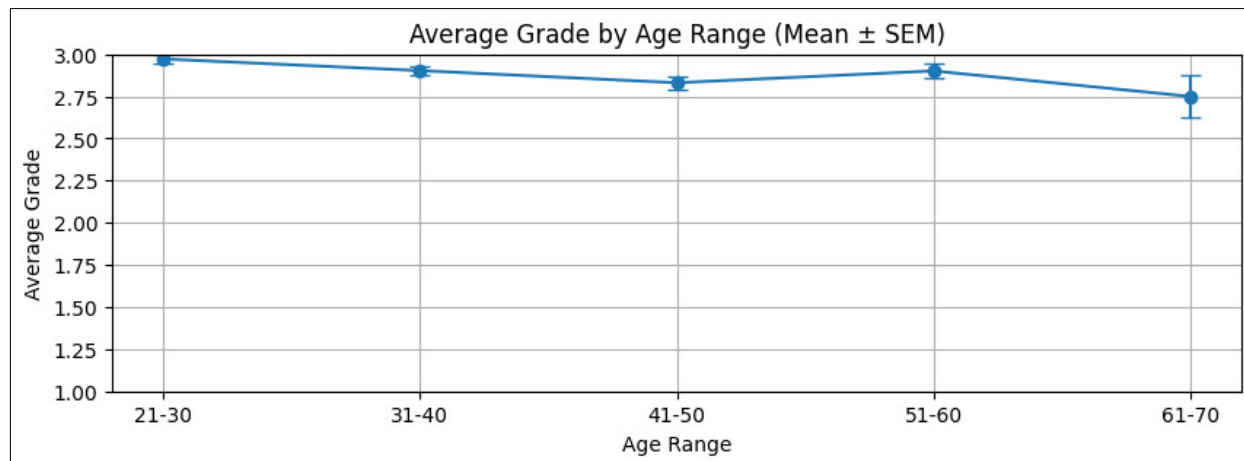


Language Learning Performance Across Age As A Preventive And Early Cognitive Biomarker

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Renne Alegria, PhD^{1,2}, Msc, Mehran Azimbagirad, PhD^{1,2}, Gisele Gouveia, PhD^{1,2}, Leonidas Angelin, PhD^{1,2}, Liazid Benarab, Msc², Telma Pantano, PhD^{1,2}, Lia Fiore, MD^{1,2},Msc, Enio Andrade, MD^{1,2}, Msc, Mariana Marmorato,PhD¹, Vinicius Leduc, MD^{1,2},Msc, Charlize Kessin, MD¹, Marcia Kubrusly, PhD^{1,2},Msc, Paschoalina Romano, PhD¹,Msc, Perry Poulard, PhD², Kecia Santos, MD², Silvia Prado, MD^{1,2}, Msc, Felipe Camoezi, ^{1,2} ,Daniel Ricardo Arenales Torres, MD^{1,2}, Matheus Miranda de Holanda, MD², Orestes Vicente Forlenza, MD^{1,2}, PhD.

¹University of Sao Paulo, Sao Paulo, Brazil | ² Instituto de Psiquiatria, Hospital das Clínicas, University of Sao Paulo, Sao Paulo, Brazil

Learning foreign languages can improve cognition and prevent Alzheimer’s Disease																						
INTRODUCTION	METHODS	RESULTS	CONCLUSIONS	REFERENCES																		
Age-related changes in cognitive function can affect learning abilities^{1,3}, particularly in tasks requiring memory, attention, and executive processing, such as second-language acquisition². It has been proven that learning a second language could prevent/delay Alzheimer's disease ^{1,4}. Language learning may therefore serve as a sensitive marker ^{2,3} for age-related learning ability as shown this study evaluating the relationship between age and language learning performance in adults.	This study included 520 employees (F=80%, M=20%) of a local hospital in Sao Paulo, Brazil, aged 20 over to 70 years, over a five-year period 2019-2023. Participants were enrolled in structured language courses in one of five languages: Spanish, French, German, English, or Arabic. All participants completed standardized language proficiency examinations at the end of their training. Results were classified as grades A (3), B (2), C(1). Participants were stratified into five age groups (spanning 10 years). Learning performance was quantitatively analysed by computing mean scores and standard deviations for each age group. Statistical comparisons were conducted to assess differences in learning outcomes across age ranges and to evaluate age- related trends in learning ability.	A total of 517 participants met the criteria (3 not present at the examinations). Analysis revealed a statistically significant difference in mean language performance scores across age groups compared 61-70 range, (p-values: 0.03, 0.08, 0,43 and 0.06). Participants aged 21-30 demonstrated the highest mean grades and lowest variability. Individuals over 60 exhibited significantly lower mean scores and greater variance in performance across all five languages (Fig.1). These trends were consistent regardless the language, suggesting that age-related effects on learning ability were not language-specific. <table><caption>Average Grade by Age Range (Mean ± SEM)</caption><tr><th>Age Range</th><th>Mean Grade</th><th>SEM</th></tr><tr><td>21-30</td><td>2.95</td><td>0.05</td></tr><tr><td>31-40</td><td>2.85</td><td>0.05</td></tr><tr><td>41-50</td><td>2.80</td><td>0.05</td></tr><tr><td>51-60</td><td>2.85</td><td>0.05</td></tr><tr><td>61-70</td><td>2.75</td><td>0.05</td></tr></table> Figure 1. Mean language performance across age groups (Mean ± SEM).	Age Range	Mean Grade	SEM	21-30	2.95	0.05	31-40	2.85	0.05	41-50	2.80	0.05	51-60	2.85	0.05	61-70	2.75	0.05	The findings demonstrate a significant association between age and language learning performance in adults, with measurable declines observed in individuals over 60 years of age^{1,2,3}. These results suggest that structured second language learning assessments may serve as a useful tool for detecting and preventing early cognitive changes as potential MCI and AD^{1,2,3,4}. Longitudinal studies incorporating neuropsychological and biomarker data^{1,2,3,4} are recommended to validate these findings.	1.Livingston, G. et al. Dementia Prevention, intervention, and care: 2024 report of the Lancet standing Commission. Lancet 404, 572-628 (2024). 2.Bialystok, E. Bilingualism: pathway to cognitive reserve.Trends Cogn. Sci.25, 355-364 (2021). 3.Li, P., Legault, J.& Litcofsky, K. A. Neuroplasticiy as a fuction of second language learning: anatomical changes in the human brain, Cortex 58, 301-324(2014). 4.Amoruso L., Hernandez, H., Santamaria-Garcia, H. et al.. Multilingualism protects against accelerated aging in cross-sectional and longitudinal analyses of 27 European countries. Nat Aging 5, 2340-2354 (2025) Acknowledgements: Prof Dr Wagner Gattaz, full Prof and the founder of the Escola de Línguas do IPq, former CEO of the Instituto de Psiquiatria do HC FMUSP The former students and teachers of the Escola de Línguas do IPq. Drs Orestes Forlenza, Florindo Stella, Marcia Radanovic, Luana Martinez, Rodolfo Ladeira, Octavio Ribeiro , Luis Monteiro, Vinicius Leduc, Franciso T. F. Cavalcante and Jouce de Almeida, (Profs and colleagues from the Psychogeriatrics outpatient clinic of LIM 27, IPq HC FMUSP). IPq Institutional Communication Center
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CONTACT																						
Dr Renné Alegria realegrias@yahoo.com.br realegrias@alumni.usp.br  																						