/learn-how-to-use-the-best-ideation-methods-scamper>
- Dam, R. F., & Siang, T. Y. (2020b). *Stage 4 in the Design Thinking Process: Prototype*. The Interaction Design Foundation. Retrieved October 2021, from <https://www.interaction-design.org/literature/article/stage-4-in-the-design-thinking-process-prototype>
- Damant, J., Knapp, M., Freddolino, P., & Lombard, D. (2016). Effects of digital engagement on the quality of life of older people. *Health & Social Care in the Community*, 25(6), 1679–1703. <https://doi.org/10.1111/hsc.12335>
- Daré, A. C. (2010). Design de iluminação voltado aos idosos. *Reação*, 14(77), 8–11. [https://www.academia.edu/24296084/O\\_Design\\_de\\_Ilumina%C3%A7%C3%A3o\\_voltado\\_aos\\_idosos](https://www.academia.edu/24296084/O_Design_de_Ilumina%C3%A7%C3%A3o_voltado_aos_idosos)

- de Sales, M. B., & de Abreu Cybis, W. (2003, August). Development of a checklist for the evaluation of the web accessibility for the aged users. *Proceedings of the Latin American Conference on Human-Computer Interaction - CLIHC '03*. CLIHC '03: Proceedings of the Latin American conference on Human-computer interaction, Rio de Janeiro, Brasil. <https://doi.org/10.1145/944519.944533>
- Derungs Licht AG. (2016). *Lighting for Senior Care Good Lighting Enriching Life* (79.715.000.04/2016). [https://www.waldmann.com/waldmann-media/file/ff8081814a15bf61014ae3eacb03dd5.de.0/seniorenpflege\\_en.pdf](https://www.waldmann.com/waldmann-media/file/ff8081814a15bf61014ae3eacb03dd5.de.0/seniorenpflege_en.pdf)
- Digital Access. (2017). *Digital Access – Digital skills for people living in the 3rd age – Effective access to public services*. Retrieved October 2021, from <http://digital-3rd-age.eu/>
- Eberle, B. (2008). *Scamper: Creative Games and Activities for Imagination Development (Combined ed., Grades 2–8)* (1st ed.). Routledge.
- European Commission. (2018). *Women's situation in the labour market*. European Commission - European Commission. Retrieved October 2021, from [https://ec.europa.eu/info/policies/justice-and-fundamental-rights/gender-equality/women-labour-market-work-life-balance/womens-situation-labour-market\\_en](https://ec.europa.eu/info/policies/justice-and-fundamental-rights/gender-equality/women-labour-market-work-life-balance/womens-situation-labour-market_en)
- Eurostat. (2019). *Ageing Europe - statistics on population developments - Statistics Explained*. European Commission. Retrieved October 2021, from [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Ageing\\_Europe\\_-\\_statistics\\_on\\_population\\_developments](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Ageing_Europe_-_statistics_on_population_developments)
- Ferreira, S. (2013). *Tecnologias de informação e comunicação e o cidadão sénior : estudo sobre o impacto em variáveis psicossociais e a conceptualização de serviços com e para o cidadão sénior* (Thesis). Universidade de Aveiro. <http://hdl.handle.net/10773/12336>
- Ferreira, S., & Veloso, A. I. (2019). Older Adults in ICT Contexts: Recommendations for Developing Tutorials. *Human Aspects of IT for the Aged Population. Design for the Elderly and Technology Acceptance*, 376–387. [https://doi.org/10.1007/978-3-030-22012-9\\_27](https://doi.org/10.1007/978-3-030-22012-9_27)

- Frigola, G. (2021). *Universal design, inclusive design, and equity-focused design*. Medium. Retrieved October 2021, from <https://medium.com/@genis.hti/universal-design-inclusive-design-and-equity-focused-design-df51e1e9d4f0>
- GCFGlobal. (1998). *Free Online Learning at GCFGlobal*. GCFGlobal.Org. Retrieved October 2021, from <https://edu.gcfglobal.org/en/>
- Gibbons, S. (2018). *Design Thinking 101*. Nielsen Norman Group. Retrieved October 2021, from <https://www.nngroup.com/articles/design-thinking/>
- Glisky, E. L. (2007). Changes in Cognitive Function in Human Aging. In D. R. Riddle (Ed.), *Brain Aging: Models, Methods, and Mechanisms.: Vol. Ed.* (p. Chapter 1). CRC Press/Routledge/Taylor & Francis Group. <https://doi.org/10.1201/9781420005523>
- Gray, D. E. (2014). *Doing Research in the Real World* (3rd ed.). SAGE Publications. [https://www.researchgate.net/publication/239938424\\_Doing\\_Research\\_in\\_the\\_Real\\_World\\_3rd\\_edition](https://www.researchgate.net/publication/239938424_Doing_Research_in_the_Real_World_3rd_edition)
- Greenwood, D. J., & Levin, M. (2006). *Introduction to Action Research: Social Research for Social Change* (2nd ed.). SAGE Publications, Inc. <https://doi.org/10.4135/9781412984614>
- Hendry, C., Farley, A., & McLafferty, E. (2012). Anatomy and physiology of the senses. *Nursing Standard*, 27(5), 35–42. <https://doi.org/10.7748/ns2012.10.27.5.35.c9332>
- ICTskills4All. (2018). *ICTskills4All – Empowering old adult citizens for a Digital World*. Retrieved October 2021, from <https://www.up.pt/ictskills4all/>
- Interaction Design Foundation [IXDF]. (2015a). *What is Design Thinking?* The Interaction Design Foundation. Retrieved October 2021, from <https://www.interaction-design.org/literature/topics/design-thinking>
- Interaction Design Foundation [IXDF]. (2015b). *What is Usability?* The Interaction Design Foundation. Retrieved October 2021, from <https://www.interaction-design.org/literature/topics/usability>
- Isle, B. A., Denno, S., & Metz, S. V. (1992). *Human Factors Design Guidelines for Elderly and People with Disabilities*. Minneapolis: Honeywell. Published. <https://www.cs.cmu.edu/~khaigh/ILSAEXTERNALWEBSITE/content/publications/1992-HumanFactors.pdf>

- Laugwitz, B., Held, T., & Schrepp, M. (2008). Construction and Evaluation of a User Experience Questionnaire. *Lecture Notes in Computer Science, Lecture Notes in Computer Science, Vol. 5298*, 63–76. [https://doi.org/10.1007/978-3-540-89350-9\\_6](https://doi.org/10.1007/978-3-540-89350-9_6)
- Lavrakas, P. (2008). *Encyclopedia of Survey Research Methods*. Thousand Oaks, CA: SAGE Publications Ltd., 1. <https://doi.org/10.4135/9781412963947>
- Lister, C., West, J. H., Cannon, B., Sax, T., & Brodegard, D. (2014). Just a Fad? Gamification in Health and Fitness Apps. *JMIR Serious Games*, 2(2), e9. <https://doi.org/10.2196/games.3413>
- Lourenço, L. (2018). *Contributos do Design Inclusivo na Autonomia e Independência dos Idosos* (Master's dissertation). Universidade Nova de Lisboa. [https://www.repository.utl.pt/bitstream/10400.5/18266/1/%22Contributos%20do%20design%20na%20autonomia%20e%20independ%C3%Aancia%20dos%20idosos...%22\\_Let%C3%ADcia%20Louren%C3%A7o.pdf](https://www.repository.utl.pt/bitstream/10400.5/18266/1/%22Contributos%20do%20design%20na%20autonomia%20e%20independ%C3%Aancia%20dos%20idosos...%22_Let%C3%ADcia%20Louren%C3%A7o.pdf)
- Midão, L., Pedreiro, E., Pinho, M. S., Dias, I., Almada, M., Garcia, K. R., Rodrigues, L. S., Christensen, C., Pereira, P. T., Bertram, M., Busse, G., Quarta, B., Poulain, M. M., Heery, D., Ruseva, G., Irbe, M. M., Amaral, M., & Costa, E. (2020). Computer Skills Among the Community-Dwelling 55+ European Population Based on Survey of Health, Ageing, and Retirement in Europe. *International Journal of Digital Literacy and Digital Competence*, 11(1), 31–45. <https://doi.org/10.4018/ijldlc.2020010102>
- miOne. (2020). *miOne*. Retrieved October 2021, from <https://mione.altice.pt/>
- Moran, K. (2019). *Usability Testing 101*. Nielsen Norman Group. Retrieved October 2021, from <https://www.nngroup.com/articles/usability-testing-101/>
- MUDA. (2017). *MUDA - Movimento Pela Utilização Digital Ativa*. Retrieved October 2021, from <https://www.muda.pt/>
- Norman, D. A. (2005). Human-centered design considered harmful. *Interactions*, 12(4), 14–19. <https://doi.org/10.1145/1070960.1070976>
- Omotayo, F. O. (2020). Use and Non-Use of Internet Banking Among Elderly People in Nigeria. *International Journal of Social Sciences and Management*, 7(2), 42–54. <https://doi.org/10.3126/ijssm.v7i2.28597>

- Page, L. [Coursera]. (2021, March 10). *Foundations of User Experience (UX) Design, Week 2, Prioritize the user* [Video]. Coursera.  
<https://coursera.org/share/bb036a3d8c51cbd613bc6fdec596e942>
- Parsons, T. (2009). User centred design, through enlightened in theory. *Blueprint*, 54.
- Patrick, V. M., & Hollenbeck, C. R. (2021). Designing for All: Consumer Response to Inclusive Design. *Journal of Consumer Psychology*, 31(2), 360–381.  
<https://doi.org/10.1002/jcpy.1225>
- Podolskiy, O. (2012). Audiovisual Learning. *Encyclopedia of the Sciences of Learning*, 384–386. [https://doi.org/10.1007/978-1-4419-1428-6\\_317](https://doi.org/10.1007/978-1-4419-1428-6_317)
- Policy, O. O. I. T. (2021). *What is Digital Literacy?* American Library Association.  
Retrieved October 2021, from <https://alair.ala.org/handle/11213/16260?show=full>
- Pordata. (2020). *População residente, média anual: total e por grupo etário Quantas pessoas existem, por faixa etária?* [Dataset]. Pordata.  
<https://www.pordata.pt/Portugal/Popula%C3%A7%C3%A3o+residente++m%C3%A9dia+anual+total+e+por+grupo+et%C3%A1rio-10>
- Prensky, M. (2001). Digital Natives, Digital Immigrants Part 1. *On the Horizon*, 9(5), 1–6.  
<https://doi.org/10.1108/10748120110424816>
- Quivy, R., van Campenhout, L., van Campenhout, L., Marques, J. M., Mendes, M. A., Carvalho, M., & Santos, R. (2008). *Manual de investigação em ciências sociais*. Gradiva.
- RUTIS. (2017). *Bem Vindo :: RUTIS - Rede de Universidades Seniores*. Retrieved October 2021, from <http://www.rutis.pt/intro/home>
- Salazar, K. (2018). *Why Personas Fail*. Nielsen Norman Group. Retrieved October 2021, from <https://www.nngroup.com/articles/why-personas-fail/>
- Schrepp, M. (2016a). Datenqualität bei Online-Fragebögen sicherstellen. In S. Hess & H. Fischer (Eds.), *UP 2016* (p. 1). Aachen: Gesellschaft für Informatik e.V. und die German UPA e.V. <https://doi.org/10.18420/muc2016-up-0015>
- Schrepp, M. (2016b). *UP 2016. Datenqualität bei Online-Fragebögen sicherstellen* (Hess, Stefan AND Fischer, Holger ed.). Aachen: Gesellschaft für Informatik e.V. und die German UPA e.V. <https://doi.org/10.18420/muc2016-up-0015>
- Stickdorn, M., & Schneider, J. (2012). *This is Service Design Thinking: Basics, Tools, Cases* (1st ed.). Wiley.

- Techboomers. (2018). *Techboomers.com - Learn How To Use Sites, Apps, and Devices For Free!!* TechBoomers.Com. Retrieved October 2021, from <https://techboomers.com/>
- United Nations. (2019). *World Population Prospects 2019: Highlights | Multimedia Library - United Nations Department of Economic and Social Affairs*. <https://www.un.org/development/desa/publications/world-population-prospects-2019-highlights.html>
- Vaportzis, E., Giatsi Clausen, M., & Gow, A. J. (2017). Older Adults Perceptions of Technology and Barriers to Interacting with Tablet Computers: A Focus Group Study. *Frontiers in Psychology*, 8. <https://doi.org/10.3389/fpsyg.2017.01687>
- Vaz Serra, A. (2006). O que significa envelhecer. In H. Firmino, A. Leuchner, & J. Barreto (Eds.), *Psicogeriatrics* (Eds. ed., pp. 21–33). Coimbra: Psiquiatria Clínica.
- W3C. (2004). *Notes on User Centered Design Process (UCD)*. <https://www.w3.org/WAI/Redesign/Ucd>. Retrieved 2021, from <https://www.w3.org/WAI/redesign/ucd>
- Wight, J. B. (2012). Paul J. Zak (ed.): The moral molecule: the source of love and prosperity. *Journal of Bioeconomics*, 15(2), 195–198. <https://doi.org/10.1007/s10818-012-9143-3>
- Wong, C. Y., Ibrahim, R., Hamid, T. A., & Mansor, E. I. (2018). Usability and Design Issues of Smartphone User Interface and Mobile Apps for Older Adults. *Communications in Computer and Information Science*, 93–104. [https://doi.org/10.1007/978-981-13-1628-9\\_9](https://doi.org/10.1007/978-981-13-1628-9_9)
- World Health Organization. (2001). *Men, ageing and health : achieving health across the life span* (WHO/NMH/NPH/01.2). <https://apps.who.int/iris/handle/10665/66941>
- World Medical Association. (2013). World Medical Association Declaration of Helsinki. *JAMA*, 310(20), 2191. <https://doi.org/10.1001/jama.2013.281053>

# Appendix A

## Development Model

Dimensions	Variables	Indicators
Adults 55+	Age	[55+]
	Marital Status	Single
		Married
		Widowed
		Divorced
		Domestic partnership
	Household	[1+]
	Academic Degree	> 12th Grade
		12th Grade
		Technical Course
Bachelor's Degree		
Master's Degree/ +		
Professional Status	Active	
	Retired	
	Other	
Digital Literacy	Information and Data Literacy	
	Communication and Collaboration	
	Digital Content Creation	
	Safety	
	Problem Solving	
Digital Experience	First Contact	
	Motivation	

		Expectations
		Limitations
		Recommendations
		Highs & Lows
		Opinion
	Digital Consumer Habits	Social Media
		Websites
		Activities
	Devices	Smartphone
		Laptop
		Tablet
		Desktop Computer
		Smartwatch
<hr/>		
Multimedia	Interaction	Likes
		Comments
		Shares
		Ratings
	Online Videos	Movies/ Series
		Short / Music Videos
		Exercise Videos
		Educational
	Games	Online
		Offline
<hr/>		
Education and Learning	Senior University	Approach
		Interaction
		Feedback
		Attendance
		Expectations
		Challenges

		Framework
	Online/ On-site Courses	Approach Interaction Feedback Attendance Expectations Challenges Framework
	Education ICT Websites	Approach Interaction Feedback Platforms Social Media Expectations Challenges Framework Access
ICT Audiovisual Learning	Content	Text Illustration Photography Print screen Infographics Animation 2D/ 3D Screencast Whiteboard Live-Action
	Legibility	Font Size Colour

	Contrast
	Hue
	Brilliance
Audio	Voice-Over
	Narration
	Subtitles
	Music
	Volume
	Tone
Storytelling	Duration
	Rhythm
	Speed
	Chronology
Interaction	Likes
	Comments
	Shares
	Ratings
	Feedback
Location	Access
	Social Media

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# Appendix B

## Informed Consent Form

Can be consulted at: <https://docs.google.com/forms/d/e/1FAIpQLSdGhBX6MYCV12VrazP-2yTeZOaWZisGYYPvqUxkBncWfvZGbg/viewform>

# Appendix C

## Interview Transcripts

Can be consulted at:

[https://docs.google.com/spreadsheets/d/1BEIW6FpIixjPogSwDRgR\\_OABxymsp8shmRveGlc59lw/edit?usp=sharing](https://docs.google.com/spreadsheets/d/1BEIW6FpIixjPogSwDRgR_OABxymsp8shmRveGlc59lw/edit?usp=sharing)

# Appendix D

## Qualitative Analysis of the Interview Data

Can be consulted at:

<https://docs.google.com/spreadsheets/d/1BGmXb9AERv9rSFR5Xg5D1YMJ6Avv7bL93aaM3RWIYr8/edit?usp=sharing>

# Appendix E

User Experience Questionnaire (Short) – Online Survey to evaluate the video

Can be consulted at:

[https://docs.google.com/forms/d/e/1FAIpQLSdQddmk1dHqCg33tPEeXlhgxrlQPtWoz1Dz3A9JWKAwcYqC7w/viewform?usp=pp\\_url](https://docs.google.com/forms/d/e/1FAIpQLSdQddmk1dHqCg33tPEeXlhgxrlQPtWoz1Dz3A9JWKAwcYqC7w/viewform?usp=pp_url)

# Appendix F

## Interview Structure (Questionnaire)

Can be consulted at:

<https://docs.google.com/spreadsheets/d/1hiVRpwCkHDLcvzKGY92jClKbdJMWg49-KzdowtmASFo/edit?usp=sharing>

# Appendix G

## Brainstorm – SCAMPER Instrument

Can be consulted at:

<https://docs.google.com/spreadsheets/d/1aId0hQpP73zrDHi09iLqVQin-u9c93Rh1zS64KBuB1o/edit?usp=sharing>

# Appendix H

## Scripts

Can be consulted at:

[https://docs.google.com/spreadsheets/d/1PjHPTjLVoOIP8SFCFM6l6du67mi\\_yyd\\_zPR540KHPIU/edit?usp=sharing](https://docs.google.com/spreadsheets/d/1PjHPTjLVoOIP8SFCFM6l6du67mi_yyd_zPR540KHPIU/edit?usp=sharing)

