



Language Learning in the Third Age

Nicole Bosisio

*Ph.D., Lecture, , Department of Education Sciences [DISFOR], University of Genoa -
Email: nicole.bosisio@unige.it*

Doi: 10.2478/gssfj-2019-0003

Abstract

This paper discusses the importance of foreign language learning as a means of maintaining healthy cognitive, psychological and social functioning in elderly people. It argues that a complex cognitive activity involving multiple skills and stimulating extensive neural networks can greatly contribute to contrast the inception of neurodegenerative disorders such as Alzheimer's and other types of dementia. Because of age-related physical and mental limitations, and because old learners find it hard to abandon tried-and-tested methodologies and attitudes, it is, however, crucial that teachers and educators try to meet the older adult's needs by customising teaching procedures and learning environment to their requirements and expectations. Rather than introducing a great amount of new information and learning techniques, it may be much more fruitful to encourage the older adult to retrieve and rely on previously acquired knowledge and consolidated learning strategies. The adoption of computer-assisted language learning, however, may be helpful and motivating for older learners, provided technological demands are kept to a minimum.

Keywords: *foreign language learning, elderly learners*

1. Introduction

Traditionally, elderly people were not expected to learn new notions; they were seen as depositories and dispensers of knowledge and culture, not as receivers. In the fast-paced 21st century world, however, lifelong learning has become a necessary means of adjusting to the continuous changes it is undergoing. Renewing and acquiring knowledge and skills is now an imperative – though at different levels and for different purposes - for people of all ages, including senior citizens. In particular, with global communication rapidly expanding, foreign language learning (henceforth FLL) has become a crucial skill without which an individual is cut out of most human activities.

Besides, it has been shown that the elderly can benefit from complex cognitive engagements requiring the activation of extensive neural networks (Ware et al., 2017), especially in relation to ever-spreading age-related neurodegenerative ailments, such as the Alzheimer's syndrome and other types of dementia. Given that no pharmacological treatment has yet

been found that could stop, or better prevent, or at least delay, the development of such diseases (Gauthier et al., 2012; Selkoe, 2012), it becomes crucial to put forward alternative solutions (Hughes, 2010; Dresler et al., 2013; Law et al., 2014). One promising path is that of attempting to maintain healthy cognitive functioning in senior citizens by means of physical, social and cognitive stimulation. This latter can be achieved by acquiring new skills and refreshing old ones. Ageing individuals who display higher levels of education and keep exercising their minds seem to be less prone to develop Alzheimer's disease since novelty and learning have been proved to be key factors in the preservation of brain plasticity (Salthouse, 2006; Kivipelto et al., 2006; Greenwood and Parasuraman, 2010).

Lifelong learning can also be seen as a means of contrasting loneliness and depression - another two factors increasing the risk of developing dementia - by means of social stimulation, since a tight bond and strong sense of belonging is often established between people sharing the same learning goals within a classroom (Tzang et al., 2015; Wang et al., 2002). These findings have led to the development of socio-educational programmes specially designed for the third age, such as *Senior Odyssey*, aiming at preventing the degeneration of neural networks by fostering mental activity (Stine-Morrow et al., 2007).

2. Learning a foreign language to fight cognitive impairment

Potentially fruitful interventions in cognitive as well as social stimulation can be based on FL teaching (Ware et al., 2017) since the development of linguistic skills can enhance resistance to cognitive impairment. Conversely, the presence of dementia or other neurodegenerative conditions has been found to greatly affect linguistic proficiency (Forbes-McKay and Venneri, 2005), thus going to show how language is inextricably intertwined with different aspects of brain functioning.

FLL may bolster so-called *cognitive reserve*, i.e. the ability to compensate for the loss of cognitive capacity in older learners through functional resistance to structural brain damage (Bialystok et al., 2007; SantaCruz et al., 2011). Since FLL involves a variety of skills, such as speech segmentation, sound discrimination, rule deduction, working memory, semantic association, inductive reasoning or task switching, it stimulates different areas of the brain, greatly contributing to maintaining its plasticity (Gold et al., 2013; Antoniou et al., 2013) and, if not avoiding, at least delaying the onset of dementia.

Lifelong bilingualism appears to affect the anatomy of the human brain so that individuals who habitually speak more than one language display a greater amount of white matter in the frontal lobes compared to their

monolingual counterparts (Olsen et al., 2015). Even late and consecutive bilinguals have been shown to be more competent at cognitive tasks and executive functioning than monolinguals (Vega-Mendoza et al., 2015), since, as language proficiency improves, brain anatomy undergoes changes, increasing its structural plasticity. This has been demonstrated not only in children and adults, but also in elderly learners, and even in the first phases of FLL (Mechelli et al., 2004; Hosoda et al., 2013; Li et al., 2014). These observations strongly point to the possibility that older adults will greatly benefit from language training: by relying on extensive neural networks, FLL can increase their neuroplasticity and strengthen their resistance to cognitive impairment. Nold (2005) has shown that, by means of suitable techniques, older adults can recover a previously learnt and then forgotten FL, even after the onset of Alzheimer's disease.

As was mentioned above, FLL can also have significant social repercussions for senior citizens, as it opens new communication channels, allowing them to interact with foreigners, gain access to worldwide information and have more opportunities to travel and engage in novel activities. At a deeper level, language shapes an individual's social identity and self-image in relation to the community, so that learning an FL can be a means of opening up to new cultural perspectives and enriching one's social awareness (Dörnyei, 2005).

3. Age differences in language learning

FLL is thus an extremely beneficial activity for the elderly. It is, however, a common assumption that older individuals are slower and less successful language learners than younger individuals. Given a suitable input, children (but also younger adults) can acquire native-like pronunciation, grammar and vocabulary of a second language, while older learners find it much more challenging to switch to a new phonological system, assimilate syntactic rules and memorising lexemes (Singleton and Ryan, 2004; Muñoz, 2006; Hu, 2016).

3.1 The CPH

Several hypotheses have been put forward to explain this phenomenon, many of which refer to a loss of cerebral plasticity as an effect of ageing. The first and most well-known of such theories is the Critical Period Hypothesis (CPH), first advanced by Penfield and Roberts (1959) and then developed by Lenneberg (1967) and Scovel (1969), which assumes the existence of a period, which goes from birth to puberty, during which the human brain is so pliable as to allow second language acquisition to take place in a similar way to first language acquisition. Given the right

environment, a child under 12-13 years of age would thus be capable of achieving a native-like competence of a second language. The loss in neuroplasticity of the adult brain would be due to the lateralisation process, by which the cerebral functions specialise and localise in the two hemispheres. In fact, early and late second language acquisition seems to activate different areas of the brain (Herschensohn, 2007), though this could also be a result of the difference between natural acquisition and more conscious language learning in educated individuals (Krashen, 1981). Some scholars (Krashen, 1985; Snow, 2002) actually argue that the difference between adults' and children's acquisitional behaviours may be entirely ascribed to non-biological factors, such as general cognitive development, experience, type of exposure, instruction, motivation, sense of identity, inhibition.

In spite of the innumerable criticisms and modifications that it has undergone in the following decades, the CPH bore in itself much food for thought, first and foremost the reference to brain plasticity. Even if the idea of a well-defined period beyond which native-like acquisition is impossible has been seen as drastic and arbitrary (Krashen, 1973; Selinger, 1978) and brain imaging has shown that the biological assumptions upon which Lenneberg acted are untenable (e.g. lateralization is complete well before puberty), we can still claim that loss of plasticity is connected with the more deliberate effort required by adult language learners – and all the more so by older adults - in a natural environment, although other factors are undoubtedly at play.

3.2 Drawbacks, but also advantages

It must be pointed out, however, that children are not always better at learning languages than adults are. In an artificial environment, the latter's higher cognitive development, education and experience make them more efficient and successful learners. Ekstrand (1976) goes so far as to claim that acquisitional skills improve with age.

Much research (Krashen et al., 1979; Snow and Marian, 1978; Dulay and Burt, 1982) points out that adults tend to be faster in the early stages of language acquisition, while children tend to be more successful in the long run, often achieving native-like competence where older learners fail to do so. Besides, while children, relying mostly on mimicry and memory, appear to be better acquirers of language skills such as pronunciation or listening comprehension (Singleton and Ryan, 2004), adults – given their more advanced cognitive development and substantial educational experience - are more successful at discourse organization, semantic relations and grammatical structure, which require greater analytic skills and knowledge of the world (Harley and Hart, 1997; Grognet, 1997). Such observations

find a biological confirmation in the claim that neural networks responsible for higher-order linguistic processes develop with age (Faust et al., 1995). These differences, however, should not be seen within a dichotomous categorisation, but as a gradually developing trend that distinguishes not only children from adults but, more fuzzily, younger learners from older learners.

According to *Adult Learning Theory* (Knowles, 1968; Kenner and Weinerman, 2011), as an individual age, her/his acquisitional ability depends less and less on biological development or educational requirements, and more and more on the demands of working and/or social life. Therefore, while children's learning is more geared towards subject knowledge, adults' is more based on problem-solving strategies. In particular, adults who have had some formal education can rely on their ability to accomplish higher-order operations, such as assumptions, deductions and generalisations, construing new information in terms of pre-consolidated knowledge. Educated individuals are better able to retrieve and recycle learning strategies from the previous acquisition of their mother tongue and, if present, FLL. Hansen et al. (2002) actually show how adults with some second language experience display superior acquisitional skills compared to those who are learning an FL for the first time.

In conclusion, the divergences in both success rates and learning paths followed by learners at different ages are probably the result of a combination of biological, psychological, cognitive and socio-cultural factors, which makes the learning experience of each individual unique. So many linguistic, cognitive and environmental variables are at play, that it is virtually impossible to pinpoint the exact proportional weight of every single factor. Nevertheless, it is still essential to study more general trends, in order to identify preferential teaching approaches for the different ages.

4. Old age and language learning

Overall, the fact remains that elderly people find it particularly hard to learn a new language, which does not mean that we should give up on it, but just find suitable ways of sustaining their learning process. Senior citizens have been proved to be capable of learning an FL (Gómez, 2016), though activities involving working and short term memory, which often undergo the most severe loss with age, can be very challenging (De Bot and Makoni, 2006). Therefore, learning a new language from scratch may be a rather daunting task for the elderly, while retrieving knowledge of a language learnt even a long time before is much more feasible. Van der Hoeven and de Bot (2012) claim that older adults can relearn apparently forgotten lexemes just as well as younger ones, while according to Bahrick (1984) an

individual may retain, at least as a dormant feature, most second-language knowledge for decades, even without using it. In Ware et al. (2017)'s study, however, even those informants who had previously learned the target language (henceforth TL) sometimes found it hard to memorise new vocabulary, which may be rather demotivating.

On the other hand, facing a complex task such as learning a novel language could be mentally stimulating for elderly people. Schroeder and Marian (2016) put forward the *Supply-Demand Mismatch* hypothesis, by which it is the difficulty itself – i.e. the shortage of cognitive resources with respect to cognitive demands – that increases the supply of resources available to the learner, provided the challenge is adequately framed and repeated over a period of time. It is, therefore, the complexity intrinsic to FLL which, through repetitive and meaningful practice, produces its main cognitive benefits.

4.1 Health issues

Physical health is an important factor in ensuring a successful and gratifying learning process, and clearly elderly people are more subject to various ailments than younger individuals. In particular, hearing and visual impairment can be a serious obstacle to comprehension and input processing, and consequently to language learning tout court. For most older adults, oral comprehension will be a particularly daunting task – especially if background noise is present – both because of phonological fossilisation and of diminished hearing capacities. Due to age-related presbyopia, reading will also become more laborious, especially if the written text is in small and/ or fancy type. Physical mobility or, conversely, the ability to sit or stand for a long time, may also be hampered; consequently, the possibility of attending classes or taking part in kinaesthetic activities will be obstructed.

More insidious still to the older learner are mental health issues, which may affect directly or indirectly their capacity to process and retain language knowledge. Depression, which is rather common among senior citizens, can hamper the learning process both by depriving the individual of self-confidence and motivation and by not allowing them to properly concentrate on the learning tasks, thus reinforcing their feelings of ineptitude (Grognet, 1997, p. 2)

A more direct and evident impairment results from short term memory loss, which is characteristic of old age, even in individuals that are not affected by dementia. This compromises, in particular, the area of vocabulary, which is arguably the most pervading and challenging aspect of a language (see Lewis, 1993), since a language's lexis is virtually infinite in size and ever-changing, and it lacks the finite regularity of grammar. It

has often been pointed out how the extent of an individual's vocabulary is strongly related to her/his ability to communicate (Harley, 1995; Nation, 1993).

4.2 Socio-psychological issues

Issues of social identity, attitude to the teacher, the co-learners and the whole learning process can be crucial in determining the outcome of the FLL enterprise. Because of their lifelong experience, elderly learners will have well-defined expectations about the educational process, which may not match the most effective procedures, and about the role and place of the teacher, who is likely to be younger than they are.

Related to such socio-psychological issues is that of *motivation*, both intrinsic to the learning environment and extrinsic, i.e. regarding the present and future applications of the acquired knowledge. Motivation plays a key role in language acquisition and in learning tout court, often compensating for weaknesses in aptitude and cognitive skills (Marinova-Todd et al., 2000; Dörnyei, 2005). Typical motivations for learning English as expressed by older adults are communicating with relatives abroad, escaping their monotonous routine, facing up to the challenge of completing the course (Ware et al., 2017, p. 6). Duay and Bryan (2008) claim that 66% of the elderly learners interviewed declared that the main reason for undertaking educational activities was to stay in touch with the outer world.

By contrast, lack of motivation and negative feelings are bound to severely impair the language learning process. According to Grognet (1997, p. 2), 'The greatest obstacle to older adults learning a language is the doubt in the mind of the learner that older adults can learn a language'. As was mentioned in the introduction, this is, unfortunately, a widespread belief, that tends to cloud even the teachers' vision of the educational experience. In particular, older learners with limited – or altogether absent – knowledge of the TL tend to be demotivated from the start, based on the idea that they will never be able to reach a satisfactory competence level. Another generalised perception that must be overcome is that older adults, with no work career and limited mobility, have no need to learn an FL. This belief is both untrue and damaging to the educational experience since it deprives the learner of any extrinsic motivation. As was said above, there are both socio-psychological and neurological reasons to encourage elderly people to approach FLL, and an adequate teaching methodology, taking into account all the above-mentioned factors, can result in satisfied, happier and healthier seniors.

5. Teaching practice

Elderly language learners can be supported in their journey by breaking down affective barriers and deconstructing false beliefs; by proposing suitable tasks and activities, adapting the learning environment and promoting the use of learning strategies; by selecting topics, situations and materials that are relevant to the student's needs and wishes.

5.1 Meeting the learners' needs

The first step in removing affective barriers is for the teacher to be persuaded that older adults can make perfectly successful language learners. A teacher with a positive attitude to the language learning process can easily pass on her/his belief to the learners themselves, who will then be able to reduce their levels of anxiety and lower their affective filter (Krashen, 1982; 1988), gaining confidence in themselves and in their educational experience. It is particularly important for teachers to show enthusiasm for the subject, to give positive feedback, to emphasise the progress made by the learners and to design activities that will allow them to be successful. Making the students aware of their progress by introducing learning to learn practices will help them better understand how language acquisition works and focus on what they have actually learnt each time. Teachers should also make sure that all students are given a chance to actively participate in classroom activities and express their personal views and feelings.

Given the objective learning difficulties that older adults are likely to encounter, it is crucial that teachers should pay particular attention to their needs, listen to their observations and requests and show they care about their progress (Djoub, 2013). It is not enough for them to be aware of the learners' technical skills; teachers must also investigate and understand the students' preferences and learning styles. To this effect, an initial needs analysis by means of questionnaires and/ or interviews is definitely in order, followed by continuous checks as the course unfolds, while more general studies targeting the necessities and interests of the elderly population in a given area can provide a useful blueprint.

Since older learners are very much aware of their own needs and wishes and very keen to accomplish them, they should be consulted about both the format and the semantic and grammatical contents of the course. It is essential that teachers do their best to comply with such requests and adjust their lessons accordingly (Djoub, 2013). This does not, however, mean that the instructor should passively follow the learners' directions: on the contrary, older adults appear to appreciate an authoritative, organised guidance (Duay and Bryan, 2008) and a learner, however, experienced,

cannot always distinguish between her/his immediate wishes and longer-term necessities. Nevertheless, whenever the teacher feels that there is a mismatch between the students' requests and their effective needs, this should be discussed with the learners themselves.

As far as form is concerned, Clough (1992) points out that older adults display a preference for working with coursemates of a similar age, avoiding traditional classroom procedures, while Duay and Bryan (2008) found that their elderly interviewees had rather take on an active role in their educational process, within a discussion, question/ answer frame. Social activities and interactive tasks are particularly useful for several reasons: they provide opportunities for TL practice, for sharing ideas and experiences, for establishing a cooperative climate in the classroom. Talking about their life and skills does not only give the elderly a sense of self-confidence but instils in them a feeling that they still have a role to play in society (Boulton- Lewis et al., 2006). In order to keep up both their interest and their faith in the learning process, it is important to make sure that the elderly get a chance to express their views and demonstrate their talents, especially if younger learners are present in the class (Grognet, 1997). The teacher must, therefore, be aware of the topics in which older students are interested and of which they have the knowledge, select them carefully and design her/his course around them, resorting to suitable tasks, activities and tools. Among the subject matters elderly people are most interested in, issues connected to their personal well-being, such as health and safety, seem to stand out (Boulton-Lewis et al. 2006), and more in general topics, they are familiar with (Duay and Bryan, 2008). In all adult learning situations, it is crucial to building on the learner's past experiences so that new information can be embedded in already consolidated cognitive structures.

Because of their difficulty in acquiring new learning strategies, older students must be encouraged to rely on those approaches that have proved to be of help in other contexts. Tasks must be explored from different angles, so as to allow seniors to adopt the strategies that are most suitable to their learning style. A visual learner may need to draw mind maps, match words to pictures or write things down, while an auditory learner may prefer to combine words with music or repeat them aloud. Allowing older students to implement the most congenial learning strategies helps them feel more comfortable in the classroom, reducing anxiety and fostering self-confidence.

Older learners' preference for problem solving (see Adult Learning Theory above) also indicates that they are likely to be interested in skills that can be applied to everyday tasks such as shopping, making telephone calls or asking for directions (Grognet, 1997).

Attention to the learners' preferences and interests will contribute to maintaining high levels of motivation, avoiding tedium and frustration. To this end, it is also important to monitor the amount and quality of language input and output in each lesson, in order to avoid older students feeling overloaded with information or, on the contrary, bored and tired with repetitive, excessively easy tasks. It is, therefore, necessary to vary topics and activities within the class in order to keep up the learners' involvement (Djoub, 2013).

5.2 Simplifying the task

When dealing with older learners, age-related issues must always be born in mind in setting up a course. In order to compensate for sight and/ or hearing impairment, the environment should be luminous and quiet and new language items should be introduced through both visual and auditory materials. It is clearly necessary to eliminate physical barriers so as to allow all students access to and movement around the classroom. Age-related impediments can be strongly demotivating for elderly learners, depriving them of confidence in themselves and in the educational experience (Boulton-Lewis et al., 2006).

In Grognet's (1997) view, the practice should include a larger amount of comprehension than of production tasks, and accuracy-oriented correction should be kept to a minimum, especially when dealing with pronunciation. Fast repetitive drills and competitive activities which require considerable concentration and processing speed will generate anxiety in the older learners, thus curbing their desire to take part in the lesson. Free use of a shared mother tongue and cooperative work are also recommended.

Though problem-solving tends to be, as was said above, a congenial way of learning for older adults, this should be kept on a practical, familiar plane, since tasks requiring higher-order cognitive processing and exploration of new paths may result too burdensome and therefore, once more, demotivating. In particular, working memory is perhaps the one most problematic aspect for the ageing learner, who should be encouraged to rely more on long-term memory strategies than on short-term memorisation, incorporating new information into well-established cognitive frameworks. Grognet (*ibid.*) suggests the use of spiralling activities and materials, in which meaningful, graded repetition will support working memory without overloading it. Rote memorisation, on the other hand, appears to be a low-yielding methodology, though commonly deemed to be effective by old learners themselves.

As Grognet (*ibid.*: 3) concludes, 'a balance needs to be struck between the teacher's beliefs, the [old learners'] beliefs, and what we know about the effect of learning on both long term and short term memory'.

5.2.1 Vocabulary and memory

Since the lexis of a language is largely arbitrary and virtually infinite, short term memory loss is bound to be particularly impairing in this module. Van Hell and Mahn (1997) argue that direct vocabulary instruction may be viable only when teaching an initial pool of words and phrases, while when dealing with larger amounts of lexemes the *Key Word Method* can be a more efficient alternative. By such a technique, the learner establishes a relation between a new word and an item in her/his native language that has a similar phonetic and/or orthographic form (e.g. English *arm* – Italian *arma* 'weapon', English *needle* – Italian *nido* 'nest'), then pictures a mental image in which the referents of the two lexemes are connected (e.g. an arm holding a weapon, or a magpie stealing a needle and carrying it to its nest). Every time the learner needs to retrieve the target word, a picture of the two referents will be evoked, so that, by affinity to the native item, the shape of the target lexeme may be recalled (Gruneberg and Pascoe, 1996). The method is likely to be more successful if the two items are not only similar in form, but also related in meaning (e.g. English *horse* – Italian *orso* 'bear'), and if they refer to concrete concepts. In all cases, the process appears to be rather laborious, since it requires the learner to go through different phases. Van Hell and Mahn themselves, in their 1997 study, admit that the informants applying the Key Word Method were slower in retrieving the target forms than those adopting rote memory strategies. This is no negligible issue since fluent language use is very much dependent on the speed of recall and production of memorised forms.

Besides, learners who have already some experience of an FL seem to benefit less from the Key Word Method, since they will have already developed their own strategies to memorise lexical items. According to Van Hell and Mahn (1997), the better performance of experienced FL learners in retaining vocabulary may be mainly due to their acquired phonological coding skills, including the capability of rehearsing silently. Encouraging older learners to rely on their previous knowledge of a FL or even of their mother tongue may well prove to be much more fruitful, especially if those languages share a certain amount of etymologies with the TL, as in sister idioms such as English and German, or Italian and Spanish, or even English and Italian. Vocabulary processing appears to be most affected by three factors: frequency of occurrence, word length and cognate status; that is, a lexeme is most quickly assimilated if it is encountered many times in the input, if it is short and, especially, if there are phonologically and semantically similar words in the learner's native language (De Groot et al., 1994; Lotto and De Groot, 1997). Analysing and

recording derivational families and semantic fields within the TL itself can also be useful.

Finally, in order to facilitate recognition and retrieval of a new lexical item, this should be presented within meaningful and varied semantic contexts, which will also provide examples of its uses and collocations.

5.3 E-learning

Some researchers (Chang and Lin, 2011; Godwin, 2015) have suggested that Computer Assisted Language Learning (CALL) may be beneficial to elderly students. According to Golonka et al. (2014), the use of technology can be highly motivating for older adults, and provide them with easy access to the TL and more opportunities to interact, giving them a sense of mastery as autonomous learners. The acquisition of computer skills is in itself a rewarding and empowering process, involving appropriation of competence that may seem to be the prerogative of the younger generations. Through the internet, elderly learners gain access to an infinity of resources, from videos to games to blogs to dictionaries to specific FLL programmes, such as *BBC Learning English* or *Duolingo*.

Many older adults, however, are rather reluctant to embrace these learning tools, both because of negative attitudes towards technological progress and because of scarce confidence in their own ability to acquire new skills (Purdie and Boulton-Lewis, 2003; Wu et al. 2015). In some cases, insisting on the implementation of an e-learning programme may become counterproductive, driving students into anxiety and alienation. In other situations, though, reluctance can be overcome by showing older learners that it is not necessary to have sophisticated technical skills to access CALL resources (Kueider et al., 2012). In fact, elderly people should not be overloaded with in-depth explanations or detailed knowledge of digital features that they will never get to use; computers must remain a means for facilitating language study, and not become an end in themselves. Neither do they need to remain the one and only teaching tool, but can effectively be integrated with traditional materials.

6. Conclusions

In conclusion, we can say that it is possible for elderly people to learn a new language. Facing complex cognitive challenges such as FLL is actually beneficial to the older adult because activating multiple neural networks has been shown to prevent or at least delay age-related mental impairment. However, the physical, cognitive, psychological and social features related to age must be taken into consideration. Older learners are likely to be subject to bodily (e.g. sight, hearing and mobility impairment) and mental

ailments (short term memory loss, depression) that may hinder the learning process: the educational environment must be modified so as to contrast such hindrances as far as possible.

Elderly people also find it hard to modify learning preferences and formats they have acquired and consolidated throughout their lifelong experience. Each individual has different cultural background, previous education and habitual learning strategies. Teachers need to carefully investigate these features and exploit them as precious resources to, at least partly, compensate for older learners' deficiencies in memory and cognitive processing.

References

- Antoniou M., Gunasekera, G. M., & Wong, P. C. M. (2013). Foreign language training as cognitive therapy for age-related cognitive decline: a hypothesis for future research. *Neurosci. Biobehav. Rev.*, 37, pp. 2689–2698.
- Bahrck, H. P. (1984). Fifty years of second language attrition: implications for programmatic research. *Mod. Lang. J.*, 68, pp. 105–118.
- Bialystok, E., Craik, F. I. M., & Freedman, M. (2007). Bilingualism as a protection against the onset of symptoms of dementia. *Neuropsychologia*, 45, pp. 459–464.
- Boulton-Lewis, G., Buys, L., & Lovie-Kitchin, J. (2006). Learning and active aging. *Educational Gerontology*, 32, pp. 271-282.
- Chang, D.-F., & Lin, S.-P. (2011). Motivation to learn among older adults in Taiwan. *Educ. Gerontol.*, 37, pp. 574–592.
- Clough, B. S. (1992). Broadening perspectives on learning activities in later life. *Educ. Gerontol.*, 18, pp. 447–459.
- De Bot, K., & Makoni, S. (2006). Language and aging in multilingual contexts. *Appl. Linguist.*, 27, pp. 760–762.
- De Groot, A. M. B., Dannenburg, L., & Van Hell, J. G. (1994). Forward and backward word translation by bilinguals. *Journal of Memory and Language*, 33, pp. 600–629.
- Djoub, Z. (2013). ICT education and motivating elderly people. *Ariadna; cultura, educación y tecnología*, 1/1, pp. 88-92.
- Dornyei, Z. (2005). *The psychology of the language learner*. London: Lawrence Erlbaum Associates.
- Dresler, M., Sandberg, A., Ohla, K., Bublitz, C., Trenado, C., Mroczko-Wasowicz, A., et al. (2013). Non-pharmacological cognitive enhancement. *Neuropharmacol.*, 64, pp. 529–543.
- Duay, D. L., & Bryan, V. C. (2008). Learning in later life: what seniors want in a learning experience. *Educ. Gerontol.*, 34, pp. 1070–1086.
- Dulay, H., & Burt, M. (1982). *Language Two*. New York: Oxford University Press.
- Ekstrand, L. (1976). Age and length of residence as variables related to the adjustment of migrant children, with special reference to second language learning. In S. Krashen, R. Scarcella and M. Long (Eds.), *Child-Adult Differences in Second Language Acquisition*. Rowley, MA: Newbury House.
- Faust, M., Babkoff, H., & Kravetz, S. (1995). Linguistic processes in the two cerebral hemispheres: implications for modularity vs interactionism. *Journal of Clinical and Experimental Neuropsychology*, 17/2, pp. 171-192.
- Forbes-McKay, K. E., Venneri, A. (2005). Detecting subtle spontaneous language decline in early Alzheimer's disease with a picture description task. *Neurol. Sci.*, 26, pp. 243-54.

- Gauthier, S., Wu, L., Rosa-Neto, P., & Jia, J. (2012). Prevention strategies for Alzheimer's disease. *Transl. Neurodegener.*, 1/13.
- Godwin, R. (2015). Emerging technologies contributing, creating, curating: digital literacies for language learners. *Lang. Learn. Technol.*, 19, pp. 8–20.
- Gold, B. T., Johnson, N. F., & Powell, D. K. (2013). Lifelong bilingualism contributes to cognitive reserve against white matter integrity declines in aging. *Neuropsychologia*, 51, pp. 2841–2846.
- Golonka, E. M., Bowles, A. R., Frank, V. M., Richardson, D. L., & Freynik, S. (2014). Technologies for foreign language learning: a review of technology types and their effectiveness. *Comput. Assist. Lang. Learn.*, 27, pp. 70–105.
- Gómez, D. R. (2016). Critical geragogy and foreign language learning: an exploratory application. *Educ. Gerontol.*, 42, pp. 136–143.
- Greenwood, P. M., & Parasuraman, R. (2010). Neuronal and cognitive plasticity: a neurocognitive framework for ameliorating cognitive aging. *Front. Aging Neurosci.*, 2/150.
- Grognet, A. G. (1997) *Elderly refugees and language learning*. Washington DC: Center for Applied Linguistics.
- Gruneberg, M. M., & Pascoe, K. (1996). The effectiveness of the keyword method for receptive and productive foreign vocabulary learning in the elderly. *Contemporary Educational Psychology*, 21, pp. pp. 102–109.
- Hansen, L., Umeda, Y., & McKinney, M. (2002). Savings in the relearning of second language vocabulary: the effects of time and proficiency. *Lang. Learn.*, 52, pp. 653–678.
- Harley, B. & Hart, D. (1997). Language aptitude and second language proficiency in classroom learners of different starting ages. *Studies in Second Language Acquisition*, 19/3, pp. 379-400.
- Harley, B. (1995). Introduction: The lexicon in second language research. In B. Harley (Ed.), *Lexical issues in language learning*, Amsterdam: John Benjamins, pp. 1-28.
- Herschensohn, J. (2007). *Language Development and Age*. Cambridge: Cambridge University Press.
- Hosoda, C., Tanaka, K., Nariai, T., Honda, M., & Hanakawa, T. (2013). Dynamic neural network reorganization associated with second language vocabulary acquisition: a multimodal imaging study. *J. Neurosci.*, 33, pp. 13663–13672.
- Hu, R. (2016) The age factor in second language learning. *Theory and Practice in Language Studies*, 6/11, pp. 2164-2168.
- Hughes, T. (2010). Promotion of cognitive health through cognitive activity in the aging population. *J. Aging Health*, 6, pp. 111–121.
- Kenner, C., & Weinerman, J. (2011). Adult Learning Theory: applications to non-traditional college students. *Journal of College Reading and Learning*, 41/2, pp. 87-96.
- Kivipelto, M., Ngandu, T., Laatikainen, T., Winblad, B., Soininen, H. & Tuomilehto, J. (2006). Risk score for the prediction of dementia risk in 20 years among middle aged people: a longitudinal, population-based study. *Lancet Neurol*, 5, pp. 735-741.
- Knowles, M. S. (1968). Andragogy, not pedagogy. *Adult Leadership*, 16/10, pp. 350-352, 386.
- Krashen, S. D. (1973). Lateralization, language learning and the critical period: some new evidence. *Language Learning*, 23, pp. 63–74.
- Krashen, S. D. (1981). *Second language acquisition and second language learning*. Oxford: Pergamon.
- Krashen, S. D. (1982) *Principles and practice in second language acquisition*. London: Pergamon.
- Krashen, S. D. (1985). *The input hypothesis: issues and implications*. New York: Longman.

- Krashen, S. D. (1988). *Second language acquisition and second language learning*. Prentice-Hall International.
- Krashen, S. D., Long, M., & Scarcella, R. (1979). Age, rate and eventual attainment in second language acquisition. *TESOL Quarterly*, 13, pp. 573–82.
- Kueider, A. M., Parisi, J. M., Gross, A. L., & Rebok, G. W. (2012). Computerized cognitive training with older adults: a systematic review. *PLoS ONE* 7:e40588.
- Law, L. L. F., Barnett, F., Yau, M. K., & Gray, M. A. (2014). Effects of combined exercise interventions on cognition in older adults with and without cognitive impairment: a systematic review. *Aging Res. Rev.*, 15, pp. 61–75.
- Lenneberg, E. H. (1967). *Biological foundations of language*. New York: Wiley.
- Lewis, M. (1993). *The Lexical Approach*. Hove: Language Teaching Publications.
- Li, P., Legault, J., & Litcofsky, K. A. (2014). Neuroplasticity as a function of second language learning: anatomical changes in the human brain. *Cortex*, 58, pp. 301–324.
- Lotto, L., & De Groot, A. M. (1998). Effects of learning method and word type on acquiring vocabulary in an unfamiliar language. *Language learning*, 48(1), pp. 31–69.
- Marinova-Todd, S. H., Bradford, M. D. & Snow, C. E. (2000). Three misconceptions about age and L2 learning. *TESOL Q.*, 34, pp. 9–34.
- Mechelli, A., Crinion, J. T., Noppeney, U., O'Doherty, J., Ashburner, J., Frackowiak, R. S., et al. (2004). Neurolinguistics: structural plasticity in the bilingual brain. *Nature*, 431, pp. 757–762.
- Muñoz, C. (2006). *Age and the rate of foreign language learning*. Dublin: David Singleton.
- Nation, I. S. P. (1993). Vocabulary size, growth, and use. In R. Schreuder & B. Weltens (Eds.), *The bilingual lexicon*, Amsterdam/Philadelphia: John Benjamins, pp.115-134.
- Nold, G. M. J. (2005). Alzheimer's speakers and two languages. In B. H. Davis (Ed.), *Alzheimer Talk, Text and Context, Enhancing Communication*, New York, NY: Palgrave Macmillan, pp. 102-128.
- Olsen, R. K., Pangelinan, M. M., Bogulski, C., Chakravarty, M. M., Luk, G., Grady, C. L., et al. (2015). The effect of lifelong bilingualism on regional grey and white matter volume. *Brain Res.*, 1612, pp. 128–139.
- Penfield, W., & Roberts, L. (1959). *Speech and brain mechanism*. New York: Atheneum.
- Purdie, N., & Boulton-Lewis, G. (2003). The learning needs of older adults. *Educ. Gerontol.*, 29, pp. 129–149.
- Salthouse, T. (2006). Mental exercise and mental aging: evaluating the validity of the "use it or lose it" hypothesis. *Perspectives on psychological science: a journal of the Association for Psychological Science*, 1(1), pp. 68-87.
- Santacruz, K. S., Sonnen, J. A., Pezhouh, M. K., Desrosiers, M. F., Nelson, P. T., & Tyas, S. L. (2011). Alzheimer disease pathology in subjects without dementia in 2 studies of aging: the Nun Study and the Adult Changes in Thought Study. *J. Neuropathol. Exp. Neurol.*, 70, pp. 832–840.
- Schroeder, S. R., & Marian, V. (2016). Cognitive consequences of trilingualism. *Int. J. Biling.*, 1, pp. 1–19.
- Scovel, T. (1969). Foreign accents, language acquisition, and cerebral dominance. *Language Learning*, 19, pp. 245–254.
- Selinger, H. (1978). Implications of a multiple critical periods hypothesis for second language learning. In W. Ritchie (Ed.), *Second Language Acquisition Research*. New York: Academic Press.
- Selkoe, D. J. (2012). Preventing Alzheimer's disease. *Science*, 337, pp. 1488–1492.
- Singleton, D., & Ryan, L. (2004). *Language acquisition: the age factor*. UK: Multilingual Matters.
- Snow, C. (2002). Second language learners and understanding the brain. In A. M. Galaburda, S. M. Kosslyn, & Y. Christen (Eds.), *The Languages of the Brain*, Cambridge, MA: Harvard University Press, pp. 151-165.

- Snow, C., & Marian, H. (1978). The critical age for SLA: evidence from second language learning. *Child Development*, 49, pp. 1114–1128.
- Stine-Morrow, E. A., Parisi, J. M., Morrow, D. G., Greene, J., Park, D. C. (2007). An engagement model of cognitive optimization through adulthood. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 62B(Special Issue I), pp. 62–69.
- Tzang, R.-F., Yang, A. C., Yeh, H.-L., Lui, M.-E., & Tsai, S.-J. (2015). Association of depression and loneliness with specific cognitive performance in non-demented elderly males. *Med. Sci. Monit.*, 21, pp. 100–104.
- Van der Hoeven, N., & De Bot, K. (2012). Relearning in the elderly: age-related effects on the size of savings. *Lang. Learn.*, 62, pp. 42–67.
- Van Hell, L. G., & Mahn, A. C. (1997) Keyword mnemonics versus rote rehearsal: learning concrete and abstract foreign words by experienced and inexperienced learners. *Language Learning*, 47/3, pp. 507–546.
- Vega-Mendoza, M., West, H., Sorace, A., & Bak, T. H. (2015). The impact of late, non-balanced bilingualism on cognitive performance. *Cognition*, 137, pp. 40–46.
- Wang, H.-X., Karp, A., Winblad, B., and Fratiglioni, L. (2002). Late-life engagement in social and leisure activities is associated with a decreased risk of dementia: a longitudinal study from the kungsholmen project. *Am. J. Epidemiol.*, 155, pp. 1081–1087.
- Ware, C., Damnee, S., Djabelkhir, L., Cristancho, V., Wu, Y.-H., Benovici, J., Pino, M., & Rigaud, A.-S. (2017). Maintaining cognitive functioning in healthy seniors with a technology-based foreign language program: a pilot feasibility study. *Front. Aging Neurosci.* 9:42.
- Wu, Y.-H., Damnée, S., Kerhervé, H., Ware, C., & Rigaud, A.-S. (2015). Bridging the digital divide in older adults: a study from an initiative to inform older adults about new technologies. *Clin. Interv. Aging*, 10, pp. 193–200.