

HOW BILINGUALISM AFFECTS COGNITIVE DEVELOPMENT IN ADULTS. EDUCATIONAL APPLICATIONS

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Abstract: This article reviews recent research on the cognitive effects of bilingualism in adults, with an emphasis on applications for adult education. Bilingual adults often exhibit enhanced cognitive reserve, delaying age-related decline and dementia onset. They also tend to perform better on tasks involving executive functions, particularly working memory, though findings vary by task and age. Neuroimaging studies show bilingual older adults use brain resources more efficiently, evidencing neural reserve in frontostriatal networks supporting working memory. While some intervention studies find limited overall gains from short-term language learning, those with lower baseline cognition may improve in specific domains like response inhibition. These patterns suggest that adult language learning and bilingual education can serve as cognitive enrichment, with implications for curriculum design in adult education.

Keywords: bilingualism; cognitive reserve; executive function; working memory; adult education; aging.

Introduction

Bilingualism – the regular use of two languages – is a rich life experience that shapes the brain. In adults, research indicates that speaking multiple languages influences cognitive development in ways that extend beyond language itself. A key concept is *cognitive reserve* (CR), the brain's resilience to age- or disease-related decline. Lifestyle factors such as education, complex occupations, and bilingualism are thought to build CR. Bilingual adults frequently show later onset of Alzheimer's symptoms and other age-related cognitive impairments compared to monolinguals. In parallel, bilingualism is hypothesized to bolster *executive functions* (e.g. inhibitory control, task switching, working memory) through constant practice in managing two active languages.

This review focuses on how bilingualism affects adult cognition – especially cognitive reserve, executive function, and memory – and the educational implications. We summarize recent (2018–2025) evidence and highlight findings relevant to adult learners. After reviewing bilingualism's protective effects in aging, we examine executive function and memory outcomes, and conclude with implications for adult education and lifelong learning contexts.

Cognitive Reserve and Aging

Bilingualism appears to confer significant cognitive reserve in older adults. Lifelong bilinguals tend to develop Alzheimer's symptoms years later than similar monolinguals. For example, bilingual patients with mild cognitive impairment reported first memory complaints about 7.4 years later than comparable monolinguals. On average, studies estimate a 4–5 year delay in dementia onset for bilingual vs. monolingual older adults. This delay is attributed to more efficient brain resource utilization: lifelong bilingualism appears to strengthen neural networks, particularly frontostriatal pathways, enabling compensation for neuropathology.

Neuroimaging evidence supports a bilingual advantage in brain *reserve* as well. Older bilinguals often show less white matter integrity loss or maintain higher gray matter density in key networks than monolingual peers, despite equivalent cognitive performance. In one functional MRI study, bilingual seniors performed faster on an n-back working memory task while engaging fewer frontostriatal resources, suggesting greater neural efficiency. These findings align with meta-analytic work indicating that bilingual advantages on cognitive tasks tend to be most pronounced in middle-aged and older groups.

At the same time, some large-scale studies nuance the bilingual-CR link. A recent population study found only small task-specific bilingual benefits in aging after controlling for education and lifestyle. The apparent bilingual advantage can depend on language proficiency and other factors. Nevertheless, accumulating evidence suggests bilingualism is a valuable component of lifelong cognitive enrichment. Enhanced cognitive reserve in bilinguals is likely mediated by their continuous practice in language control, which generalizes to other domains of cognition.

Executive Function and Bilingualism

Executive functions (EF) – the attentional and control processes that regulate thought and action – have been a major focus in bilingualism research. Bilingual adults must constantly select one language while inhibiting the other, potentially “training” their inhibitory control, task switching, and working memory systems. Recent work shows bilinguals often outperform monolinguals on certain EF tasks, though results vary by task type and participant age. A meta-analysis of 170 studies found that bilingual advantages were modest overall but more pronounced on specific tasks and in older adults. For instance, bilinguals were faster and more accurate than monolinguals on four of seven EF tasks, and the effect size was much larger in participants over age 50 (Hedges' $g \approx 0.49$) than in young adults ($g \approx 0.12$). This suggests bilingualism helps compensate for age-related EF declines.

However, this *bilingual advantage* is not uniform. A recent experimental study with Chinese–English bilinguals found that, after controlling for intelligence and demographics, bilingualism predicted superior performance only on working memory (both auditory and visual) but showed no advantage on inhibitory control or cognitive flexibility tasks. Similarly, intervention studies generally report weak effects. In one randomized trial, short-term language training did not significantly improve overall executive scores in older adults; only those with lower initial cognition showed modest gains in response inhibition. Another meta-analysis also questioned broad EF gains and highlighted the risk of publication bias.

In sum, bilingualism appears to enhance certain facets of executive control in adulthood, particularly tasks tapping working memory and interference suppression. These benefits are subtle and task-specific, and they may accumulate over a lifetime of dual-language use.

For educators, this implies that bilingual adult learners could leverage improved working memory and attention in complex learning tasks, and that language learning curricula might intentionally engage these executive processes.

Memory and Bilingualism

Memory – especially working memory – is closely intertwined with executive function and shows parallels in the bilingualism literature. The aforementioned Chinese-English study found bilingual effects were “process-specific” to working memory. Supporting this, bilingual older adults have demonstrated faster performance on demanding working memory tasks: one neuroimaging study reported bilinguals had quicker reaction times on a 2-back task than monolinguals, despite generally lower gray and white matter volumes. Critically, bilinguals in that study maintained better white matter integrity in key pathways (superior corona radiata) that likely support frontal-executive and memory circuits.

Conversely, bilingual advantages in other memory domains (e.g. item recognition, episodic recall) are less clear. The same study found no differences between bilinguals and monolinguals on simple recognition memory tasks. Thus, while bilingualism seems to boost working memory capacity and efficiency (a core EF component), it does not universally enhance all memory functions.

Importantly, new language learning can itself serve as cognitive training for memory. Several intervention studies report that engaging in adult second-language (L2) courses tends to improve *attentional switching* and *inhibition*, both of which support working memory updating. Functional connectivity in attentional networks also increased after intensive language learning in older samples. These results suggest adult learners may simultaneously strengthen memory-related executive processes by studying another language.

The cognitive findings above have direct implications for adult education. Given that bilingual experiences bolster cognitive reserve and executive control, adult education programs can incorporate language learning and bilingual activities as forms of cognitive enrichment. For example, **second-language courses for seniors** can be promoted not just for linguistic skill but for their “brain health” benefits. Systematic reviews note that L2 learning in later life tends to boost attentional switching, inhibitory control, and working memory, even after brief training. While general curriculum effects may be subtle, targeted programs could focus on **learners at risk of cognitive decline**, as they may reap the most benefit. Indeed, one trial found individuals with lower baseline cognition showed greater improvement in response inhibition from language study.

For **all adult learners**, educators can design bilingual education tasks that explicitly engage executive functions. For instance, exercises that require alternating between languages can train cognitive flexibility, while translation and interpretation practice can challenge working memory and inhibition. Even **metalinguistic activities** (e.g. comparing grammar or sounds across languages) leverage the enhanced cognitive monitoring skills of bilinguals. These strategies not only reinforce language learning but also exercise domain-general cognitive skills. Adult education contexts should also recognize that bilingual learners bring strengths to the classroom. Instructors can encourage bilingualism as an asset: dual-language use may facilitate problem-solving, multitasking, and creative thinking in vocational or academic training. Accommodating bilingual students’ cognitive profiles—for example, providing support when switching tasks or managing translation demand—can optimize learning outcomes. In summary, by **fostering bilingualism and intentional executive skill training**, educational programs can support both language acquisition and broader cognitive development in adults.

Conclusion

Current research indicates that adult bilingualism confers meaningful cognitive advantages, especially in the context of aging. Lifelong bilinguals accumulate cognitive reserve that delays dementia symptoms by several years. They exhibit enhanced working memory and task-switching abilities, which emerge more strongly in older adults. Educationally, these insights support the inclusion of language learning as a tool for cognitive enrichment. Structured L2 instruction and bilingual activities in adult education can harness the brain-training effects of bilingualism, potentially improving executive function and memory in learners. Future research should continue to refine best practices for integrating bilingualism into adult learning curricula, particularly for seniors and cognitive rehabilitation programs. Overall, promoting bilingualism across adulthood appears to be a promising avenue for enhancing lifelong cognitive health.

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