Language learning: Cognitive improvements across the lifespan

KEY POINTS

1. Learning a language for even a short period can benefit the brain at all ages
2. Improvements in attention and memory were seen in learners aged 18 - 78 after a one-week intensive language course
3. Follow up tests showed that those who practiced 5 or more hours a week maintained the benefits 9 months later
4. Investing in language learning programmes could be a powerful tool for improving cognitive health across the lifespan

Background: Bilingualism and cognition

A large body of research suggests that learning two languages from early childhood is associated with better cognitive functions such as attention and memory. More recently, research has suggested similar advantages for those who learn a language in early adulthood, even when they don't reach native-like proficiency.

The effects of language learning also seem to include a protective effect on the brain in later life. Knowing more than one language is linked with better cognitive skills at age 73 [1], a 4-5 year delay in the onset of dementia symptoms [2], and doubling the likelihood of cognitive recovery after a stroke [3].

The idea that mental exercise can increase the brain's resilience to damage (caused by e.g. ageing, dementia or stroke) is not new. This resilience is also known as cognitive reserve, and is used to explain the fact that people who sustain similar levels of brain damage can show such wide variation in the extent to which they recover. The greater your cognitive reserve, the better your chances.

What we don't know is how much language learning is needed in order to improve cognitive function.

This study expands our current knowledge by addressing three important questions:

- How soon after starting to learn a language can we detect cognitive changes?
- How much practice is needed to sustain these effects?
- Do the effects appear at all stages of life, or is there an upper age-limit?

Previous research has looked at those who have been studying languages for several years or more. Finding an effect over a shorter period, in novice learners, would demonstrate that the cognitive benefits of language learning are available to all, regardless of background.

The study

We tested 33 early stage learners of Gaelic before and after an intensive one week language course at Sabhal Mòr Ostaig, a Gaelic college on the Isle of Skye. The course included around 14 hours of language classes plus Gaelic language entertainment (e.g. films and music) in the evenings.

The learners' ages at the start of the study ranged from 18 to 78. Eleven learners were aged 18 - 40; nine learners were aged 41 - 60; and thirteen learners were aged 61 - 78.

We assessed learners' cognitive functions using three auditory tasks from the Test of Everyday Attention [4], a well-established clinical test measuring different aspects of attention. This test has been successfully used to examine the influence of early and late bilingualism [5] and language learning [6] on attentional functions.

The tasks we selected are known as Elevator Tasks: participants are asked to imagine they are in a faulty elevator, and have to work out which floor they are on by counting different types of beeps (auditory tones). The three tasks measure different aspects of attention (see task details, opposite).

The Gaelic learners' results on these tasks were compared with the results of 34 other participants who did not take part in the language course. These control participants were selected so that there were no differences between the groups in terms of age, gender, and level of education. The control participants were split into two subgroups: active controls and passive controls.

Active controls were tested before and after a similarly intensive one week course that did not involve learning another language (e.g., art, documentary film, teaching English to speakers of other languages). Passive controls followed their usual routines for a week and did not undertake any course.

To establish the long-term cognitive effects of this learning experience, we retested over half of the language participants nine months after their course ended.

Task 1: Auditory sustained attention

Hear the same pitched tone at irregular intervals;

Count all instances of this tone.

Measures participants' ability to maintain attention.

Task 2: Auditory selective attention/ inhibition

Hear high and low tones;

Count low tones and ignore high tones.

Measures participants' ability to ignore irrelevant information.

Task 3: Auditory attentional switching

Hear high, low and medium tones;

Count the medium tones, switching between counting up and down. When you hear a low tone, subtract 1 for each medium tone. When you hear a high tone, switch to adding 1 for each medium tone.

Measures participants' working memory and ability to switch attention between different actions.

Findings

After one week, those who took part in the language course showed a significant improvement on Task 3 (measuring attentional switching and working memory). Those who took part in a non-language course improved, but not to the same extent as the language learners.

The improvement in language learners was found across all age groups. In fact, the biggest improvement in performance was found in the two older age groups (ages 40+). At the end of the week, the scores of the 41 - 60 and 61 - 78 year olds matched or exceeded the pre-course scores of the 18 - 40 and 41 - 60 year olds. This shows that even older adults can obtain significant benefits to their cognitive functions by learning a new language.

To test whether these effects would disappear as quickly as they appeared, we conducted a follow-up study 9 months later with over half the language learners.

All those who continued to study the language for an average of 5 hours or more per week maintained the improvement on their cognitive skills. Those who studied 4 hours or fewer showed inconsistent results. In other words, practicing for around an hour per day (with weekends off) was enough to sustain the effect from the initial intensive course.

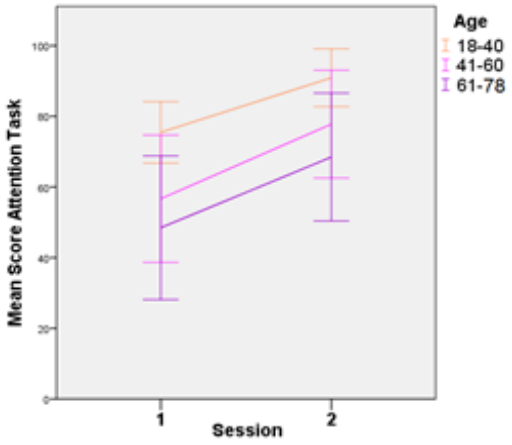

Figure 1. Learners' performance on the Auditory Attentional Switching Task (Task 3) before (session 1) and after (session 2) a 1 week intensive Gaelic course, by age group.

This study reveals that language learning is a dynamic, novel, and challenging task that can lead to improved cognition in as little as one week. This improvement was found across all age groups and in those who had little or no previous experience learning the language. Further, with continued language practice (5+ hours per week, or just 1 hour a day) the benefits were lasting.

IMPLICATIONS FOR POLICY AND PRACTICE

Our research shows that people of all ages, including the elderly, can benefit cognitively from language learning. Importantly, we showed benefits even for beginner learners.

This finding complements recent research suggesting a positive effect of bilingualism on dementia, stroke and ageing. Investing in language learning may be a useful tool for public health systems increasingly needing to care for an older population [7].

Language learning should not be seen as too difficult, confusing or burdensome for older adults. Even a short course can boost attention and memory skills.

Centre for Cognitive Ageing and Cognitive Epidemiology

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BILINGUALISM MATTERS

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