Language Cortices Are Alive with the Sound of Music

Examining the Link between Music Training and Language Acquisition

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Introduction

QUESTIONS

Is there an impact of training in the arts on the learning of new knowledge in other cognitive domains?

Is there an impact of childhood music training on adult language learning?

BACKGROUND

Widely reported research asserts that music exposure leads to general cognitive advantages across a broad range of cognitive domains. Research examining this view is controversial (the Mozart Effect[1]), and is scarce

Studies report that early bilingual language exposure leads to cognitive enhancement in other cognitive domains due to the demand for rapid switching between two distinct linguistic systems[2]. Research examining this view is also scarce and focuses primarily on children[2]

SIGNIFICANCE

This is a new systematic investigation into how early and extensive music training and/or bilingual exposure impacts adult learning of a new language in an instructional setting

HYPOTHESES

Advantage

Extensive music training and extensive bilingual exposure provide cognitive advantages. Musicians and Bilinguals will have greater expressive fluency in their new language than Monolingual Non-Musicians

Combined Advantage

Bilingual Musicians will exhibit a greater cognitive advantage than those with **either** music training or bilingual exposure alone. Bilingual Musicians will exhibit the greatest expressive fluency in their new language compared to other groups

No Advantage

There is no cognitive advantage afforded by music training or bilingualism on learning in other cognitive domains. All groups will perform the same

Methods

PARTICIPANTS

Dartmouth College students enrolled in introductory Italian (N = 19; mean age 20 years)

3 Groups - Monolingual Non-Musicians (n=6); Monolingual Musicians (n=10); Bilingual Musicians (n=3)

Musicians - extensive music training by age 7 maintained into adulthood

Bilinguals - exposure to a second language by age 5 maintained into adulthood

PROCEDURE

Two Testing Sessions - Beginning of Term (T1); End of Term (T2)

Measures by Testing Sessions

T1 Beginning of Academic Term

- Screening
  - Language/Music Screening
  - Academic Performance
- Language Assessment (English, Italian)[3,4]

T2 End of Academic Term

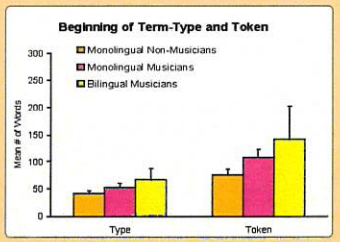
- Language Assessment (Italian)
- Cognition (SRC)[5]
- Self-Evaluation
- Final Grade

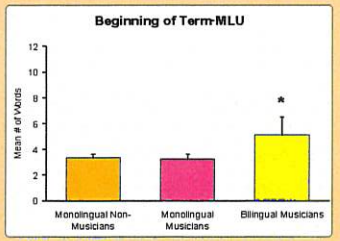
Results

ITALIAN LANGUAGE PERFORMANCE

Bilingual Musicians showed the greatest expressive fluency from the start, with Monolingual Musicians having lower scores and Monolingual Non-Musicians having the lowest scores

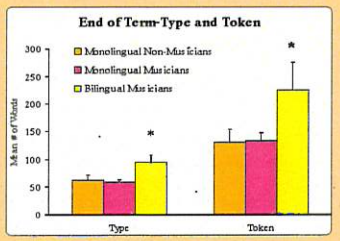
Bilingual Musicians had significantly higher MLU scores ($p < 0.05$)

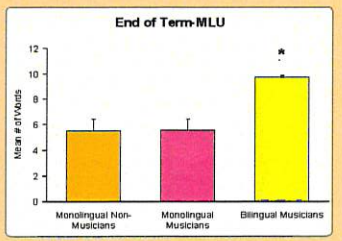




Bilingual Musicians showed the greatest expressive fluency after receiving extensive language training

Bilingual Musicians had significantly higher Type, Token and MLU scores ($p < 0.05$)

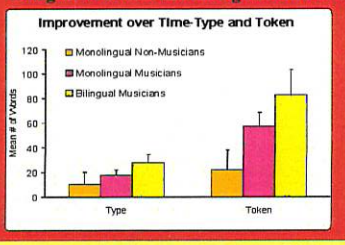


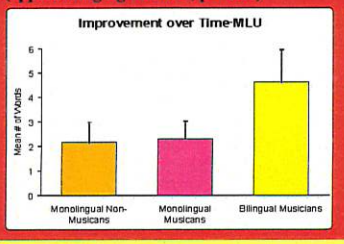


IMPROVEMENT

Bilingual Musicians showed the greatest improvement in expressive fluency (from T1 to T2) followed by Monolingual Musicians, with Monolingual Non-Musicians showing the least improvement

Bilingual Musicians had the highest MLU score (approaching significance; $p = 0.06$)





Final Test Grades - All participants performed comparably ($p > 0.05$)

Cognitive Stimulus Response Compatibility Task - All participants performed comparably ($p > 0.05$)

Self-Evaluation - All participants reported an equal level of enjoyment, effort and performance in language classes

ANALYSIS - Language Fluency Measures

Type - # of unique words produced by the participant in the target language

Token - Total # of words produced by the participant in the target language

Mean Length of Utterance (MLU) - # of words per phrase produced by the participant in the target language

Conclusions

There is an impact of early arts training on learning in other cognitive domains

There is a cognitive advantage afforded by early and extensive music training and bilingual exposure on adult learning of a new language in an instructional setting

Advantage

Monolingual Musicians showed a trend towards greater improvement in expressive fluency in their new language than Monolingual Non-Musicians

Combined Advantage

Bilingual Musicians performed better in learning their new language than Monolingual Musicians and Monolingual Non-Musicians

Implications

These results provide educators, policy makers, and parents with evidence that early training in the arts may afford students long-lasting advantages in other core cognitive domains

References

1 **Rauscher, F.H.** (1993). *Nature, 365: 611*

2 **Bialystok, E.** (2001). *New York: Cambridge University Press*

3 **Petitto, L.A. et al.** (2000). *PNAS, 97(25):13961-6*

4 **Kegl, J.** (1994). *Signpost, 7(1):24–31*

5 **Jonides, J.** *PNAS, 95:8410–8413*

Acknowledgments

Advisor – Dr. Laura-Ann Petitto

Second Reader – Professor Daniel Ansari

Ioulia Kovelman, Rachael Degenshein and other members of the Petitto Laboratory

Funding provided by Dean of Faculty Grant, Dana Foundation, Petitto Dartmouth Funding