Foreign language training improves other cognitive abilities
Susan G. Campbell, Meredith M. Hughes, Jared A. Linck, Noah H. Silbert, Medha Tare, Benjamin K. Smith, Michael F. Bunting
University of Maryland Center for Advanced Study of Language

Abstract
People who have successfully completed an intensive foreign language training program show better cognitive abilities in certain domains than people who are starting the same course. This difference, however, could be due to attrition: perhaps only people who have better cognitive abilities in the first place can finish intensive language training. We compared the cognitive abilities of students who were starting a course to students who were close to completing the same course. Using outcome data about which students went on to successfully finish the course, we restricted our analysis to only those beginning and near-graduate students who finished. We determined from this analysis that certain abilities, such as associative memory and phonological short-term memory, improved during language training.

Theory
Which comes first: individual differences in cognitive abilities or language training?
- Working Memory (Linck & Weiss, 2011) and Associative Memory (learning new associations in LTM; Carroll, 1985) predict successful second language acquisition.
- Bilinguals (successful language learners) show better Working Memory and Attentional Control than monolinguals (Adesope et al., 2010).
- But do you need to be a lifelong bilingual to show cognitive ability improvements from learning a language?

Methods
Tested students in an intensive foreign language course on cognitive abilities.
- Two different groups of students (same time):
  - NE: new enrollments, tested 1 week into the course
  - NG: near-graduates, tested about 3/4 of the way through the course
- All students also had Defense Language Aptitude Battery (DLAB) scores (collected before being assigned to language courses). DLAB correlates with measures of general intelligence.
- Students were only included in the analysis if they went on to finish the course.
- Students were in one of two types of language course:
  - Category III: hard languages (e.g. Russian), 47 weeks
  - Category IV: harder languages (e.g. Korean), 64 weeks

Results: Phonological STM
Measure: Non-Word Span (NWS)
In regression including DLAB score, predicted by NE vs. NG (pR²=.016) and by DLAB score (pR²=.028).

Results: Associative Memory
Measure: Paired Associate Recall (PAT)
In regression including DLAB score, predicted by NE vs. NG (pR²=.039) and by DLAB score (pR²=.035).

Results: Working Memory
Measure: Running Memory Span (RMS)
In regression including DLAB score, predicted by DLAB score (pR²=.039) and by NE vs. NG (pR²=.035).

Control: DLAB Scores
Measure: DLAB total score (collected before being assigned to language training at all, used to place students into classes)

Overall Results
- Phonological STM and Associative Memory were both better for students who had finished several weeks of intensive foreign language training.
- Working Memory might have been better for students who had finished several weeks of intensive foreign language training, but it is possible that this effect is due to differences in cognitive abilities between the samples.

Alternative Explanations
Maybe lower levels of these abilities led people to drop out?
This may be true, but it cannot explain these effects; only students who finished the course the first time are included in these analyses.

The NG sample had slightly higher DLAB scores. Maybe they were smarter to begin with.
Differences in Working Memory may be accounted for by DLAB scores, but the two samples differ significantly in both Phonological STM and Associative Memory after controlling for DLAB score.

Conclusions
Intensive foreign language training improves certain cognitive abilities, but may not improve others.
- Cognitive individual differences may be both the cause and the effect of language learning.
- The cognitive abilities used for language learning improve with use.
- Studies of language learning should take into account changes in cognitive abilities as well as the cognitive abilities that students have at the beginning.

Even non-balanced bilinguals may show cognitive advantages over monolinguals.
- Cognitive benefits of bilingualism may start to manifest during language training, even for adults with little previous language experience.

Future Directions
- Does this effect hold if the design is longitudinal rather than cross-sectional?
- Does this change happen just as a result of intensive foreign language training?
- Do different kinds of language training affect cognitive abilities differently?
- Does starting ability affect what amount of improvement occurs?

References

Disclaimer: This material is based on work supported, in whole or in part, with funding from the United States Government. Any opinions, findings and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the University of Maryland, College Park and/or any agency or entity of the United States Government.