Title: Challenges of digital healthcare service adoption by [us] the next generation of Older Adults

Filipa Ferreira-Brito[1,2,*] and Tiago Guerreiro[1,+]

[1] LASIGE, Faculdade de Ciências da Universidade de Lisboa, Lisbon, Portugal
[2] ISAMB, Faculdade de Medicina da Universidade de Lisboa, Lisbon, Portugal
[*] filipa.brito@campus.ul.pt
[+] tjvg@di.fc.ul.pt

In the aftermath of the first pandemic of the XXI century, it is undeniable the importance of digital healthcare services (DHS), such as telemedicine, teleconsultation, e-prescription, telerehabilitation, disease surveillance and prevention apps [1,2]. Perhaps, the irrefutable proof of such success is that what were non-existent or low-scale implemented services before the COVID-19 pandemic are now large-scale services provided daily, with some being co-financed by health insurances (e.g., teleconsultation).

However, the massive development of DHS during the public health emergency crisis also highlighted that a considerable percentage of the population is still deprived of access to these services, even in developed countries [3]. The impact of the digital divide was highlighted by the UN Secretary-General, António Guterres, who stated that the digital divide is currently *"… a matter of life and death for people who are unable to access essential healthcare…"* [5]. Two of the most common causes of restricted or no access to DHS by older adults are lack of access to computers, smartphones, internet connection (i.e., first-level digital divide), or absence of the skills to use those services effectively and efficiently (i.e., second-level digital divide) (cit. by [4]).

As an example of the barriers that less technologically savvy users still face, we share our experience during a project where we collaborated with older adults to develop a digital platform for neuropsychological rehabilitation [6]. Although all participants were Information and Communication Technologies (ICT) class attendees, it was surprising to see that some participants could not initiate or conclude an action without the validation/encouragement of the researcher. As external observers, it looked like these participants did not have confidence in their ability/skill to proceed and were blocked by the fear of doing something wrong. Nonetheless, participants knew what they needed to

do (e.g., click on the conclude button to finish a task), as they were able to verbalise it (e.g., I have to click here now).

The impact of participants' confidence and attitudes towards technology on the adoption of cognitive and other digital health apps has been stressed by several theoretical models [7]. However, most feasibility studies rarely assess users' subjective and emotional experience while using digital health platforms [8,9] or users' perceived confidence level in using and adapting to computers and new technologies [10]. Thereby, despite the efforts to accommodate users' necessities and limitations, through the use of user-centred design approaches, the impact of users' digital literacy, technology self-confidence, and capacity to effectively use digital cognitive and health applications in the long-term (i.e., therapeutic adherence) is not considered in most studies [8,9].

This scenario contrasts with the one existing in the medical devices sector (e.g., diabetes monitoring), where users are given training until the proper use of the medical devices can be ensured. We believe that a similar approach must be implemented to close the digital gap that prevents some users from effectively using DHS. Although, this training period can be seen as an onboarding phase (present in some platforms), it goes beyond it, as it should (ideally) be part of the platform's implementation and efficacy evaluation strategy [11].

One interesting approach to promoting adherence to DHS comes from Vygotsky's theory of Zone of Proximal Development [12]. According to Vygotsky, one's capacity to learn and adapt to new, unreachable content can be promoted if a more experienced agent supports the learning process [12]. However, with the current overload and lack of human resources in the health sector, the question arises of who could provide such services.

In this regard, we would like to share our experience with senior universities (SU). Senior universities are public and private institutions that aim to promote healthy ageing by offering older adults cognitive enrichment activities (e.g., ICT, music, craftwork) usually taught by retired teachers. Therefore, SU have specialised and motivated collaborators who can dedicate their time to teach older adults how to use DHS. Furthermore, the closeness in age with someone who also grew up without technology (i.e., the teacher) might promote/strengthen the identification between student and teacher, thus fostering the learning process and even improving older adults' perceptions about their capacity to learn and adapt to DHS.

Not all older adults experienced the digital divide, and there are protective factors [13]. In addition, one can argue that with less technologically savvy people growing older, the digital divide tends to disappear. However, cognitive and psychological sciences show that our capacity to learn and acquire new information changes throughout life [14].

Our cognitive ability to think speedily and solve new problems without relying on past experiences and knowledge (i.e., fluid intelligence) starts to decrease at the end of adolescence [14]. With this in perspective, it is without surprise that we realise the older population struggles to learn how to use an app that, in theory, is very similar to one previously learnt. In other words, it is almost like the knowledge acquired in previous experience with different apps was crystallised and could not be used/adapted/generalised to other apps. This might indicate that a tailored training period should be implemented for each new DHS older adults' need or want to use.

The shift from a problem-solving approach based on fluid intelligence to crystallised intelligence is biologically determined; therefore, there is the possibility that if an (even more drastic) technological jump occurs, future older adult generations will face their share of difficulties adapting to new technologies. If that becomes the case, the lessons learnt today while helping older adults to adapt to changes associated with their technological jump, for instance, by implementing a system that ensures effective learning of DHS, can be used as the basis of tomorrow's feasibility and effectiveness evaluation programs that will help today's adults (the next older adult generation) to adapt to the future [technology].

Funding

This work was supported by LASIGE Research Unit, ref. UIDB/00408/2020 and ref. UIDP/00408/2020, and the ShiftHRI project, a CMU Portugal Exploratory Project funded by Fundacão para a Ciência e Tecnologia (FCT), with reference CMU/TIC/0026/2021.

Reference

[1] D. Golinelli, E. Boetto, G. Carullo, A.G. Nuzzolese, M.P. Landini, M.P. Fantini, Adoption of digital technologies in health care during the COVID-19 pandemic: Systematic review of early scientific literature, J. Med. Internet Res. 22 (2020) 1–29. doi:10.2196/22280.

[2] E. Mbunge, J. Batani, G. Gaobotse, B. Muchemwa, Virtual healthcare services and

digital health technologies deployed during coronavirus disease 2019 (COVID-19) pandemic in South Africa: a systematic review., Glob. Heal. J. 6 (2020) 102–113.
[3] A. Ramsetty, C. Adams, Impact of the digital divide in the age of COVID-19, J. Am. Med. Informatics Assoc. 27 (2020) 1147–1148. doi:10.1093/jamia/ocaa078.
[4] L. Liu, F. Wu, H. Tong, C. Hao, T. Xie, The digital divide and active aging in China, Int. J. Environ. Res. Public Health. 18 (2021). doi:10.3390/ijerph182312675.
[5] A. Guterres, Digital Divide 'a Matter of Life and Death' amid COVID-19 Crisis, Secretary-General Warns Virtual Meeting, Stressing Universal Connectivity Key for Health, Development, United Nations, Meet. Cover. Press Release. (2020). https://press.un.org/en/2020/sgsm20118.doc.htm (accessed February 13, 2023).
[6] F. Ferreira-Brito, S. Alves, O. Santos, T. Guerreiro, C. Caneiras, L. Carriço, A. Verdelho, Photo-Realistic Interactive Virtual Environments for Neurorehabilitation in Mild Cognitive Impairment (NeuroVRehab.PT): A Participatory Design and Proof-of-Concept Study, J. Clin. Med. 9 (2020) 3821. doi:10.3390/jcm9123821.
[7] C.D. Norman, H.A. Skinner, eHealth literacy: Essential skills for consumer health in a networked world, J. Med. Internet Res. 8 (2006). doi:10.2196/jmir.8.2.e9.
[8] F. Ferreira-Brito, F. Ribeiro, D. Aguiar de Sousa, J. Costa, C. Caneiras, L. Carriço, A. Verdelho, Are Video Games Effective to Promote Cognition and Everyday Functional Capacity in Mild Cognitive Impairment/Dementia Patients? A Meta-Analysis of Randomized Controlled Trials, J. Alzheimer's Dis. 84 (2021) 329–341. doi:10.3233/jad-210545.
[9] F. Ferreira-Brito, M. Fialho, A. Virgolino, I. Neves, A.C. Miranda, N. Sousa-Santos, C. Caneiras, L. Carriço, A. Verdelho, O. Santos, Game-based interventions for neuropsychological assessment, training and rehabilitation: which game-elements to use? A systematic review, J. Biomed. Inform. 98 (2019) 103287. doi:10.1016/j.jbi.2019.103287.
[10] C. Cheng, A. Beauchamp, G.R. Elsworth, R.H. Osborne, Applying the Electronic Health Literacy Lens: Systematic Review of Electronic Health Interventions Targeted at Socially Disadvantaged Groups., J. Med. Internet Res. 22 (2020) e18476. doi:10.2196/18476.
[11] V. Ridde, D. Pérez, E. Robert, Using implementation science theories and frameworks in global health, BMJ Glob. Heal. 5 (2020) 1–8. doi:10.1136/bmjgh-2019-002269.
[12] L.S. Vygotsky, Interaction between learning and development, in: Mind Soc., Harvard University Press, Cambridge, 1978: pp. 79–91. doi:10.1016/S0006-3495(96)79572-3.
[13] S.J. Czaja, N. Charness, A.D. Fisk, C. Hertzog, S.N. Nair, W.A. Rogers, J. Sharit, Factors predicting the use of technology: Findings from the Center for Research and Education on Aging and Technology Enhancement (CREATE), Psychol. Aging. 21 (2006) 333–352. doi:10.1037/0882-7974.21.2.333.
[14] R.B. Cattell, Theory of fluid and crystallized intelligence: A critical experiment, J. Educ. Psychol. 54 (1963) 1–22. doi:10.1037/h0046743.