IMPACT OF AN EDUCATIONAL PROGRAM TO IMPROVE OLDER ADULTS' DIGITAL SKILLS

IMPACTO DE UM PROGRAMA EDUCATIVO PARA MELHORAR AS HABILIDADES DIGITAIS DE ADULTOS MAIS VELHOS **PT**

—

IMPACTO DE UN PROGRAMA EDUCATIVO PARA MEJORAR LAS HABILIDADES DIGITALES DE PERSONAS MAYORES **ES**

KEROLYN RAMOS GARCIA

Postgraduate Program in Health Sciences and Technologies (PGCTS/UnB), Faculty of Ceilândia and University of Envelhecer (UniSER/UnB) of the University of Brasília - UnB, Brasilia, Brazil; .

✉ kerolynramos@gmail.com

LILIANA RODRIGUES

Competences Centre on Active and Healthy Ageing (Porto4Ageing), UCIBIO/REQUIMTE, Faculty of Pharmacy, University of Porto, Portugal.

✉ l13.rodrigues@gmail.com

GRAŻYNA BUSSE

Stowarzyszenie ECIM HIPOKAMP, Lodz, Poland;

✉ hipokamplodz@gmail.com

LUÍS MIDÃO

Competences Centre on Active and Healthy Ageing (Porto4Ageing), UCIBIO/REQUIMTE, Faculty of Pharmacy, University of Porto, Portugal.

✉ luismidao@gmail.com

MARIANA ROCHA DE SOUSA

Especialista em Enfermagem Médico Cirúrgica, Mestre em Gestão de Unidades de Saúde, Enfermeira no Centro Hospitalar Universitário Cova da Beira, Covilhã, Portugal.

✉ mariana.rocha@catolica.arq.br

MADARA IRBE

Riga Active Seniors Alliance, Riga, Latvia;.

✉ madara.m.irbe@gmail.com

ISABELLA GOMES DE OLIVEIRA KARNIKOWSKI

Postgraduate Program in Health Sciences and Technologies (PGCTS/UnB), Faculty of Ceilândia and University of Envelhecer (UniSER/UnB) of the University of Brasília - UnB, Brasilia, Brazil;

✉ gok.isabella@gmail.com

MARTA ALMADA

Competences Centre on Active and Healthy Ageing (Porto4Ageing), UCIBIO/REQUIMTE, Faculty of Pharmacy, University of Porto, Portugal.

✉ martassalmada@gmail.com

INÊS DIAS

Competences Centre on Active and Healthy Ageing (Porto4Ageing), UCIBIO/REQUIMTE, Faculty of Pharmacy, University of Porto, Portugal..

✉ ines.saal.dias@gmail.com

DANIEL HEERY

Cybermoor, Alston, UK; 6All Digital, Brussels, Belgium; 7Foundation 2035, Lodz, Poland.

✉ daniel.heery@cybermoor.org.uk

RACHEL HARDY

Cybermoor, Alston, UK; 6All Digital, Brussels, Belgium; 7Foundation 2035, Lodz, Poland.

✉ rachel.hardy@cmsl.org.uk

BARBARA QUARTA

All Digital, Brussels, Belgium;

✉ barbaraquarta@gmail.com

MARIA MAGDALENA POULAIN

Foundation 2035, Lodz, Poland.

✉ magda.poulain@gmail.com

MARIOLA BERTRAM

Stowarzyszenie ECIM HIPOKAMP, Lodz, Poland;

✉ mariolabertram@gmail.com

MARGÔ GOMES DE OLIVEIRA KARNIKOWSKI

Postgraduate Program in Health Sciences and Technologies (PGCTS/UnB), Faculty of Ceilândia and University of Envelhecer (UniSER/UnB) of the University of Brasília - UnB, Brasilia, Brazil;

✉ margounb@gmail.com

ELÍSIO COSTA

Competences Centre on Active and Healthy Ageing (Porto4Ageing), UCIBIO/REQUIMTE, Faculty of Pharmacy, University of Porto, Portugal;

✉ emcosta@ff.up.pt

Garcia, K., Rodrigues, L., Busse, G., Midão, L., Sousa, M., Irbe, M., Karnikowski, I., Almada, M., Dias, I., Heery, D., Hardy, R., Quarta, B. Poulain, M., Bertram, M., Karnikowski, M. & Costa, E. (2022). Impact of an educational program to improve older adults digital skills. *Egitania Sciencia*, número especial: Congresso Internacional Age.Comm, pp.9-31.

Submitted: 17th February 2022
Accepted: 12th September 2022

ABSTRACT

Digital illiteracy has been identified as an important indicator that impacts the quality of life of older adults. This work aims to analyze the impact of three different educational approaches (intergenerational, peer-to-peer and online) on older adults' digital skills in different European countries (Latvia, Poland, Portugal and the United Kingdom) participating in the Erasmus+ project ICTskills4All.

This is a quasi-experimental study. Digital Skills Self-Assessment Questionnaire, which is divided according to the domains of a digital competence framework for citizens (I&DL – information and data literacy; C&C – communication and collaboration; DCC – digital content creation; S – safety), was applied before and after the course. Qualitative evaluation about the pilot courses was also performed.

The peer-to-peer and intergenerational (in-person) formats proved to be more effective than the online format in improving I&DL and C&C skills, and the online approach improved the DCC dimension.

The results demonstrate that all the educational approaches used in the study are effective possibilities for teaching and learning ICT skills for older adults.

Keywords: Intergenerational, Peer-to-Peer, distance learning, Older Adults, Information and Communications Technology (ICT), Digital Literacy.

RESUMEN

El analfabetismo digital ha sido identificado como un indicador importante que se refleja en la calidad de vida de las personas mayores. Este estudio tiene como objetivo analizar el impacto de tres enfoques educativos diferentes (intergeneracional, entre pares y en línea) sobre las competencias digitales de las personas de tercera edad en diferentes países europeos (Letonia, Polonia, Portugal y Reino Unido) que participan en el proyecto Erasmus + ICTskills4All .

Se trata de un estudio cuasi experimental. El Cuestionario de Autoevaluación de Habilidades Digitales, que se divide según los dominios de un marco de competencia digital para los ciudadanos (I&DL - alfabetización en información y datos; C&C - comunicación y colaboración; DCC - creación de contenido digital; S - seguridad), se aplicó antes y después del curso. También se realizó una evaluación cualitativa de los cursos piloto.

Los formatos entre pares e intergeneracionales (en persona) demostraron ser más efectivos que el formato en línea para mejorar las habilidades de I&DL y C&C, y el enfoque en línea mejoró la dimensión DCC.

Los resultados demuestran que todos los enfoques educativos utilizados en el estudio son posibilidades efectivas para enseñar y aprender habilidades TIC para personas mayores.

Palabras Clave: Intergeneracional, educación a distancia, Personas mayores, Tecnologías de la información y las comunicaciones (TIC), Alfabetización digital.

RESUMO

A iliteracia digital foi identificada como importante indicador que tem impacto na qualidade de vida dos adultos mais velhos. Este trabalho visa analisar o impacto de três abordagens educacionais diferentes (intergeracionais, peer-to-peer e online) nas competências digitais dos adultos mais velhos em diferentes países europeus (Letónia, Polónia, Portugal e Reino Unido) que participam no projeto Erasmus+ ICTskills4All.

Este é um estudo quase-experimental. O Questionário de Autoavaliação de Competências Digitais, que está dividido de acordo com os domínios de um quadro de competências digitais para os cidadãos (I&DL - informação e literacia de dados; C&C - comunicação e colaboração; DCC - criação de conteúdos digitais; S - segurança), foi aplicado antes e depois do curso. Foi também realizada uma avaliação qualitativa sobre os cursos-piloto.

Os formatos peer-to-peer e intergeracionais (presenciais) provaram ser mais eficazes do que o formato online para melhorar as competências de I&DL e C&C, e a abordagem online melhorou a dimensão DCC.

Os resultados demonstram que todas as abordagens educacionais utilizadas no estudo são possibilidades eficazes de ensino e aprendizagem de competências TIC para adultos mais velhos.

Palavras-chave: *Intergeracional, Peer-to-Peer, educação à distância, idosos, Tecnologias de Informação e Comunicação (TIC), Literacia Digital.*

INTRODUCTION

In recent years, special attention has been given to the use of Information and Communication Technology (ICT) by older people. As the old age (65+ years old) profile is expected to change globally in the coming decades, representing 22% of the world population by 2050 (Bloom, Boersch-supan, Mcgee, & Seike, 2011), technological advances offer an excellent opportunity to face the challenge of promoting independence, strengthening social connectedness, and preventing isolation in older individuals. Furthermore, the use of computers for leisure can help with social isolation and loneliness and produced an overall significant reduction in mental health impairments, such as dementia, as well as other common problems related to old age (Khosravi, Rezvani, & Wiewiora, 2016).

However, the digital divide, described as "the distinction between those who have internet access and are able to make use of new services offered on the World Wide Web, and those who are excluded from these services" (European Union Commission, 2016), can be a barrier to the accessibility and usability of technologies for older people (European Union Commission, 2016). The use of ICT by older adults has been considered necessary to expand the knowledge and skills of this population and to reduce the digital divide, which is notably present in this age group (Midão et al., 2020). Educational programs for people over 55 years old (55+) were shown to be beneficial and effective, increasing access to information and services and making this population feel more adapted to modern society (Garcia, 2017; Hinojo-Lucena, Aznar-Díaz, Cáceres-Reche, & Romero-Rodríguez, 2019; Zadworna, 2020; Zielińska-Więczkowska, 2017).

The current literature points out different educational approaches for improving digital skills in older populations, such as the intergenerational and peer-to-peer or face-to-face and distance modalities, among others (Bhattacharjee, Baker, & Waycott, 2020; Garcia et al., 2021; Martins et al., 2019)we present findings from a literature review of 22 articles conducted to a. However, there is a lack of scientific evidence on the best approach for this population in terms of learning impact.

Therefore, this study aims to analyze the impact of three different educational approaches (intergenerational, peer-to-peer and online) in improving older adults' digital skills.

THEORETICAL FRAMEWORK

Population ageing is the achievement of more years of life, while it also brings many challenges for the new social configuration that is established with this demographic change. While people are ageing, global societies and economies are undergoing significant changes, especially related to the inclusion of digital and technological innovations in people's daily lives. Thus, the lack of digital skills is a major challenge for the elderly population, with consequences associated with the worsening of social isolation, difficulty in accessing information and services, loss of autonomy and increased feeling of inability to adapt to new social realities (All Digital, 2021; SZEKELY, 2017). This impacts negatively the guarantee of fundamental rights of effective participation of this age group in various sectors of society, which are nowadays primarily digital.

Improving digital skills in older adults is a way to guarantee their rights and improve their quality of life through an active lifestyle (education, social participation, hobbies, e-health etc.), conferring greater independence and autonomy, basic principles of human existence, especially in old age. In addition to the individual and collective benefits of

this age group, by enhancing this knowledge, it will enable the exercise of citizenship in different areas of society, resulting in participation in online discussions on policies for the older adults, exercise free will to remain in the labour market with updated human resource skills trends or contribute to the productivity of society (social and economic). On the other hand, the difficulties of the elderly to participate in the digital world is configured in one of the examples of exclusion and potentialization of vulnerabilities in old age.

Regarding this situation, many key EU policies and initiatives in the field of adult learning and digital education have been undertaken in recent years, such as the Green Paper on Ageing - Promoting solidarity and responsibility between generations; the Digital Education Action Plan 2021-2027; the key competences defined in the Council Recommendation on Key Competences for Lifelong Learning; the Digital Competences Framework for Citizens (DigComp); The European Agenda for Adult Learning (EAAL); the European Education Area; among others (All Digital, 2021; Khan & Vuopala, 2019; RASA, 2019).

"*How to do"* and the effectiveness evaluations of what has been done, however, are not yet clearly established in these policies and initiatives, especially regarding educational approaches and innovative methodologies that can be used to promote the improvement of digital skills in older adults. As pointed out in the "Report on intergenerational and peer-to-peer educational programs to improve digital skills in older adults." (RASA, 2019) and by Martins in 2019 (Martins et al., 2019), peer-to-peer - P2P (older adult-older adult) and intergenerational (older adult - other generation) approaches have been standing out in the configuration of educational proposals.

In a survey conducted by the European Commission ICTskills4All project, Peer-to-peer and group learning approaches are the most common learning methods available. Although several initiatives in recent years have tested intergenerational approaches with the financial support of various European funds, there is a lack of evaluation of the impact of digital skills training programmes for seniors (RASA, 2019). The evaluation initiatives carried out are limited to participants' satisfaction with the proposal, and therefore do not address other aspects of social validity of the actions of equal importance, as well as the effectiveness of the proposals.

Peer-to-peer learning is a method where individuals from the same social group help each other's learning process by teaching and/or giving skills training to one another. In the peer-assisted learning method, students actively direct each other, share practices, actively participate in the discussion and feedback process (Raymond, Jacob, Jacob, & Lyons, 2016; Stigmar, 2016). The pedagogical roots of this educational strategy are based on theorists like Piaget and Perry. From a Piagetian view, peer interaction facilitates learning therefore we can understand the students' cognitive development, so we can arrange more effective education (Tenenbaum, Winstone, Leman, & Avery, 2020). According to Perry; students change in their approach to learning as they progress through their education years (Perry Jr., 1998).

On the other hand, as society faces increasing social challenges, the attributes of intergenerational learning and their associated values became increasingly important. The quantity and quality of intergenerational relationships affect the ability to transfer support and resources between generations (Santini, Tombolesi, Baschiera, & Lamura, 2018). Intergenerational educational method can serve as an avenue to teach older adults about technology and positively influence attitudes toward digital use, and technological competences (Freeman et al., 2020; Leedahl et al., 2018; Seguí, de San Pedro, Verges, Algado, & Cuyàs, 2019). It can also be made with different generations involved: children, young adults, older adults.

Furthermore, the available data to guide public policy and decision making about common means to obtain ICT skills in the elderly population in the EU are insufficient. They mostly reflect on self-study methods via internet, trainings paid by individuals themselves and free trainings offered by public programs or organizations, but they are not detailed enough to be replicable or analyzed from an impact evaluation perspective or in a way that is possible to compare the approaches used - P2P or intergenerational (RASA, 2019).

It should be noted that six different reports were carried out, prior to this study, to theoretically underpin the proposal. The reports can be found at the link <https://www.up.pt/ictskills4all/> and deal specifically with intergenerational and peer-to-peer approaches, online resources for senior citizens and policy recommendations.

METHODS

STUDY DESIGN

This is a quasi-experimental study comparing three educational approaches for improving digital skills in older adults – peer-to-peer, intergenerational and online. The intervention group was run in four European countries, Latvia, Poland, Portugal and the United Kingdom, who were partners in the ICTskills4All Erasmus+ project. The intervention groups were composed of adults over 55 years old who participated in the proposed educational program. In this paper, "older adults" refers to people aged 55 years of age and over. This age group was chosen because it is an educational proposal that seeks to impact the European Union needs to address the digital divide, which means having a digitally skilled population and highly skilled digital professionals (EU, 2021). The participants were a mix between people who was still active at work market and those who were retirement. Participants were selected by invitations sent to institutions that served the target audience and had computers and the space available to carry out the activities, as well as by invitations sent through social networks to participate in the online version.

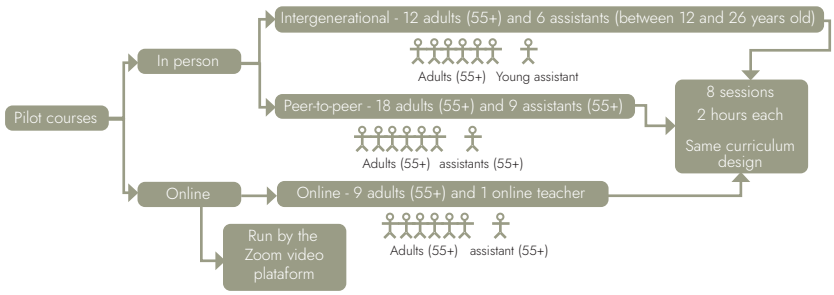
Three different educational approaches were designed for the same audience (55+) using the same curriculum design, with different profiles for the assistants responsible for leading the classes, as shown in Figure 1. The assistants could be young people between 12 and 26 years old (intergenerational approach) or adults over 55 years old (peer-to-peer). The age of 55 years for the peer-to-peer group was chosen to maintain the peer approach, considering that the intervention group was 55+. Regarding to assistants, the intergenerational approach wanted to include different generations that already had experience in the use of technologies to be used in the classroom, so they could properly assist during the intervention. The online approach occurred due to the COVID-19 pandemic, which prevented face-to-face meetings during 2020. Consequently, as it occurred in a virtual environment, there was only one 55-year-old assistant.

The present study is limited to examining data from the phase of the ICTskills4all project that consisted of the realization of the educational program. A review of the existing intergenerational and peer-to-peer educational programs was performed in order to create educational materials and the curriculum for the in-person and online courses. All educational materials (activity books, evaluation tools and presentations) and curricula were developed in English; they were then translated into Polish, Portuguese and Latvian.

The classes followed a series of methodological guidelines based on the current literature on active teaching methodologies, including in-person, remote, intergenerational and peer-to-peer (Ahn, Weng, & Butler, 2013; Aschbrenner, Naslund, & Bartels, 2016; KANE, 2007; Martins et al., 2019; Pihlainen, Korjonen-Kuusipuro, & Kärnä, 2021; Purser,

Towndrow, & Aranguiz, 2013; Socias et al., 2018) the integration between the generations involved in the study occurred as an educational tool, with the creation of emotional bonds between the participants and interactivity beyond classroom content between the students and the educators (Freire, 2011; Kane, 2007). This is an important factor in improving the potential of educational methodologies that use generational differences to induce improvements in the educational environment. Regarding the online approach, active teaching-learning methodologies were used in a traditional model with only one teacher responsible for the class, following the guidelines of Garcia (Garcia et al., 2021) with the expectation that this educational virtual environment would provide effective learning.

COURSE DESIGN



GENERAL GUIDELINESS

LEVEL OF EDUCATION	Beginner – the participant has little or no digital competence; older adults (55+) with no engagement with digital technology.
MAIN OBJECTIVES	Preparation and motivation for self-continued training, using e-learning + support (I can, I want, it's worth); overcoming the fear of technology and gaining skills to independently use a computer (I'm not alone, It's not so difficult, It cannot be spoiled, It's not about how long it takes, I can work at my own pace); strengthening trust in success (I can do it, I will do it).
NUMBER AND DURATION OF SESSIONS	Eight sessions, two periods of 45 minutes (two class hours with a break of about 10 minutes).
REMARKS TO ASSISTANTS	Before starting the course, the assistants must be prepared to work with the public (55+). Preparation should include education in the following fields: communication competence, knowledge about the generational experience of participants, behavior, empathy, skills of observation and analysis (especially deficits important from the point of view of learning and computer use and right- or left-handedness), knowledge about reducing or coping with barriers resulting from observed deficits, skills to create an individual approach to the participant's needs. The teaching plan (objectives and timetable) should be presented and discussed with the class in the classroom.
POSSIBLE DIFFICULTIES THAT MUST BE TAKEN INTO ACCOUNT	Hearing impairment; amblyopia (seeing impairment); shaking hands; lack of feeling in fingers; rheumatic and arthritic changes; back pain; hand pain; lack of reading comprehension skills; lack of or poor understanding of commands, including encoding the forms of infographics or icons; lack of ability to combine acquired knowledge to build competence; low self-esteem; fear of technology, or technophobia; fear of judgment; assessment trouble with memory; secondary illiteracy; inability to make notes; nervousness; problems with concentration and attention; and fear of time pressure, among others.

FORMULA OF CLASSES	Constant – taking into account the variable defined needs of the group concerning the length of individual parts, number of repetitions, number of cycles, topics that can be assimilated, etc. PART ONE (about 15 minutes): Introduction to the topic in the form of an educator's lecture with a presentation (images from the projector) and with the possibility of a short training segment (up to 10 minutes). PART TWO (about 30 minutes): Independent work with the support of an assistant and educator, the possibility of a short presentation on the screen and commentary on the difficulties most frequently observed by assistants. FOLLOWING CYCLES: Run according to the adopted schedule's topics/problems. The workshop will be run in the form of 2 participants + 1 supporting person (ASSISTANT).
ADDITIONAL REMARKS AND PRACTICAL RECOMMENDATIONS	Well-made diagnosis of needs, expectations and possibilities (mainly intellectual and manual) of participants. Knowledge of the type and level of motivation of participants to learn (loneliness, contact with children, curiosity, the need for self-education, etc.). Building a good relationship based on trust and actual support in the process – motivating, helping but not handing over, patience, solving problems together, solving problems with using a mouse or touchpad. Using andragogy rules – recalling common experiences and known areas, explaining the unknown by the known (here, a big threat is that young people may explain the unknown by the unknown). Achieve as many small successes as possible in the learning process. Repeated, "by the way" reminders about the possibility of making mistakes ("enter" key, scrolling pages, layout for diacritic sign keys). Introducing elements of fun and the opportunity for laughter. Permanently indicating the usefulness of each newly acquired piece of knowledge or skill in a specific life situation and pointing to the individual and functional benefits of saving time, finances, the universality of action, actuality, etc. Encouraging participants to talk to people on the internet. With the presence of young assistants, have a conversation about changes in the use of various services (travel planning, hotel booking, trip planning, shopping, etc.). The use of memorization methods through associations. Familiarizing the participants with special vocabulary – always based on English – will be useful for reading various instructions and understanding the content of instructional videos in further educational processes. Approval of the timetable by the assistants and the learners together.
DIDACTIC METHODS	Problem-oriented lectures – multimedia presentations; Questions – ad rem explanations; Self-training with the support of assistants; Discussion of all the following problems; Exercises and evaluation in each session.
TOOLS AND MATERIALS	Activity book: The contents of the workbook will be classroom activities; homework; evaluation; evaluation tools (as part of the activity book); presentations; action guides.
COURSE CONTENT	The content was focused on the essentials of using digital devices, including a desktop, laptop, tablet or smartphone; basic functions of a keyboard, a mouse and a computer; essential skills for getting started online; essential skills for staying safe online; how to connect with friends and family using social networks; and how to make video calls using Skype, WhatsApp and Facetime.
EDUCATIONAL RESULTS: KNOWLEDGE SHARED AND SKILLS	It is necessary to describe what participants know and to what range / level of advancement. Introduction and discussion of the content that will be learned during the course is required. It is also necessary to describe what participants can do and at what level / degree of advancement.
	SESSIONS
SESSION 1 - Basics FIRST CONTACT WITH A COMPUTER	After the end of session 1, educators and assistants together make a diagnosis of the needs of the group and the individual needs of the participants based on the observation of behaviors, deficits, declarations and evaluation questionnaires.
SESSION 2 - Continued topic SECOND CONTACT WITH A COMPUTER	The purpose of the second session is to make participants feel confident about the knowledge and skills gained in session 1. Reinforcement is needed to make the next sessions easier to follow.

SESSION 3 - FIRST CONTACT WITH THE INTERNET	Local and individual differences may occur in this session due to differences in local (national) availability and technical suitability (PC and Mac). Focus on the most popular browsers and search engines in a given region; less popular browsers can be presented, but only as interesting additional info – in this case, too much information will create noise and hinder the process. Suggest working on the search engine Google due to its friendly nature for beginners, but the lecturers may have different experiences – optional variants.
SESSION 4 - FIRST CONTACT WITH KNOWLEDGE IN THE DIGITAL DIMENSION	For exercises, we recommend Skype and WhatsApp due to the universality of the portals (many language versions) and the minimum number of ads, which can hinder internet learning during this phase of education.
SESSION 5 - HOW TO NAVIGATE	Suggest working on the search engine Google due to its friendly nature for beginners, but the lecturers may have different experiences – optional variants
SESSION 6 - FIRST CONTACT WITH ONLINE SECURITY	Local and individual differences may occur in this session due to differences in local (national) availability and technical tools. It's necessary to use different tools to help participants memorize their passwords or, by association, make their passwords safe and memorable.
SESSION 7 - Continued topic SECOND CONTACT WITH ONLINE SECURITY	Use of videos and real situations of everyday life; use of simulations.
SESSION 8 - FIRST CONTACT WITH E-LEARNING AND YOUTUBE	Sharing videos, contact information and social media can help participants to enjoy the topic and keep their motivation to learn after the course. Conclusion of meetings – conversations and final evaluation.

FIGURE 1. ICTSKILLS4ALL EDUCATIONAL PROGRAM DESIGN – LOGICAL MODEL.

QUANTITATIVE EVALUATION

A Digital Skills Self-Assessment Questionnaire was applied before the beginning of the first session (pre) and after the end of the eighth session (post). The instrument is based on 4 areas of competencies presented in "The Digital Competence Framework for Citizens – DigComp 2.1", namely "information and data literacy (I&DL)", "communication and collaboration (C&C)", "digital content creation (DCC) " and "safety (S)" (Carretero, Vuorikari, & Punie, 2017). The area of "problem solving" from DigComp 2.1 was excluded from this analysis because it is a competency that requires more digital skills than those recommended by the initial curriculum of the ICTskills4All proposal. To understand more about the motivation to learn digital skills, participants were also asked about their motivation to continually develop and update skills and competencies (Question 47). The participants were asked to answer the questions on a scale of 1 (strongly disagree) to 5 (strongly agree). The questionnaire used for evaluation and all the other instruments that were used in the project are available on the project website at the link <https://www.up.pt/ictskills4all/>, as well all the educational tools used during the intervention.

Quantitative data analysis was performed using the statistical data analysis program SPSS® v.26.0 (Statistical Package for Social Sciences). Categorical variables were described using absolute frequencies (n) and relative frequencies (%). The answers to the questions that compose the questionnaires were described using the interquartile range [median (25th percentile and 75th percentile)]. Variables were created for the differences between pre-intervention and post-intervention values for all items in the questionnaire. Significant differences between post and pre-test responses were verified using the Mann Whitney test. Hypotheses about differences between groups (intergenerational, peer-to-peer and online) were tested using Kruskal–Wallis nonparametric tests. To calculate Delta (the differences), it was subtracted pre-test score from the post-test score. Post hoc comparisons for the Kruskall–Wallis test were also performed. In all hypothesis tests, a significance level of $\alpha = 5\%$ was considered.

QUALITATIVE EVALUATION

The qualitative evaluation of pilot courses was also performed in all pilot participant groups, in order to collect information that was helpful for improving the educational material and schedule of the in-person approaches. To evaluate the participants' satisfaction with the course, the sessions were individually evaluated by the participants using the Session Evaluation Questionnaire, in which the participants were asked to describe "what they enjoyed most", "what would they change", "what was most difficult" and "what was easier" during the session that occurred, as well as classifying the quality of the session from 1 (very poor) to 5 (excellent).

Data was analyzed according to the content analysis proposed by Minayo (2006), with the following steps: (A) ordering of the data to map the material obtained, re-reading the material and organizing the reports; (B) classification of the data with exhaustive and repeated readings of the texts by a research team for the constitution of a corpus of communication, followed by the transversal reading of each body as a cut-out of the registration unit and, finally, the cutting of the most relevant data; (C) final analysis and elaboration of the analytical categories, or the phase in which the research objectives and the themes that emerge from the observations are taken into account and the data is articulated with the theoretical framework, defining the analytical categories. All the qualitative analyses were made by six researchers; there were four meetings to discuss the data, which was analyzed by each one of them, until there was consensus among the researchers about the results.

For the content analysis of the descriptions of "what they liked the most" and "what they would change" in the sessions, the word cloud presentation method was used; it is a tool that consists of a form of graphic visualization based on the frequency of words written in the session evaluation questionnaires, which were categorized and displayed using the free Word It Out software. The categories have colors and sizes relative to their repetitions. Connectors and words that had no meaning for the study were excluded.

As for the content analysis of the descriptions of "what was more difficult" and "what was easier", semi-integral descriptions (with adaptations for categorization) were presented, tabled in their appropriate categories and with the number of repetitions. Four categories were pre-determined regarding the 4 competence areas presented in "The Digital Competence Framework for Citizens – DigComp 2.1 (2017)", namely "information and data literacy (I&DL)"; "communication and collaboration (C&C)"; "digital content creation (DCC)"; and "safety (S)", as well as five more categories that emerged from data exhaustion, which were "class design"; "physical adaptation"; "complexity of tasks"; "cognitive domain"; and "problem solving (PS)". The last category, "problem solving", is also a competence area presented at DigComp 2.1, but it was not focus of the ICTskills4All intervention because it is a competency that requires more digital skills than those recommended by the initial curriculum of the ICTskills4All proposal. However, that competence still emerged from participants, which why it was not presented in this paper as pre-determined category, but as a category that emerged from data exhaustion.

RESULTS

The sample was composed of 39 participants (30 for the in-person format and 9 for the online format) in the evaluation of educational approaches (Table 1). All participants from Portugal were aged between 55 and 64 years old. Regarding to Latvia, 5.3% of the participants were between 55-64 years old, 42.1% were between 65-74 years and 52.6% were between 75-85 years. About participants from Poland, 25% were 55-64 years old, 25% were 65-74 years, and 50% were 75-85 years old. 33.3% of participants from UK were aged between 55-64 and 66.7% aged between 65-74.

APPROACH	TOTAL		PEER-TO-PEER		INTERGENERATIONAL		ONLINE	
	(n = 39)		(n = 18)		(n = 12)		(n = 9)	
	n	(%)	n	(%)	n	(%)	n	(%)
Sex								
Female	25	(64.1)	13	(72.2)	7	(58.3)	5	(55.6)
Male	14	(35.9)	5	(27.8)	5	(41.7)	4	(44.4)
Age								
55–64	9	(23.1)	2	(11.1)	4	(33.3)	3	(33.3)
65–74	16	(41.0)	4	(22.2)	6	(50.0)	6	(66.7)
75–85	14	(35.9)	12	(66.7)	2	(16.7)	0	(0.0)
Country								
Portugal	3	(7.7)	NA	NA	3	(25.0)	NA	NA
Latvia	19	(48.7)	10	(55.6)	9	(75.0)	NA	NA
Poland	8	(20.5)	8	(44.4)	NA	NA	NA	NA
United Kingdom	9	(23.1)	NA	NA	NA	NA	9	(100.0)

*NA – Not applicable

TABLE 1 - DESCRIPTION OF THE PARTICIPANTS' CHARACTERIZATION VARIABLES OF THE PEER-TO-PEER, INTERGENERATIONAL AND ONLINE APPROACHES.

Table 2 shows the results of the impact of the program divided by approach and domain, presented by interquartile range (IQR). There is homogeneity of the sample of all groups in the pre-moment regarding ND and DCC domains. However, they differ at the pre moment in the other domains. In the comparison between the peer-to-peer and the online approaches (P2), as well the intergenerational and online (P3), I&DL, C&C and S domains had differences before the course (pre-moment), showing that the online participants had more skills at the beginning of the course than the peer-to-peer and intergenerational participants.

All medians (Q2) in the different groups and domains increased from pre to post moment, with the exception of the median of the intergenerational group in the DCC domain, which showed a decrease in the score. There was no significant difference comparing pre and post moment in the ND domain in any of the approaches (motivation question), which

shows that none of the formats was effective in improving participants' motivation (ND). The online course was more effective in improving DCC skills, being the only one that showed a significant difference in this domain.

Comparing the approaches, the intergenerational and peer-to-peer groups did not show significant differences between them. Both groups, however, showed a difference when compared to the online approach in the I&DL, C&C and S domains.

Regarding the questions of the four identified domains, the peer-to-peer and intergenerational programs were effective in improving the skills evaluated in 45 questions: all 23 competences in I&DL (100%); all 9 competencies in C&C (100%); and 13 of the 14 competences (93%) in S. In the online format, the course proved to be effective in improving the skills evaluated in 35 (71.4%) questions: 14 out of 23 (61%) in I&DL; 5 out of 9 (56%) in C&C; all 14 skills (100%) in S; and all 2 skills in DCC (100%).

Peer-to-peer and intergenerational courses were more effective in improving I&DL and C&C skills (100% effective in both domains, compared to 61% and 56% effective, respectively, in online courses).

		PEER-TO-PEER (P2P)				INTERGENERATIONAL				ONLINE				P1	P2	P3
DOMAIN*		WQ1	Q2	Q3	P	Q1	Q2	Q3	P	Q1	Q2	Q3	P			
IeDL	Pre	1,50	2,09	3,28	0,0001	1,65	2,41	3,32	0,001	3,65	4,13	4,37	0,019	NS	0,0001	0,0001
	Post	3,34	3,72	4,27		3,62	3,91	4,26		4,43	4,83	4,89		NS	0,001	0,002
CeC	Pre	1,22	1,78	2,94	0,0001	1,06	2,06	3,17	0,01	3,00	3,67	4,11	0,05	NS	0,0001	0,002
	Post	2,56	3,22	3,81		2,81	3,44	4,00		3,67	4,78	4,78		NS	0,002	0,006
S	Pre	1,29	1,93	2,61	0,0001	1,57	2,00	3,05	0,012	3,11	3,50	3,64	0,0001	NS	0,0001	0,012
	Post	2,64	3,29	4,11		3,16	3,43	4,11		4,29	4,57	4,96		NS	0,001	0,002
ND	Pre	3,50	4,00	5,00	0,606	1,25	4,00	5,00	0,755	3,50	4,00	5,00	0,387	NS	NS	NS
	Post	4,00	4,50	5,00		4,00	4,00	5,00		4,00	5,00	5,00		NS	NS	NS
DCC	Pre	2,50	3,25	4,63	0,501	2,13	4,00	4,00	0,977	2,25	3,00	3,25	0,004	NS	NS	NS
	Post	3,00	4,00	4,50		3,00	3,75	4,00		3,50	4,00	4,75		NS	NS	NS

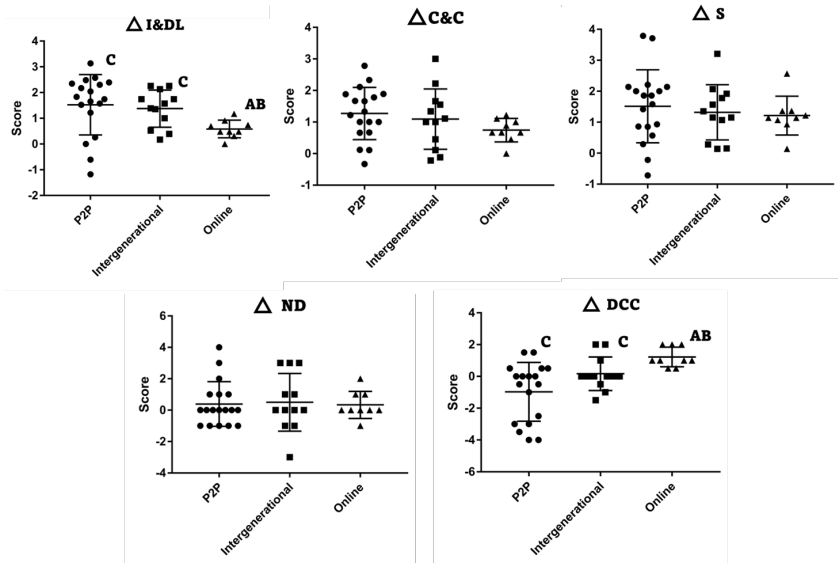
p≤0,05; P1- comparison between peer-to-peer and intergeracional; P2 - comparison between peer-to-peer and online; P3 – comparison between intergeracional and online. NS – Not significant. *Division of the Digital Skills Self-Assessment Questionnaire by domains of Digital competence framework for citizens: ND- non defined (motivation question); I&DL – information and data literacy; C&C – communication and collaboration; DCC – digital content creation; S – safety.

TABLE 2 - COMPARISON OF INTERVENTIONS MOMENTS PRE AND POST, BY DOMAIN AND BETWEEN EACH APPROACH USED, PRESENTED BY INTERQUARTILE RANGE (Q1, Q2, Q3).

Figure 2 shows the difference between the groups' post and pre moments in relation to the domains: this variation is called Delta (Δ). Thus, the dot plot graphic representation shows us the interquartile ranges (Q1, Q2, Q3) and the sample dispersion between the ranges. The position of the second quartile (median) is what determines the real variation

of each group, i.e., if a group has its median equal to 2 on the scale of a given domain, it means that there was an improvement of 2 points from the pre to the post moment for this group.

The only domains that present significant variation between the groups are the I&DL and the DCC, in which, in both, the P2P (A) and Intergenerational (B) groups were significantly different from the online (C). In the I&DL domain, all groups varied positively, with groups A and B showing the greatest variation. In the DCC domain, group C expressed greater oscillation. In the other domains all the groups had positive variation without expressive differences among themselves.



Δ Delta by Domain according to the Division of the Digital Skills Self-Assessment Questionnaire of Digital competence framework for citizens: ND – non defined (motivation question); I&DL – information and data literacy; C&C – communication and collaboration; DCC – digital content creation; S – safety. AB – Group Online significantly different from groups P2P and Intergenerational; C – Group P2P and Intergenerational significantly different from group Online.

FIGURE 2 - COMPARISON OF DELTA SCORES IN INTERQUARTILE RANGE (IQR) USING DOT PLOT GRAPHIC REPRESENTATION, WITH THE GROUP VARIATION BY DOMAIN.

The analysis of the participants' feedback is presented in Table 3 and Figure 3. In order to understand what would need to be modified and what was most enjoyable in the sessions for the participants, the speeches were analyzed and categorized, as presented in Figure 3. Group interaction was especially highlighted as "what was most enjoyable" during the sessions, referring to direct interaction with other classmates and with assistants. The

assistants support was also mentioned in this category, specially related to the support needed to carry out activities during classes. Practical classes was mentioned as most enjoyable and with requests for more. The words ***everything*** for "most enjoyable" and ***nothing*** for "what to change" also was mentioned a lot for most of the participants.

FIGURE 3. WORD CLOUD ABOUT "WHAT WAS MOST ENJOYABLE" (1) AND "WHAT TO CHANGE" (2) ABOUT THE SESSIONS ACCORDING TO THE PARTICIPANTS.

When the participants discourse was analyzed, as presented in Table 3, they mainly pointed out difficulties in keeping up with the work pace of classmates and in understanding details related to the application of activities, such as double-clicking the mouse and closing windows, among others. As for the facilities, the assistant's support in carrying out the practical activities was pointed out in particular as important to keep going. Some aspects presented in the participants discourse points to difficulties related to physical and cognitive limitations, even such difficulties were considered in the design of the intervention. Information and data literacy (I&DL) and Class Design categories had more mentions in the speeches, both in terms of facilities and difficulties.

CATEGORY	DESCRIPTION	MOST DIFFICULT "SPEECH" (NUMBER OF CITATIONS)	MOST EASY "SPEECH" (NUMBER OF CITATIONS)
Information and data literacy (I&DL)	Browsing, searching, and filtering data, information and digital content; Evaluating data, information and digital content; Managing data, information and digital content; Using the equipment; mouse and keyboard; screen.	"Coordination between the mouse and screen" (4); "Hard to find the mouse pointer" (4); "The technical terms." (1); "Typing and navigation with the mouse was challenging, especially with special characters such as Ā, Ņ, Š, Ļ, Ū, Ž" (7); "Understand details, apply" (25); "Using the computer keyboard." (1); "To use the commands." (1).	"Activities with the mouse" (2); "Creating an email." (1); "Doing internet research." (1); "e learning to write." (2); "Formulate and saving passwords." (2); "Interactive training tools (planting flowers, placing apples in a basket)"(2); "Learning how to draw." (1); "Making folders" (1); "Managing excel work" (3); "Opening up excel"(2); "practical application of new skills." (3);); "start the computer." (5); "Switching outlook calendar on and off." (2); "The interaction with the subject." (1); "To use the computer again." (1); "Turning on/off"(8); "Typing"(3); "Unpinning icons." (2); "Using excel" (1); Using the keyboard." (2) "Windows updates." (2); "Working with spreadsheets"(2); "Working with the mouse"(1).
Communication and collaboration (C&C)	Interacting through digital technologies; Sharing through digital technologies; Engaging in citizenship through digital technologies; Collaborating through digital technologies; Netiquette; Managing digital identity	"Dealing with multiple email accounts"(2); "How to do electronic signatures." (2); "The email subject." (1) ; "Understanding how to use microphone and camera options on zoom." (2)	"Emailing." (5) "Finding greeting cards on the Internet"(1) "Talking on Zoom." (2)
Digital content creation (DCC)	Developing digital content; Integrating and re-elaborating digital content; Copyright and licenses; Programming	"Spreadsheets, readers and PDFs." (4); "Spreadsheet discussion, there was a lot of information to digest." (2)	"To elaborate the drawings"(1)
Safety (S)	Protecting devices; Protecting personal data and privacy; Protecting health and well-being; Protecting the environment.	"Session on security." (4); "Realizing how many ways we could be hacked." (2); "Learning how exposed I was to risks and scams." (2); "Security issues." (2); "Understanding anti-viruses." (2); "Password security." (2); "Recognizing spam emails." (2); "Saving information on excel securely." (2); "The discussion about the types of cybercrime." (1)	"Checking website authenticity." (2) "Information about getting rid of old hard drives." (2) "Sessions on scams." (4) "Learning some of the tools to help me avoid risks and scams."(2) "Shredding for security"(2)
Problem solving	Solving technical problems; Identifying needs and technological responses; Creatively using digital Technologies; Identifying digital competence gaps.	"Learning to do the same tasks in different ways." (4) "Talking about your own set-up." (2) "Updating software." (2)	"Having confidence to be able to do things correctly." (2)
Class Design	Session time; Pedagogical approach; Content; Group interaction; Assistant support	"adapt to the pace of work of others" (36); "Differences between the learners" (4) ; "Could be more coordination training tasks"(4); "Could be more typing tasks"(3); "Difficulties in explaining specific functions and actions" (4); "It was a harder class for me because the time of it was short." (1); "Mistakes in English classes" (1); "New information and too little time" (4); "Questionnaires are tiring" (1) ; "The subject of the class was a little difficult for me to learn." (1);"The teacher's explanation." (1)	"All explained if I had any problems." (2); "Confidence that I could always ask other delegates." (2); "Friendly atmosphere." (2); "Learning from other comments." (4); "Surprising how much we have covered in such a short time." (2); "The dialogue with the assistants." (2); "The didactic method." (6); "The session on email." (2); "The teacher's clear explanation"(2); "The way it was presented, was easy to follow" (2); "Verbal explanations" (2); "Verbal guidance"(2) ; "Visual examples" (2) ; "when starting work, work after the presentation with the support of an assistant." (55); "Working with the assistant"(1).

Physical adaptation	Adapt the eyes to the screen; hear the computer noises; adapt to the posture using mouse and keyboards.	"Poor vision, found it difficult to see everything on the screen." (2); "Poor eyesight and small screen." (2); "Coordination with the hands and fingers" (4)	–
Complexity of tasks	Perform simple tasks	"Each new topic was difficult at first, but then proved to be understandable." (24); "It was a little bit difficult, but I was able to learn." (1)	–
Cognitive domain	Remembering the content; assimilate the symbols.	"Difficulties to switch to new topics" (4); "Concentration, understanding" (4) ; "Realize how much I had forgotten"(2); "Remembering all content that had already been covered." (6); "Remembering the images"(1); "To hear the sound of the video." (1); "To recognize the symbols" (1); "To remember the explanation of the previous class." (1)	"Feeling positive about what I had remembered." (2) "Recapping previous lessons and the reinforcement of messages." (2)
Nothing or Everything	–	"Nothing" (46) "Everything" (5)	"Nothing" (6) "Everything" (20)

TABLE 3 - CATEGORIZATION OF THE PARTICIPANTS' DISCOURSE REGARDING THE MAIN DIFFICULTIES AND FACILITIES RELATED TO THE PRESENTIAL SESSIONS.

DISCUSSION

This study demonstrates the effect of the educational program on improving the digital skills of the participants in all three course formats, which proved to be effective in improving all the domains of digital skills assessed. The increase in the medians in all domains and groups presented in table 2 shows that there was an improvement in the participants' digital skills, concluding that all approaches were effective in their objectives. The literature points out that the benefits related to educational programs for older adults depend on many factors, such as the meaning that participants can attribute to the activities and the organization of the program; in the case of intergenerational programs, the participants' knowledge of the other generation is also important (Giraudeau & Bailly, 2019; Seguí et al., 2019).

In our study, the previous phases of curriculum design and content organization can explain the assessed success in our quantitative and qualitative results from before and after the course, being also validated by the "class design" mention in the what was most enjoyable evaluation (figure 3). The context of the COVID-19 pandemic also boosted the need for digital improvement in all populations (Garcia et al., 2021; Xie et al., 2020)not only in terms of health, but also in the economic, psychosocial, and educational domains. Information and communication technologies (ICT, especially in the older adults group; this attributed a special meaning to the course activities, such as talking to family members using a smartphone or using social media. Although the questions about the motivation to keep learning digital skills showed no significant differences before and after the course, participants were motivated to learn; their motivation levels were simply already high at the beginning of the course.

This study reflects the digital divide among the population of older adults and the need for training, as previously indicated by other studies (Martínez-Alcalá et al., 2018; Peral-Peral, Arenas-Gaitán, & Villarejo-Ramos, 2015); this was demonstrated by the weak

digital skills present in the participant groups at the beginning of the pilot courses. The results show that the majority of participants from different countries had little or no experience in improving their digital skills, with the exception of some participants in the online approach, where it was necessary for them to have some skills to deal with the online classes; in particular, they had to turn their computer on and off, use the mouse and connect to the Zoom platform. Even with some previous experience, the participants in the online course improved 71% of their skills, and unlike the peer-to-peer and intergenerational approaches, the results from the online approach showed the improvement of digital content creation (DCC) skills. This could be related to the previous skills of the participants: the in-person courses required more effort and spent more time in the other basic domains (I&DL, C&C and S).

Comparing the face-to-face and online sessions, it is possible to point out that the face-to-face course demonstrated to be more effective in improving digital skills for a population with no digital skills, because they needed close assistance to execute the tasks more easily. This is highlighted by our qualitative results when participants pointed their necessity for more individual attention and the relevance of group interaction.

Differences related to the use of the browsers and the search toolbar were identified between the in-person approaches (peer-to-peer and intergenerational). Both of the approaches – intergenerational and peer-to-peer – presented in this study are effective in educational programs for teaching ICT skills to an older population. However, other aspects, like the interaction between the different generations, bonding and cognitive and social skills, need to be more deeply evaluated to understand their long-term effects; participants, especially those from the intergenerational group, declared that working with the assistant was what made the course easy and enjoyable. Other studies demonstrate the important role of intergenerational approaches in the development of social skills and well-being (Giraudeau & Bailly, 2019; Martins et al., 2019).

Most of the participants declared that they enjoyed the group interaction (with the classmates/assistants) and that the content made sense to them; they also stated that the learning topics kept their attention. Because the participants were not confused or frustrated by how the learning topics were structured and would not change anything, the results show their satisfaction with the content and design of the classes. According to Xie et al. (2020)older adults are (1, the motivation of the elderly to study a subject or new technology increases when this learning helps them to satisfy some personal or social need, when they consider it to be practical and when it occurs primarily in social contexts where there is a collaborative learning process based on support and peer assistance. The eight sessions were designed considering these prerogatives, which is why the methodologies used involved real situations for the use of technologies, as well as practice done in the class. These important elements were pointed out as relevant by the participants in the evaluation of their satisfaction with the educational program (Figure 3) and should be used in the construction of educational programs for teaching ICT skills in the population of older adults.

This data may serve as the basis for the design of and experimentation involving specific educational programs for lifelong learning in regard to the lesser-known aspects of ICT, considering the needs of the population of older adults.

A study with a larger number of individuals and a paired sample across different countries would enable impact analysis in different age groups and cultures, which was not possible with this study. More comparisons of the online approach with different assistants should also be performed.

CONCLUSION

Peer-to-peer, intergenerational and online approaches have shown to have potential for improving digital skills in the members of the 55+ population that participated in this study. The results showed that the educational materials and all the different approaches used in the intervention are effective for teaching and learning for older adults. However, it is important to emphasize that other items must be evaluated to understand the impact of the intergenerational modality, such as the interaction between different generations and the understanding of the aging process by young people who participate.

The use of the theme of digital skills is indicated because of the need to improve the digital skills of the elderly population to help them maintain their autonomy and independence in a digital world as well as because it is a relevant topic for improvements in cognition, insertion, interaction and social networking. More studies should be carried out comparing the different approaches and also addressing qualitative aspects of the interaction between different groups.

However, it should be recognized that the European and world's scenario faces the problems of unwanted isolation, loneliness and digital illiteracy, in a world full of new technology and post-pandemic. Covid-19 increased ICT consumption in all generations, as a way to combat isolation and social distance measures, to work, to keep informed about new pandemic information's (Lee, Malcein, & Kim, 2021; Yang et al., 2020). This reality reenforce the necessity to improve digital skills and to raise awareness about the healthy use of these tools to all ages. Since the impact results of this study were similar between peer-to-peer and intergenerational approaches, it is recommended that intergenerational practice be encouraged, as there is a contribution beyond the impact on learning and development of digital skills, but can help different generations to learn what they need, as well improve their social and digital skills.

By using intergenerationality as a pedagogical tool, a serviceable space is promoted for the development and exchange of knowledge about social and communication skills between different generations, as verified in other studies (Burnes et al., 2019; Gaggioli et al., 2014; Murayama et al., 2015; Pinquart Silka Wenzel Martin, 2000) and pointed out in the results of this paper when the work of the assistants was highly valued. The contribution of children and young people to the social and digital inclusion of the aging population should be especially encouraged as it uses the educational approach as a way to decrease the gap between generations, and may also contribute to the anticipated perception of the human life cycle and the need to, since youth, keep always developing educational practices, self-care, promotion and prevention in health to promote a more dignified, active and healthy old age.

Education policies and strategies towards adult learning and education need to move from a focus on restrictive and generalized curricula towards learner- centeredness. Anyone can learn, irrespective of age and background, provided that learning programmes take the learners' needs into account and also propose broad and holistic

approaches. Strengthen adult learning policy making is necessary, improving and supporting the creation of more ambitious and holistic strategies that take learners of all ages into account.

REFERENCES

Ahn, J., Weng, C., & Butler, B. S. (2013). The Dynamics of Open, Peer-to-Peer Learning: What Factors Influence Participation in the P2P University? In 2013 46th Hawaii International Conference on System Sciences (pp. 3098–3107). Retrieved from https://doi.org/10.1109/HICSS.2013.515

All Digital, Ict. P. (2021). Recommendations for transferability of ICTskills4All results. European Commission. Retrieved from https://www.up.pt/ictskills4all/intellectual-outputs/o6-policy-recommendations/

Aschbrenner, K. A., Naslund, J. A., & Bartels, S. J. (2016). A mixed methods study of peer-to-peer support in a group-based lifestyle intervention for adults with serious mental illness. Psychiatric Rehabilitation Journal. Aschbrenner, Kelly A.: Department of Psychiatry, Geisel School of Medicine at Dartmouth, 46 Centerra Parkway, Lebanon, NH, US, 03766, kelly.aschbrenner@dartmouth.edu: Educational Publishing Foundation. Retrieved from https://doi.org/10.1037/prj0000219

Bhattacharjee, P., Baker, S., & Waycott, J. (2020). Older adults and their acquisition of digital skills: A review of current research evidence. ACM International Conference Proceeding Series, 437–443. Retrieved from https://doi.org/10.1145/3441000.3441053

Bloom, D. E., Boersch-supan, A., Mcgee, P., & Seike, A. (2011). Population aging: facts, challenges, and responses. Program on the Global Population Aging, 71(71), 1–11. Retrieved from https://doi.org/10.1.1.697.7186

Burnes, D., Sheppard, C., Henderson, C. R., Wassel, M., Cope, R., Barber, C., & Pillemer, K. (2019). Interventions to Reduce Ageism Against Older Adults: A Systematic Review and Meta-Analysis. American Journal of Public Health, 109(8), e1–e9. Retrieved from https://doi.org/10.2105/AJPH.2019.305123

Carretero, S., Vuorikari, R., & Punie, Y. (2017). DigComp 2.1: The Digital Competence Framework for Citizens. Publications Office of the European Union. Retrieved from http://publications.jrc.ec.europa.eu/repository/bitstream/JRC106281/web-digcomp2.1pdf_(online).pdf

EU, E. C. website. (2021). Europe's Digital Decade. Retrieved 24 May 2022, from https://digital-strategy.ec.europa.eu/en/policies/europes-digital-decade

European Union Commission, E. (2016). Education and training glossary (Online repository). European Union Commission. Retrieved from https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Category:Education_and_training_glossary

Freeman, S., Marston, H. R., Olynick, J., Musselwhite, C., Kulczycki, C., Genoe, R., & Xiong, B. (2020). Intergenerational Effects on the Impacts of Technology Use in Later Life: Insights from an International, Multi-Site Study. International Journal of Environmental Research and Public Health . Retrieved from https://doi.org/10.3390/ijerph17165711

Freire, P. (2011). Pedagogia do Oprimido (50th ed.). São Paulo: Paz e Terra.

Gaggioli, A., Morganti, L., Bonfiglio, S., Scaratti, C., Cipresso, P., Serino, S., & Riva, G. (2014).

Intergenerational Group Reminiscence: A Potentially Effective Intervention to Enhance Elderly Psychosocial Wellbeing and to Improve Children's Perception of Aging. Educational Gerontology, 40(7), 486–498. Retrieved from https://doi.org/10.1080/03601277.2013.844042

Garcia, K. R. (2017). Aspectos avaliativos de um Programa de extensão educacional para a maturidade. Universidade de Brasília. Retrieved from http://repositorio.unb.br/bitstream/10482/31281/1/2017_KerolynRamosGarcia_PARCIAL.pdf

Garcia, K. R., Rodrigues, L., Pereira, L., Busse, G., Irbe, M., Almada, M., … Costa, E. (2021). Improving the digital skills of older adults in a COVID-19 pandemic environment. Educational Gerontology, 47(5), 196–206. Retrieved from https://doi.org/10.1080/03601277.2021.1905216

Giraudeau, C., & Bailly, N. (2019). Intergenerational programs: What can school-age children and older people expect from them? A systematic review. European Journal of Ageing, 16(3), 363–376. Retrieved from https://doi.org/10.1007/s10433-018-00497-4

Hinojo-Lucena, F. J., Aznar-Díaz, I., Cáceres-Reche, M. P., & Romero-Rodríguez, J. M. (2019). A tour of Open Universities through literature: A bibliometric analysis. International Review of Research in Open and Distance Learning, 20(4), 117–131. Retrieved from https://doi.org/10.19173/irrodl.v20i3.4079

KANE, L. (2007). Educators, learners and active learning methodologies. International Journal of Lifelong Education, 23(3), 275–286. Retrieved from https://doi.org/10.1080/0260/37042000229237

Khan, F., & Vuopala, E. (2019). Digital Competence Assessment Across Generations: A Finnish Sample Using the Digcomp Framework. International Journal of Digital Literacy and Digital Competence (IJDLDC), 10(2). Retrieved from https://doi.org/10.4018/IJDLDC.2019040102

Khosravi, P., Rezvani, A., & Wiewiora, A. (2016). The impact of technology on older adults' social isolation. Computers in Human Behavior, 63, 594–603. Retrieved from https://doi.org/https://doi.org/10.1016/j.chb.2016.05.092

Lee, Y.-C., Malcein, L. A., & Kim, S. C. (2021). Information and Communications Technology (ICT) Usage during COVID-19: Motivating Factors and Implications. International Journal of Environmental Research and Public Health, 18(7), 3571. Retrieved from https://doi.org/10.3390/ijerph18073571

Leedahl, S. N., Brasher, M. S., Estus, E., Breck, B. M., Dennis, C. B., & Clark, S. C. (2018). Implementing an interdisciplinary intergenerational program using the Cyber Seniors® reverse mentoring model within higher education. Gerontology & Geriatrics Education, 1–19. Retrieved from https://doi.org/10.1080/02701960.2018.1428574

Martínez-Alcalá, C. I., Rosales-Lagarde, A., Alonso-Lavernia, M. de los ángeles, Ramírez-Salvador, J. A., Jiménez-Rodríguez, B., Cepeda-Rebollar, R. M., … Agis-Juárez, R. A. (2018). Digital inclusion in older adults: A comparison between face-to-face and blended digital literacy workshops. Frontiers in ICT, 5(AUG), 1–17. Retrieved from https://doi.org/10.3389/fict.2018.00021

Martins, T., Midão, L., Veiga, S. M., Dequech, L., Busse, G., Bertram, M., … Costa, E. (2019). Intergenerational Programs Review: Study Design and Characteristics of Intervention, Outcomes, and Effectiveness. Journal of Intergenerational Relationships, 17(1), 93–109. Retrieved from https://doi.org/10.1080/15350770.2018.1500333

Midão, L., Pedreiro, E., Pinho, M. S., Dias, I., Almada, M., Garcia, K. R., … 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. Retrieved from https://doi.org/10.4018/IJDLDC.2020010102

Minayo, M. C. S. (2006). O desafio do conhecimento: Pesquisa qualitativa em saúde (9th ed.). São Paulo: Hucitec.

Murayama, Y., Ohba, H., Yasunaga, M., Nonaka, K., Takeuchi, R., Nishi, M., … Fujiwara, Y. (2015). The effect of intergenerational programs on the mental health of elderly adults. Aging & Mental Health, 19(4), 306–314. Retrieved from https://doi.org/10.1080/13607863.2014.933309

Peral-Peral, B., Arenas-Gaitán, J., & Villarejo-Ramos, ángel F. (2015). From digital divide to psycho-digital divide: Elders and online social networks. Comunicar, 23(45), 57–64. Retrieved from https://doi.org/10.3916/C45-2015-06

Perry Jr., W. G. (1998). Forms of Ethical and Intellectual Development in the College Years: A Scheme. Jossey-Bass. Retrieved from https://www.wiley.com/en-us/+of+Ethical+and+Intellectual+Development+in+the+College+Years%3A+A+Scheme-p-9780787941185

Pihlainen, K., Korjonen-Kuusipuro, K., & Kärnä, E. (2021). Perceived benefits from non-formal digital training sessions in later life: views of older adult learners, peer tutors, and teachers. International Journal of Lifelong Education, 40(2), 155–169. Retrieved from https://doi.org/10.1080/02601370.2021.1919768

Pinquart Silka Wenzel Martin, S. S. R. (2000). CHANGES IN ATTITUDES AMONG CHILDREN AND ELDERLY ADULTS IN INTERGENERATIONAL GROUP WORK. Educational Gerontology, 26(6), 523–540. Retrieved from https://doi.org/10.1080/03601270050133883

Purser, E., Towndrow, A., & Aranguiz, A. (2013). Realising the Potential of Peer-to-Peer Learning: Taming a MOOC with Social Media. SLearning Papers, 33(May), 1–5.

RASA, R. A. S. A.-Ict. project. (2019). Report on intergenerational and peer-to-peer educational programs to improve digital skills in older adults. European Commission. Retrieved from https://www.up.pt/ictskills4all/intellectual-outputs/o2-report-on-p2p-and-intergenerational-approaches/

Raymond, A., Jacob, E., Jacob, D., & Lyons, J. (2016). Peer learning a pedagogical approach to enhance online learning: A qualitative exploration. Nurse Education Today, 44, 165–169. Retrieved from https://doi.org/https://doi.org/10.1016/j.nedt.2016.05.016

Santini, S., Tombolesi, V., Baschiera, B., & Lamura, G. (2018). Intergenerational Programs Involving Adolescents, Institutionalized Elderly, and Older Volunteers: Results from a Pilot Research-Action in Italy. BioMed Research International, 2018, 4360305. Retrieved from https://doi.org/10.1155/2018/4360305

Seguí, F. L., de San Pedro, M., Verges, E. A., Algado, S. S., & Cuyàs, F. G. (2019). An intergenerational information and communications technology learning project to improve digital skills: User satisfaction evaluation. JMIR Aging, 2(2), 1–9. Retrieved from https://doi.org/10.2196/13939

Socias, C. O., Barceló, M. V., Gilliland, G., Costa, E., Brage, L. B., Barrio, B. P., … Veiga, S. M. (2018). Guidelines on Implementing Intergenerational Learning Programmes Based on the SACHI 2 Project experiences. Retrieved from Lodz, Palma, Glasgow, Porto: https://gifes.uib.eu/digitalAssets/560/560338_SACHI2_OI1-Guidelines_ENGxx.pdf

Stigmar, M. (2016). Peer-to-peer Teaching in Higher Education: A Critical Literature Review. Mentoring & Tutoring: Partnership in Learning, 24(2), 124–136. Retrieved from https://doi.org/10.1

080/13611267.2016.1178963

Tenenbaum, H. R., Winstone, N. E., Leman, P. J., & Avery, R. E. (2020). How effective is peer interaction in facilitating learning? A meta-analysis. Journal of Educational Psychology, 112(7), 1303–1319. Retrieved from https://doi.org/10.1037/edu0000436

Xie, B., Charness, N., Fingerman, K., Kaye, J., Kim, M. T., & Khurshid, A. (2020). When Going Digital Becomes a Necessity: Ensuring Older Adults' Needs for Information, Services, and Social Inclusion During COVID-19. Journal of Aging and Social Policy, 32(4–5), 460–470. Retrieved from https://doi.org/10.1080/08959420.2020.1771237

Yang, S., Fichman, P., Zhu, X., Sanfilippo, M., Li, S., & Fleischmann, K. R. (2020). The use of ICT during COVID-19. Proceedings of the Association for Information Science and Technology. Association for Information Science and Technology, 57(1), e297–e297. Retrieved from https://doi.org/10.1002/pra2.297

Zadworna, M. (2020). Healthy aging and the University of the Third Age – Health behavior and subjective health outcomes in older adults. Archives of Gerontology and Geriatrics, 90(May), 104126. Retrieved from https://doi.org/10.1016/j.archger.2020.104126

Zielińska-Więczkowska, H. (2017). Correlations between satisfaction with life and selected personal resources among students of universities of the third age. Clinical Interventions in Aging, 12, 1391–1399. Retrieved from https://doi.org/10.2147/CIA.S141576