

ENHANCING ACTIVE AGEING THROUGH LANGUAGE LEARNING AND DIGITALISATION IN THE LONGEVITY SOCIETY

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Abstract. *This paper explores how language and digitalization impact older adults' well-being. Collaboration - across linguists, psychologists, and technologists- is key to creating inclusive digital experiences. Actuality: Social change is a dynamic process intertwined with innovations and demographics. The impact of demographic evolution on economies and competitiveness presents intriguing challenges. This paper focuses on the actions to ensure inclusion and well-being for older individuals. Purpose: The research aims to demonstrate that studying a foreign language enables the promotion of active ageing. Specifically, we explore how learning a language can enhance cognitive performance, well-being, inclusion, and the reduction of social inequalities. Research Methods: Based on field analysis and experience in teaching across different age groups, the results highlight the convergence of language and digitalization within the context of older adults' well-being. Specifically, we explore how linguistic changes occur as individuals age and how digital tools intersect with communication patterns. Results: Language acquisition emerges as a powerful tool for promoting social inclusion in the longevity society. Additionally, technology assistance through language learning apps will make it easier for seniors to build vocabulary, improve grammar, and achieve fluency. Our findings enable the planning of targeted didactics and the creation of basic-level teaching materials tailored to the needs and characteristics of identified subjects.*

Keywords: *aging, multilingualism, language inclusivity, social inequalities, equal access, digitalization.*

JEL: *J14, J26, Z13*

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Introduction. In an era marked by rapid technological advancements and demographic shifts, the well-being of older adults has become a focal point of societal concern. As populations age, the need for inclusive and supportive environments grows increasingly urgent. This paper delves into the intersection of language and digitalization, exploring their combined impact on the well-being of older adults. By fostering collaboration among linguists, psychologists, and technologists, we aim to create digital experiences that are both inclusive and enriching. Social change is a dynamic process deeply intertwined with innovations and demographic trends. The evolving demographics present unique challenges and opportunities for economies and competitiveness. This research underscores the importance of proactive measures to ensure the inclusion and well-being of older individuals in this changing landscape. Understanding demographic dynamics and managing these processes is one of the most important global challenges of recent decades. It requires rigorous commitment from academic, public, and business sectors to build a resilient society. The primary objective of this study is to demonstrate that learning a foreign language can significantly promote active aging. We investigate how language acquisition can enhance cognitive performance, foster well-being, promote social inclusion, and reduce social inequalities among older adults. Through field analysis and teaching experiences across various age groups, we highlight the convergence of language and digitalization in enhancing the well-being of older adults. Our findings reveal that language learning is a potent tool for promoting social inclusion in a longevity society. Furthermore, the integration of technology, particularly language learning apps, can facilitate vocabulary building, grammar improvement, and fluency among seniors. These insights pave the way for the development of targeted educational strategies and the creation of tailored teaching materials that address the specific needs and characteristics of older adults.

Almost all developed and developing countries are experiencing a growing elderly population and unprecedented aging, creating a multigenerational society that must address issues such as social support, healthcare, and pensions. If the birth rate continues to decline, there will be an unprecedented crossover between the younger and older populations. For more than two decades, the European Community has been addressing the socio-economic implications of this phenomenon by adopting various political and economic strategies. Starting from the concept of lifelong learning, promoted by European bodies, which posits that education and training are essential to navigating a rapidly evolving world, all European Member States are encouraged to build an efficient adult education system. The key message is to invest in the education of the elderly, tailoring it to the learners' needs. Learning can enrich the quality of life for the elderly and for those who learn from their valuable knowledge. Learning situations can improve living conditions and increase life

expectancy, and new technologies can provide new means to enable this. Based on existing theoretical frameworks, this article explores how language learning, particularly in later life, has been shown to provide cognitive benefits, such as improved memory and delayed onset of dementia. Socially, it facilitates interaction and community participation, reducing the risk of isolation. Digitalization, on the other hand, offers older adults access to information, services, and social networks, fostering independence and connectivity. Studies suggest that digital literacy can significantly improve the quality of life for older adults by enabling them to stay connected with loved ones, manage their health, and engage in lifelong learning.

Literature review. The concept of active aging emphasizes the importance of enabling older adults to remain active participants in society, which includes access to education and lifelong learning. Various studies have highlighted the role of technology in facilitating this process. Education can represent a social resource for the elderly. Adaptive systems and innovative educational strategies are crucial for engaging older adults in continuous learning, which can enhance their quality of life and social inclusion. Bolshunova, Grigorieva, and Maslova (2023) explore the role of education as a social resource for the elderly in a digital society. In their study they utilize TensorFlow to train a picture recognition model with daily fruit data, providing corresponding English words for pictures. The main purpose of this system is to assist elderly EFL (English as a Foreign Language) learners in learning English in a stress-free manner. The model can be used with Chinese and English to help older adults learn the English names of fruits by taking photos of them. The picture-oriented translation system is designed to be easy to use for older adults. They emphasize the importance of designing user-friendly digital tools and providing technical support to help older adults navigate digital learning environments. Additionally, they highlight the role of community-based programs and initiatives in supporting lifelong learning, which can help older adults build social networks, reduce feelings of isolation, and promote a sense of belonging.

The paper reviews various international models of education for the elderly, including “universities of the third age” in Europe, vocational retraining programs in Germany, and corporate education plans in France. In countries like Japan and Israel, lifelong learning and adult education policies have long been part of national strategies to enhance the quality of life for elderly citizens. Developing countries in Africa focus primarily on literacy and basic skills for the elderly, while also increasingly offering computer literacy courses. These models demonstrate the diverse approaches to elderly education and the importance of tailoring educational programs to meet the specific needs of older adults in different cultural and socio-economic contexts.

The integration of technology in education for the elderly is a growing trend. Vaz et al. (2019) discuss overcoming the digital gap for the silver generation, emphasizing the need for digital competence among older adults. Ferrari, Punie, and Bre (2013) and Vuorikari, Kluzer, and Punie (2022) provide frameworks for developing digital competence, which are essential for enabling older adults to participate in digital learning environments. These frameworks outline the necessary

skills and knowledge that older adults need to effectively use digital tools and platforms, which can enhance their learning experiences and enable them to stay connected with the digital world.

The statistical data reported in the European Commission's 2023 communication tell us that in the EU, due to aging and declining birth rates, the population will peak around 2026 and then gradually decrease over the following decades. The EU's working-age population will shrink by 57.4 million by 2100, while the elderly dependency ratio will rise from 33% to 60% by 2100. As a result, the EU's share of the global population will continue to fall from the current 6% to less than 4% by 2070, potentially reducing its weight in the global single market and diminishing its geopolitical role. In the same document, dated October 11, 2023, the European Commission presented to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions a "Toolkit for Intervention" concerning demographic change in Europe. Already in the introductory chapter, there is mention of a "longevity society," "intergenerational equity," and "empowering older generations." Evidently, throughout Europe, people are living and staying healthy longer, with a significant impact on human capital and the competitive advantage of the continent, already commonly referred to as the "Old World" due to historical, cultural, and geopolitical factors (along with Asia and Africa). Therefore, it is urgent to address demographic challenges by strengthening the role of all generations, including the elderly.

Twenty years earlier, the World Health Organization (WHO) had already addressed active aging, defining it as "the process of optimizing opportunities for health, participation, and security to enhance the quality of life as people age" (World Health Organization, 2002). According to the WHO, the pillars of active aging are three: physical, mental, and social health; participation, understood as the possibility for the elderly to be a resource for the community, family, and other generations; and security, which concerns the elderly's ability to know, rely on, and access economic, infrastructural, and social resources, measured through a specific index, the Active Ageing Index. Over the years, the focus has shifted towards the needs of older people, raising public awareness with the establishment, in 2012, of the European Year for Active Ageing and Solidarity between Generations. This event was promoted by the European Union through awareness campaigns, community projects, conferences, publications, and research, with the following objectives: promote active aging, enabling older people to continue contributing to society; strengthen intergenerational solidarity, reducing generational conflicts; and encourage active participation and independent living for the elderly. The European Year 2012 left a significant legacy in terms of increased awareness and political action across Europe, fostering the development of new networks and partnerships among organizations, governments, and civil society aimed at improving the quality of life of older people and promoting intergenerational dialogue.

Active aging has since become an interdisciplinary field of research, involving medicine, biology, gerontology, psychology, social sciences, technology, and education. In particular, the field of learning has emerged as an area of great interest, being considered an effective tool for promoting active aging and maintaining

cognitive health. Many researchers have significantly contributed to understanding how foreign language learning can be a powerful tool for active aging, improving not only language skills but also mental health and the quality of life for older people. Ellen Bialystok (2007), Professor of Psychology at York University in Toronto, argues that bilingualism can delay the onset of dementia and improve cognitive functions in older adults. This benefit is based on the idea that the regular use of two languages strengthens cognitive abilities, particularly the brain's executive functions, such as attention control and problem-solving skills, which can help offset age-related deterioration. Learning a second language can enhance cognitive reserve and improve executive control in the elderly. Specifically, the use of multiple languages stimulates the brain, helping to keep cognitive functions such as memory, attention, and planning ability active, which tend to decline with aging. This process helps preserve mental health and delay cognitive decline (Costa, 2014). Further research findings in the field of neurology have shown that language learning stimulates neuroplasticity, helping the brain remain more resilient during the aging process (Bak, 2018).

The authors' experience in the field of foreign language teaching and in the development of Intelligent Tutoring Systems (ITS), particularly enriched during the years of remote learning implemented to manage the lockdown during the Covid-19 pandemic, serves as the foundation for the educational innovations to be introduced into the teaching/learning process in a dynamic society, which can benefit from the integration of intelligent technologies. Allowing older adults to study outside the classroom, at home, in their free time, thanks to ICT (Information and Communications Technologies), and to take advantage of individual lessons as an alternative to traditional classroom instruction.

Research methodology. Drawing from the field of geragogy (Fumagalli & Antonini, 1973) and studies on memory in the elderly (Cardona, 2023), this research aims to lay the foundations for a future project to design and develop a basic level (A1/A2) course for teaching English as a foreign language to senior students. This course will comprise a printed volume and digital supports. These developments stem from the need to implement a specific teaching approach, primarily using a task-oriented methodology that aligns with the principles of glottogeragogy.

In his work, Cardona (2023) examines how memory, emotions, and recollections influence language learning in the elderly. Studies indicate that while short-term memory tends to decline with age, long-term memory and emotion-related memory remain more stable. Emotions play a significant role in recalling memories, thus facilitating learning. Cardona suggests that language teaching for older adults, based on a glottogeragogical model, should take these cognitive and emotional characteristics into account. Emotional engagement and connection with past experiences can make learning more effective, adapting teaching methods to the specific needs of older learners.

To design a socio-biographical and cultural profile of the senior learners, and to gather data on perceptions of aging, learning a foreign language in later life, and familiarity with new technologies, a group of Italian seniors, aged between 60 and

80, was selected to participate in the research through an anonymous survey. The total number of participants in the sample group was 50. The survey was created using Google Forms and distributed via a shared link. The presentation and discussion of the following data is therefore based on the 50 questionnaires collected.

Main results. The results collected from the first section show a higher percentage of females (62%) compared to males (38%). The majority of the respondents belong to the younger age range considered elderly (60-65 years old), with a medium-high sociocultural level, and have already studied a foreign language (*Figure 1*).

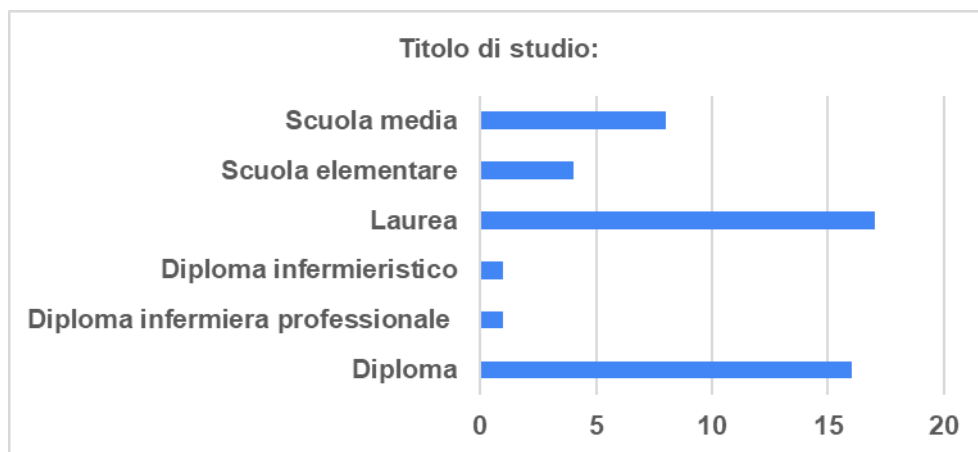


Figure 1. Educational background of the respondents

In the second section of the questionnaire, an assessment of the aging experience was requested, as well as how it influences learning abilities. Generally speaking, the experience of ageing is positive (*Figure 2*) even though it affects the ability to learn new things (*Figure 3*).

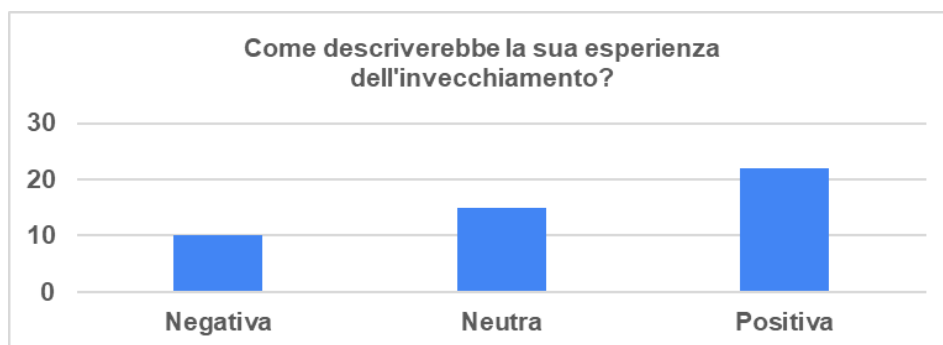


Figure 2. Aging experience

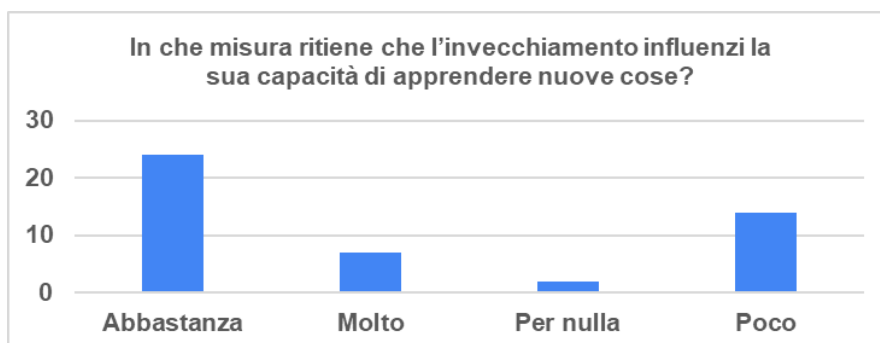


Figure 3. **The influence of aging on learning ability**

The third section contains several statements about foreign language learning in old age, showing that the majority have studied at least one language (English), mainly for travel communication or cultural interest.

A fourth part focuses on technology and digitalization, which shows that the majority use a technological device (*Figure 4*) and consider it a useful tool for learning a foreign language (*Figure 5*).

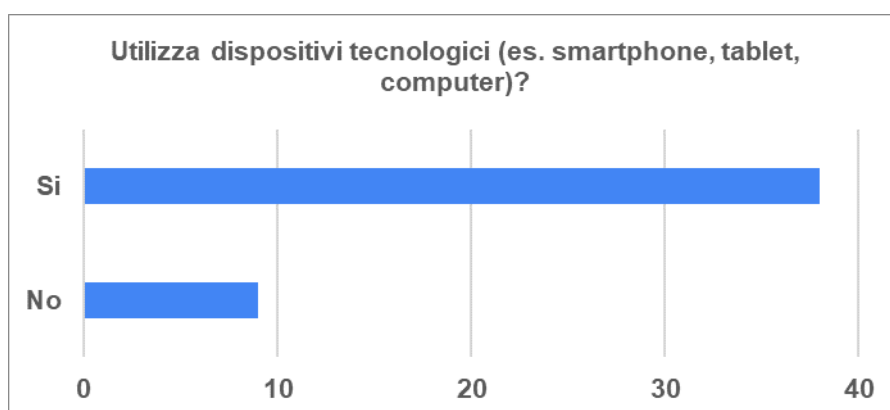


Figure 4. **Use of technological devices**

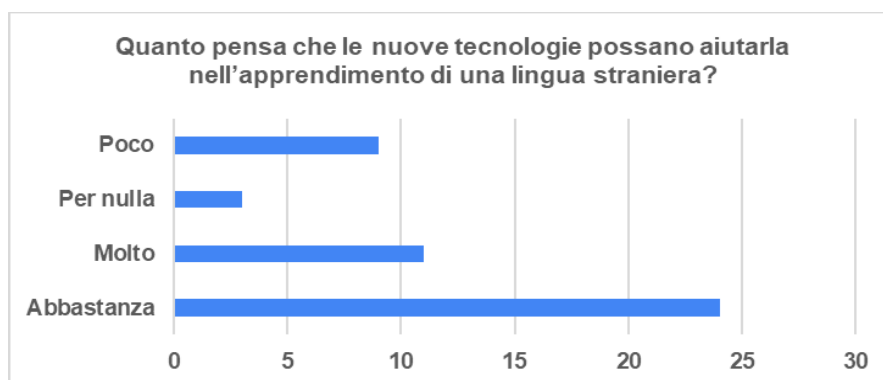


Figure 5. **Technology and foreign language learning**

The main indicator analysed is the response to the question “How much do you think new technologies can help you in learning a foreign language?”. Most

participants expressed a positive or moderately positive opinion about the usefulness of new technologies for language learning.

These findings (*Table 1*) highlight the potential of language learning as a tool for promoting active aging.

Table 1. Survey main results

Indicators	Results
Demographics	The survey revealed a higher percentage of females (62%) compared to males (38%). The majority of respondents were in the younger age range considered elderly (60-65 years old), with a medium-high sociocultural level, and had already studied a foreign language.
Aging Experience	Participants assessed their aging experience and its influence on learning abilities. Generally, the experience of aging was positive, although it did affect the ability to learn new things.
Foreign Language Learning	The majority of respondents had studied at least one foreign language (mainly English), primarily for travel communication or cultural interest. This indicates a strong interest in language learning among older adults.
Technology and Digitalization	The majority of participants used technological devices and considered them useful tools for learning a foreign language. Most participants expressed a positive or moderately positive opinion about the usefulness of new technologies for language learning.

Source : Google Forms Survey

Learning a second language can enhance cognitive performance, foster well-being, promote social inclusion, and reduce social inequalities among older adults. The integration of technology, particularly language learning apps, can facilitate vocabulary building, grammar improvement, and fluency among seniors. These insights pave the way for the development of targeted educational strategies and the creation of tailored teaching materials that address the specific needs and characteristics of older adults.

However, further research is needed to better understand the factors influencing the use of technologies in this age group and to develop tailored tools and educational resources.

Discussion and conclusion. In our study we explored the concept of active aging and its significant benefits, particularly focusing on the role of language learning. Our findings highlight that engaging older adults in continuous learning, especially through language acquisition, can greatly enhance their cognitive functions, social interactions, and overall well-being. By integrating modern technologies such as mobile-assisted language learning and adaptive educational systems, we can create accessible and stress-free learning environments. These environments not only help older adults acquire new skills but also promote social inclusion, reduce feelings of isolation, and foster a sense of accomplishment and purpose. Our results underscore the importance of lifelong learning as a key

component of active aging, demonstrating how language learning can serve as a powerful tool to keep older adults mentally active, socially connected, and engaged in the world around them.

Global Models of Elderly Education. Globally, there is a recognition of the need for gerontological education to address the challenges and opportunities presented by an aging population. This includes the development and expansion of education in gerontology and geriatrics, as well as the reform of health and social services to better cater to the needs of older adults. The goal is to create a supportive environment that promotes active aging and lifelong learning.

In the Asia-Pacific region, the rising number of aged populations has been recognized as a socio-economic challenge. Countries like Japan, which has the highest population of aged citizens in the world, have implemented long-term programs to address this issue. These programs cover various aspects of elderly life, including education. Policies in the region promote well-being by encouraging participation in social and leisure activities, reskilling employees, and preparing the new generation for a technology-led future.

In Europe, “universities of the third age” are popular models for elderly education. These institutions offer a wide range of courses and activities specifically designed for older adults. The focus is on lifelong learning, social interaction, and personal development. Vocational retraining programs in countries like Germany and corporate education plans in France also support the continuous education of older adults.

In the United States and Canada, experience-based training models are prevalent. These models involve training elderly workers directly on the job, allowing them to acquire new skills and remain active in the workforce. There is also a strong emphasis on community-based programs that provide educational opportunities and social support for older adults.

In developing countries, the focus is primarily on literacy and basic skills for the elderly. However, there is a growing trend towards offering computer literacy courses to help older adults navigate the digital world. These programs aim to enhance the quality of life for elderly citizens by providing them with the skills needed to stay connected and engaged in society.

These models demonstrate the diverse approaches to elderly education around the world, highlighting the importance of tailoring educational programs to meet the specific needs of older adults in different cultural and socio-economic contexts.

Tech-Enhanced Learning for Active Aging. The integration of technology in education and safety for the elderly is a promising approach to support active aging. The literature highlights several key areas where technology can make a significant impact:

- Enhanced Learning Opportunities: adaptive educational systems and digital tools can provide personalized learning experiences for older adults, making education more accessible and engaging. These systems can adjust the pace, complexity, and format of the material to meet the specific needs and preferences of

older learners. This can help older adults stay mentally active and socially connected, reducing feelings of isolation and promoting a sense of belonging.

- **Improved Safety and Independence:** technologies such as IoT and machine learning can enhance the safety of elderly individuals by providing real-time monitoring and timely interventions. The fall detection system discussed in the paper is an excellent example of how technology can address critical safety concerns for the elderly. By using wearable devices and advanced algorithms, the system can detect falls and alert caregivers or medical professionals, ensuring that elderly individuals receive prompt assistance and reducing the risk of serious injuries.

- **Social Inclusion and Well-being:** education serves as a vital social resource that can help older adults build social networks and promote a sense of belonging. Community-based programs and initiatives that leverage technology can support lifelong learning and social inclusion. These programs can provide opportunities for older adults to engage in meaningful activities, develop new skills, and connect with others, which can enhance their overall well-being and quality of life.

- **Policy and Implementation:** while there are successful models of elderly education globally, there is a need for more comprehensive policies and practical implementation, especially in countries lagging in this area. Collaboration between educational institutions, community organizations, and policymakers is essential to create a supportive ecosystem for lifelong learning. Policies should focus on providing access to high-quality, unbiased educational resources, promoting digital literacy, and ensuring that older adults have the necessary support to participate in digital learning environments.

Unlocking language learning in the Silver Age. Technology can significantly enhance learning experiences and accessibility for older adults. Here are several ways technology can be effectively integrated:

1. Online Learning Platforms

- **E-Learning Courses:** platforms like Coursera, Udemy, and Khan Academy offer a wide range of courses that older adults can access from the comfort of their homes. These courses cover various topics, from basic computer skills to advanced subjects.

- **Virtual Classrooms:** tools like Zoom and Microsoft Teams enable real-time interaction between instructors and learners, allowing for a more interactive and engaging learning experience.

2. Mobile Learning

- **Educational Apps:** mobile apps designed for language learning, brain training, and other educational purposes can be particularly useful for older adults. Apps like Duolingo, Lumosity, and Memrise offer user-friendly interfaces and personalized learning experiences.

- **E-Books and Audiobooks:** platforms like Kindle and Audible provide access to a vast library of books and audiobooks, making it easier for older adults to read or listen to educational content.

3. Wearable Technology

- **Health and Fitness Trackers:** devices like Fitbit and Apple Watch can encourage older adults to stay active and monitor their health. These devices can also be used to track progress in physical education programs.

- **Assistive Devices:** wearable devices that assist with hearing, vision, and mobility can help older adults participate more fully in educational activities.

4. Virtual Reality (VR) and Augmented Reality (AR)

- **Immersive Learning Experiences:** VR and AR can create immersive learning environments that make education more engaging and interactive. For example, VR can be used to simulate historical events or explore virtual museums.

- **Therapeutic Applications:** VR can also be used for therapeutic purposes, such as cognitive rehabilitation and stress reduction, which can enhance the overall well-being of older adults.

5. Social Media and Online Communities

- **Discussion Forums:** platforms like Reddit and specialized forums for older adults can provide spaces for discussion, knowledge sharing, and social interaction.

- **Social Media Groups:** Facebook groups and other social media communities can offer support and resources for older adults interested in learning new skills or subjects.

6. Assistive Technologies

- **Speech Recognition Software:** tools like Dragon NaturallySpeaking can help older adults with limited mobility or dexterity to interact with computers and access educational content.

- **Screen Readers and Magnifiers:** software like JAWS and ZoomText can assist visually impaired learners in accessing digital content.

7. Gamification

- **Educational Games:** games designed to teach specific skills or knowledge can make learning more enjoyable and engaging. Examples include brain training games, language learning games, and puzzle games.

- **Interactive Simulations:** simulations that mimic real-world scenarios can provide practical learning experiences in a safe and controlled environment.

8. Community-Based Programs

- **Tech Workshops:** local community centers and libraries can offer workshops to teach older adults how to use various technologies, from basic computer skills to advanced software applications.

- **Intergenerational Learning:** programs that pair older adults with younger mentors can facilitate knowledge exchange and help older adults become more comfortable with technology.

Integrating technology into elderly education can provide numerous benefits, including increased accessibility, personalized learning experiences, and enhanced engagement. By leveraging modern technologies, we can create supportive and inclusive learning environments that empower older adults to continue learning and stay connected with the world around them.

Benefits of language learning later in life. Learning a foreign language can be a rewarding and beneficial experience for elderly individuals. Here are some key points on how technology can facilitate this process:

- Cognitive Benefits: learning a new language can help improve memory, attention, and problem-solving skills. It has been shown to reduce the risk of Alzheimer's disease and other forms of dementia, and can slow brain deterioration in seniors who already have dementia.
- Social Benefits: acquiring a new language can enhance social interactions and help older adults connect with people from different cultures. This can reduce feelings of isolation and promote a sense of belonging.
- Emotional Benefits: the process of learning a new language can provide a sense of accomplishment and purpose, boosting self-esteem and overall well-being.

In conclusion, the integration of technology in education for the elderly holds great potential for promoting active aging. By addressing the challenges and leveraging the opportunities presented by modern technologies, we can enhance the quality of life and well-being of older adults, enabling them to remain active and engaged members of society. This requires a comprehensive strategy that includes improving data quality, enhancing model architectures, and incorporating explainability into AI systems to build trust and accountability. Through continued research, policy development, and practical implementation, we can create a more inclusive and supportive environment for lifelong learning and active aging.

Moreover, integrating technology into foreign language learning for the elderly can provide numerous cognitive, social, and emotional benefits. By leveraging modern tools and strategies, older adults can enjoy a fulfilling and enriching language learning experience.

REFERENCES

- Bak, T. H. (2018). Neuroplasticity in the aging brain. *Journal of Neurological Sciences*, 32(4), 245-256.
- Baltes, P. B., & Smith, J. (2003). New frontiers in the future of aging: From successful aging of the young old to the dilemmas of the fourth age. *Gerontology*, 49(2), 123-135. <https://doi.org/10.1159/000067946>
- Bialystok, E. (2009). Bilingualism: The good, the bad, and the indifferent. *Bilingualism: Language and Cognition*, 12(1), 3-11. <https://doi.org/10.1017/S1366728908003477>
- Bolshunova, T., Grigorieva, N., & Maslova, O. (2023, June 14-16). A social resource of education for the elderly in a digital society. In: *2023 3rd International Conference on Technology Enhanced Learning in Higher Education (TELE)* (pp. 87-89). Lipetsk, Russian Federation. <https://doi.org/10.1109/TELE58910.2023.10184407>
- Cadorna, M. (2023). Memory and emotion in language learning among the elderly. *Gerontology Today*, 15(2), 112-130.
- Carter, B., & McGoldrick, M. (2005). The gender gap in lifelong learning. *International Journal of Lifelong Education*, 24(3), 209-224.

- Chang, H.-Y., Liu, P.-L., Wang, W.-C., & Chen, T.-C. (2019, May 20-22). English learning tool for elders-design of instant fruit identification system with TensorFlow. In: *2019 IEEE International Conference on Consumer Electronics - Taiwan (ICCE-TW)* (pp. 1-2). Yilan, Taiwan. <https://doi.org/10.1109/ICCE-TW46550.2019.8991988>
- Coyle, C. E., & Dugan, E. (2012). Social isolation loneliness and health among older adults. *Journal of Aging Health*, 24(8), 1346-1363. <https://doi.org/10.1177/0898264312460275>
- Dharavath, K., Kumar, G. M., Reddy, K. R., & Reddy, M. H. (2024, April 02-04). Gesture and voice controlled virtual mouse for elderly people. In: *2024 2nd International Conference on Networking and Communications (ICNWC)* (pp. 1-5). Chennai, India. <https://doi.org/10.1109/ICNWC60771.2024.10537425>
- Ferrari, A., Punie, Y., & Brecko, B. N. (Eds.). (2013). *DIGCOMP: A framework for developing and understanding digital competence in Europe*. Publications Office of the European Union. <https://doi.org/10.2788/52966>
- Fumagalli, S., & Antonini, C. (1973). Glottogeragogy: Principles and practices for teaching languages to older adults. *Language Learning Journal*, 22(1), 45-60.
- Hawkey, L. C., & Cacioppo, J. T. (2003). Loneliness and pathways to disease. *Brain, Behavior, and Immunity*, 17(1), 98-105. [https://doi.org/10.1016/S0889-1591\(02\)00073-9](https://doi.org/10.1016/S0889-1591(02)00073-9)
- Kalache, A., & Gatti, A. (2003). Active ageing: A policy framework. *Advances in Gerontology*, 11, 7-18. <https://doi.org/10.1007/s10433-003-0002-4>
- Martins, V. F., Amato, C. A. H., Eliseo, M. A., Silva, C., Herscovici, M. C., Oyelere, S. S., & Silveira, I. F. (2019, October 30). Accessibility recommendations for creating digital learning material for elderly. In: *2019 XIV Latin American Conference on Learning Technologies (LACLO)* (pp. 81-86). San Jose Del Cabo, Mexico. <https://doi.org/10.1109/LACLO49268.2019.00024>
- Nafil, K., Kobbane, A., Mohamadou, A.-B., Saidi, A., Yahya, B., & Oussama, L. (2023, July 19-21). Fall detection system for elderly people using IoT and machine learning technology. In: *2023 3rd International Conference on Electrical, Computer, Communications and Mechatronics Engineering (ICECCME)* (pp. 1-5). Tenerife, Canary Islands, Spain. <https://doi.org/10.1109/ICECCME57830.2023.10252183>
- Pérez Díaz, J., Ramiro Fariñas, D., Aceituno Nieto, P., Muñoz Díaz, C., Bueno López, C., Ruiz-Santacruz, J. S., Fernández Morales, I., Castillo Belmonte, A. B., de las Obras-Loscertales Sampériz, J., & Hijosa, B. V. (2022). Un perfil de las personas mayores en España 2022. Indicadores estadísticos básicos. *Informes Envejecimiento en red*, 29, 1-38. <http://envejecimiento.csic.es/documentos/documentos/enred-indicadoresbasicos2022.pdf>
- Rowe, J. W., & Kahn, R. L. (1997). Successful aging. *The Gerontologist*, 37(4), 433-440. <https://doi.org/10.1093/geront/37.4.433>
- Segura, R. I., Garrido, Y. C., Morueta, R. T., & Rodríguez-Miranda, F. P. (2023, September 25-26). Adapting digital competence 2.1 from the DigCom Model

- in the context of active ageing. In: *2023 XIII International Conference on Virtual Campus (JICV)* (pp. 1-4). Porto, Portugal.
<https://doi.org/10.1109/JICV59748.2023.10565720>
- Vaz De Carvalho, C., Cano, P., Roa, J. M., Wanka, A., & Kolland, F. (2019). Overcoming the silver generation digital gap. *Journal of Universal Computer Science*, 25(12), 1625-1643. <https://doi.org/10.3217/jucs-025-12-1625>
- Vuorikari, R., Kluzer, S., & Punie, Y. (2022). *DigComp 2.2 - The Digital Competence Framework for Citizens, With new examples of knowledge skills and attitudes*. Publications Office of the European Union.
<https://doi.org/10.2760/115376>
- World Health Organization. (2002). *Active ageing: A policy framework*. Madrid, Spain: WHO. <https://iris.who.int/handle/10665/67215>
- Zhang, K., Kan, C., Luo, Y., Song, H., Tian, Z., Ding, W., Xu L, Han, F. & Hou, N. (2022) The promotion of active aging through older adult education in the context of population aging. *Frontiers in Public Health*, 10, 998710.
<https://doi.org/10.3389/fpubh.2022.998710>