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Older adults' training courses: Considerations for course design and the development of learning materials

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Demographic trends indicate that older adults live longer and maintain active lifestyles. The majority are educated and many enjoy the stimulation that ongoing learning opportunities present. In order for these older adults to benefit from learning opportunities, circumstances specific to these individuals (e.g. age-related decline) need to be considered. The current paper reviews cognitive literature to establish older adults' ability to learn. This is followed by a discussion of training programs as well as suggestions for course design specifically focused on older adults.

Introduction

With adults now living longer and healthier lives than in the past, the size of the ageing population continues to increase. Recent reports from the Australian Bureau of Statistics (ABS, 2009) indicate that, while in 2007 there were 2.4 million Australians aged between 65 and 84, there will be an estimated four million by 2022 and 6.4 million by 2056. With this continual growth in mind it is crucial for older adults to maintain healthy and active lifestyles. The importance of this maintenance is twofold: to increase older adults' quality of life and to reduce the increasing demand on the public health system. In order for this to be achieved, course designers need to be informed of the latest research in healthy ageing. This paper focuses specifically on recent advances in cognitive ageing and cognitive training, placed in an educational context. Of particular relevance is the older person's ability to learn new information. As such a discussion on training programs and suggestions for course design and learning materials will be prefaced by considering older adults' cognitive and sensory abilities.

Older adults' cognitive abilities

Cognition refers to mental functions and mental processes, and in adulthood, cognitive functioning contributes to the maintenance of independence and psychological well-being (Llewellyn, Lang, Langa & Huppert 2008). Older adults show declines in a number of cognitive and sensory abilities, potentially reducing independence and increasing the demand on caregivers and the public health system (Anstey, Stankov & Lord 1993). For example, cognitive abilities associated with fluid intelligence (Horn 1982) (e.g. working memory—ability to maintain and manipulate information; episodic memory—recalling information acquired at a specific time and place; and executive functions—integrating and organising information, for example planning and abstract thinking) show age-related declines. At the neurochemical level, age-related declines in the neurotransmitter dopamine have been linked to declines in cognition, notably episodic memory and perceptual speed (Bäckman, Nyberg, Lindenberger, Li & Farde 2006). Similarly, age-related declines in processing speed underlie some of the declines associated with cognitive functions (e.g. Salthouse 1996, 2000). In addition to processing speed mediating age-related declines in cognitive abilities, working memory (e.g. short term memory maintenance and active processing of information) also mediates declines in cognitive functioning (Park & Reuter-Lorenz 2009). This is related to inhibitory dysfunction which implies that older adults take into account some irrelevant information in the contents of their working memory, thereby slowing down their processing speed (Hasher & Zacks 1988, Park & Reuter-Lorenz 2009).

Compared with younger adults, older adults show different patterns of functional activation during cognitive tests. For example, functional imaging techniques (e.g. fMRI or PET scans) show that young adults have neural activation in the left prefrontal area when conducting verbal working memory tasks, whereas older adults show activation in both the left and right prefrontal areas (e.g. Cabeza 2002, Reuter-Lorenz *et al.* 2000). To explain this phenomenon, Park and Reuter-Lorenz (2009) have proposed the Scaffolding Theory of Aging and Cognition. According to their theory cognitive function is maintained by recruitment of additional neural links, and the brain functionally reorganises and adapts to compensate for deficient or low functioning neural links. Park and Reuter-Lorenz further believe that evidence from experimental animal studies support their claim and has relevance to older adults. These types of studies indicate that brain structures of older animals can change as a result of training, cognitive challenges and stimulating environments. Research has indicated that cognitive engagement assists in protecting against Alzheimer's disease, and this also lends support to this theory (e.g. Bennett *et al.* 2003). Park and Reuter-Lorenz also suggest that cognitive training promotes scaffolding by creating additional neural connections, thereby making it easier for older adults to compensate for neural deficits in some areas.

According to the cognitive reserve theory some factors, such as high intelligence in childhood, educational success, and an active, stimulating lifestyle act as a buffer in preventing cognitive decline in old age (Stern 2002, Stern *et al.* 1994). The brain reserve theory was developed to explain findings from autopsy studies showing that older adults with neuropathological changes did not necessarily show cognitive impairment. There is growing evidence that interventions do improve cognitive function and so may impact on cognitive reserve throughout the life course.

Sensory changes in late adulthood

In addition to cognitive changes, there is also a decrease in sensory function in late adulthood. Research indicates that declines in sensory functions mean that older adults experience increased perceptual thresholds and decreased cognitive abilities to respond to sensory information (e.g. Levine *et al.* 2000). For example, in the eyes changes occur, such as declines in visual acuity, size of visual field, colour vision (blue-yellow defects) and contrast sensitivity (Haegerstrom-Portnoy, Schneck & Brabyn 1999). In turn, the prevalence of eye diseases (e.g., cataracts, glaucoma and macular degeneration) also increases in old age (Evans, Fletcher & Wormald 2007). Thus, older adults might have more difficulty with text-based information presented in small fonts or when information is presented at low levels of luminance. In the ear there is a loss of hair cells in the cochlea (Pheiffer *et al.* 2009) and a loss of sensitivity to high frequencies (Blake & Sekuler 2006). Therefore, many older adults experience hearing loss and have difficulty hearing information presented at high frequencies. In addition, due to increased hearing loss and a decrease in being able to make use of auditory cues, older adults have difficulty following conversations where there are two or more speakers, or where the environment is noisy (Murphy, Daneman & Schneider 2006).

Sensory declines (e.g. auditory and visual) have also been associated with cognitive function in cross-sectional studies (Lindenberger & Baltes 1994), although longitudinal research has shown weaker associations (Anstey, Hofer & Luszcz 2003, Lindenberger & Ghisletta 2009). Studies have shown that the connection between sensory and cognitive declines is not the result of reduced visual and auditory acuity during cognitive assessment. Researchers found that by simulating the sensory experiences of older adults (e.g. reduced visual acuity and reduced auditory acuity), middle-aged adults did not experience any reduced cognitive performance (Lindenberger, Scherer & Baltes 2001). Another recent longitudinal study indicated that the connection between sensory and cognitive decline in old age is weaker than what was originally suggested by Baltes and Lindenberger in 1997 (Lindenberger & Ghisletta 2009). Anstey, Hofer and Luszcz (2003) examined cross-sectional and longitudinal data from a large sample and suggested that independent factors merge to give the impression of one underlying factor leading to declines in both cognitive and sensory functions.

Training programs and training considerations

The majority of older adults continue to live in the community, are educated and maintain active lifestyles (Mehrotra 2003). Their motives for participating in educational programs are influenced by personal interests, social contact, and a desire to maintain a high level of self-efficacy and functioning (both cognitive and physical); it could also be facilitated by a transitional experience (e.g. death of a spouse) (Mehrotra 2003). Jamieson (2007) found that formal study (through process and content) contributes to older adults' quality of life.

Despite inevitable brain ageing and sensory declines, functional and neural plasticity is retained into late life, allowing for the acquisition of new information through the development or scaffolding of new neural pathways. This may allow cognitive training programs to stimulate further development of new neural pathways and could also be a protective factor against developing dementia related diseases such as Alzheimer's. With this in mind, we review some training programs that have been developed for older adults.

The most significant cognitive intervention study is the ACTIVE trial. Ball and colleagues (2002) conducted this large-scale ($N = 2834$), randomised, community-based training study of adults aged 65 to 94. Specifically they focused on areas previously identified as problematic for older adults (memory, reasoning and speed of processing) and designed group-based training across ten contact sessions. They found that, in comparison with the control group, each of the interventions had the desired effect of improving performance in memory, reasoning and speed of processing, and the targeted cognitive abilities were still improved at two years follow-up. These types of interventions would indicate that age-related, cognitive decline can be reversed or at least slowed down.

Dahlin, Nyberg, Backman and Stigsdotter-Neely (2008) conducted a comparative training study between young and old adults. Using a computerised adaptive training program over a period of five weeks that specifically focused on enhancing executive function in cognition, they found that although younger adults showed the greatest improvements, older adults also made significant gains. These results were maintained at 18 months. Particularly, older adults showed post-training improvements that were comparable or surpassed younger adults' baseline measurements. However, whereas younger adults in this study showed some transfer to other cognitive tasks, older adults did not. Dahlin and colleagues attribute this to older adults in this study not quite reaching the task proficiency that younger adults attained, but also in general, to the greater neural plasticity evident in younger adults.

The major criticism of training programs focused on skills, such as the ones noted above, is that learning tends to be quite specific and often does not transfer to other similar tasks. As discussed, this lack of transfer is particularly evident in older adults (e.g. Dahlin *et al.* 2008). Green and Bavelier (2008) suggest that, in order to improve the transferrable skills gained from learning experiences, the learning task should relate to real-life experiences and be more complex than, for example, a task focused on one aspect of cognition (as is often found in experimental studies). They cite examples of these more complex learning paradigms which include action video games, musical training and athletic training where improvements are found across a range of skills. (Incidentally, this relates to the recent development of Nintendo Wii computer consoles specifically focused on older consumers with games such as "Brain Training" and "Sight Training"). Green and Bavelier furthermore note that an incremental increase in task difficulty, once the learner has shown sufficient mastery of skills, significantly aids the learning process. (This corresponds to Vygotky's (1978) 'zone of proximal development' and Bruner's (1975) scaffolding process). Green and Bavelier furthermore argue that appropriate levels of task difficulty (i.e. 'when the task is challenging, yet still doable', p. 697) influences the learner's motivation and helps maintain optimal arousal/interest levels. Mehrotra (2003) notes that older adults vary greatly in the learning abilities, learning experiences and individual interests that they bring with them to the learning environment. For example, some older adults have participated in a range of educational experiences, or have held highly technical occupations until quite recently. For these adults it is much easier to participate in educational programs, and according to Mehrotra they need little encouragement. However, other older adults have low levels of formal education and as a result they need more guidance, encouragement and support. To encourage self-directed learning, Mehrotra suggests that courses for older adults be designed to incorporate information on the learning process itself, including memory techniques, which can then be transferred to other settings. In turn, this would have the added benefit of enhancing cognitive development more broadly with the potential of enhancing other activities of daily living.

Mehrotra (2003) furthermore suggests that course designers cater for individual differences by providing a variety of options (e.g. variety of topics, variety of skill levels). Already, training institutions, such as the universities of the third age, offer a wide variety of online (e.g. www.u3aonline.org.au) and community-based courses for older adults. One of the main advantages of web-based learning is the flexibility and convenience it offers older students in that they can participate in courses at a time and location suitable to them. This is particularly relevant to older adults who live in isolated or rural communities. These courses presented in an online learning environment are different from other traditional distance learning modes in that students can participate in, and develop, a learning community, for example, via online discussion forums. As social support continues to be an important aspect for older adults, such courses can facilitate peer-to-peer learning. Older adults have a wealth of knowledge and by utilising peer-to-peer learning formats (e.g. small team projects), older adults' needs for social contact and knowledge sharing can be facilitated. Although some older adults might initially lack technological knowledge to utilise online learning platforms, this could be overcome by introductory web-orientation courses.

Given older adults' reduced cognitive processing speed, and wealth of knowledge gathered over a lifetime, it can be suggested that older adults be given time to think and reflect on learning tasks. Course designers should thus not only consider the pace of presenting material, but also leave sufficient space for older adults to reflect and share experiences with each other. However, given that older adults can be very attached to world views or ideas (Spigner-Littles &

Anderson 1999), the course designer might find it helpful to establish clear, mutually agreed upon discussion protocols and boundaries. As older adults are accustomed to exercising their judgment, Spigner-Littles and Anderson furthermore recommend that it is useful for older adults to play a key role in planning the pace of their course work. To aid the learner Delahaye and Ehrich (2008) also note that instructors should return prompt and meaningful feedback on performance, and although older adults might require more positive feedback to attain equal gains in self-efficacy as younger adults (Mehrotra 2003), the feedback should consist of informational and motivational elements.

Course design considerations

Given the literature discussed, the following course design considerations can be summarised as follows:

- Cater for a wide variety of interests and skill levels by adapting the learning to the learner, given that older adults bring diverse life experiences and expertise to the educational setting
- Develop tasks that are challenging, yet doable, and which progress the learner from beginner to advanced levels
- Include frequent breaks to minimise fatigue, especially if the learners are on medication, have health problems or are experiencing stressors (e.g. family concerns, health issues, money worries, or impending life transitions such as loss of driver's licence or shift to a rest home)
- Reduce distractions in the learning environment, as older adults may have more difficulty inhibiting irrelevant information
- Allow sufficient time to complete tasks
- Develop built-in adaptable print and audio functions to allow for larger text, higher contrast text and louder audio when using online formats

- Include larger, high contrast text where possible and test audio to ensure all learners can hear in class-based teaching
- Use a constructivist paradigm that facilitates peer-to-peer learning, group discussions and social contact
- Enable learners to participate in planning the pace of their course and encourage self-directed learning
- Include clear, mutually agreed upon boundaries at the start of the course regarding discussions and group participation
- Include information about the learning process and memory exercises to enable transfer to other domains of functioning
- Repeat instructions if learners forget and normalise memory concerns
- Give clear, prompt and personalised feedback to learners

Conclusion

In summary, this paper has reviewed older adults' cognitive and sensory abilities and established that older adults are still very capable of learning new information and skills. For a variety of reasons (e.g. interest, a desire to maintain cognitive or physical functioning), many older adults also want to participate in courses, and research indicates that it contributes to their psychological well-being and quality of life. Older adults are a unique student population and, given the literature on cognitive ageing, a number of these course design considerations could be generalised to the older learner. However, future research could focus on examining the effectiveness of these course design considerations for older adults in an empirical sense.

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