Inequality of Educational Opportunity Differentially Impacts Women's and Men's Later-life Cognitive Performance

Anja Leist, Eyal Bar-Haim, Louis Chauvel

University of Luxembourg

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Background

- Understand the drivers of older-age cognitive functioning and ageing
- Main cognitive development takes place during schooling (Kremen et al., 2019; Lövdén et al., 2020), and older-age cognitive outcomes are heavily influenced by schooling (Zahodne et al., 2011).
- Schooling systems, i.e., inequality of educational opportunity (IEO), can partly explain student cognitive outcomes (Burger, 2016; Gamoran & Mare, 1989).
- IEO describes to which extent schooling opportunities depend on parental background rather than student cognitive skills, measured as correlation between years of education of parents and their offspring (Rotman et al., 2016)

Background

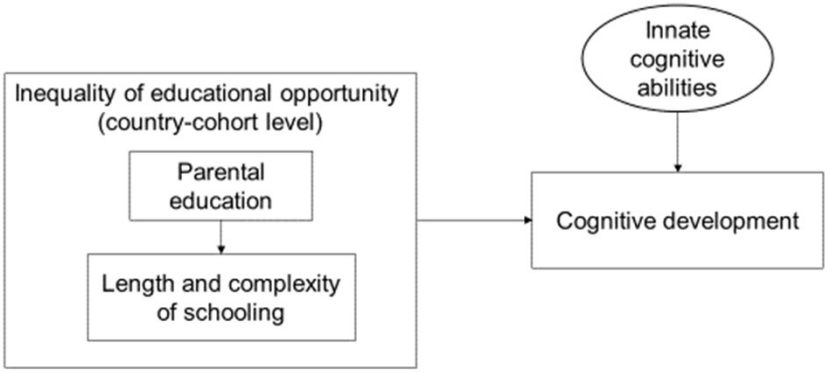
- Length of compulsory schooling influences older-age cognitive functioning (Glymour et al., 2008; Schneeweis et al., 2014)
- Distribution in educational attainment is linked to heterogeneity of cognitive functioning at older ages (Olivera et al., 2018)
- Exposure to economic recessions, associated limited work opportunities (Leist et al., 2014)

Higher-IEO contexts may provide better educational resources to children from more advantaged backgrounds, whereas lower-IEO contexts may be more equitable. We hypothesise there is an optimal match between children's cognitive skills and the length and complexity of schooling, which may be more likely realized in lower-IEO contexts.

Research Objectives

- Quantify the associations of IEO at time of schooling and older-age cognitive functioning and rate of cognitive decline with age
- Test if these associations differ between men and women in general, and between men and women with different educational attainment.

Assumed pathways



Data

W1 2004	W2 2006	W3 SHARELIFE	W4 2011	W5 2013	W6 2015	W7 2017 *or* SHARELIFE
Cognitive assessment + economic, social, and health situation	*Cognitive assessment + economic, social, and health situation*	*Life histories: School performance, parental SES, childhood health*	*Cognitive assessment + economic, social, and health situation*	*Cognitive assessment + economic, social, and health situation*	*Cognitive assessment + economic, social, and health situation*	*Life histories or Cognitive assessment etc. if particip. in w3*

2-13 years of follow-up to investigate cognitive aging

Within the restrictions of this study (country represented in World Bank data, ≥2 observations per individual), we have data of three cohorts born 1940-49, 1950-59, and 1960-63 from 16 European countries and Israel.

Individual-level variables

Outcomes

- *Immediate recall*: Remembering words from 10-word list read-out loud immediately afterwards
- *Delayed recall*: Remembering 10-word list after standardized delay
- *Verbal fluency*: Naming as many animals as possible in 1 min

Education: ISCED-97 recategorized in *up to lower secondary*, ISCED 0-2, *upper secondary*, ISCED 3, and *post-secondary and tertiary*, ISCED 4-6.

Covariates: Cohabitation status, current job situation, self-rated health, number of chronic conditions, number of depressive symptoms, (occupational level w/ISCO).

Childhood covariates: Parental SES (number of books), school performance relative to peers in language, and in mathematics, health at age 10.

Contextual-level Variables

Inequality of Educational Opportunity (IEO): World Bank Global Database on Intergenerational Mobility

- Country-cohort Pearson's correlation coefficient between parent and & child years of education of cohorts 1940-49, 1950-59, 1960-63

GDP per capita PPP: World Bank

Healthy life expectancy at age 60: WHO Global Health Observatory, 2005

Human Development Index (HDI): UN Human Development Reports, 2005

Multilevel (mixed-effects) models

Level 3	49 country-cohorts	Random intercept
Level 2	25,544 women; 20,904 men	Random intercept (Random age slope)
Level 1	77,284 - 89,748 observations (women); 61,807 - 71,525 observations (men)	

Strategy of data analysis

- Exposure of interest: **IEO at time of schooling** on mid-age immediate, delayed recall, and verbal fluency, and rate of cognitive decline (IEO*age) over 2-13 years of follow-up
- Interactions of IEO, sex, and education on 3 cognitive measures
- Adjusted for indicator for first testing (practice effects), age squared
- Suppl analyses: +1 contextual determinant: HDI, GDP, HLE60; childhood information (subsample), ISCO information (subsample)

Descriptive statistics

Cognitive measures: *M*=5.56 (*SD*=1.66) immediate recall; *M*=4.22 (*SD*=2.06) delayed recall; *M*=21.36 (*SD*=7.55) fluency

Age: 50-76 years; *M*=59.3 (*SD*=6.00) (women) and *M*= 59.6 (*SD*= 5.97) (men)

Length of follow-up: 2-13.5 years; *M*=7.22 years, *SD*=3.50

Number of assessments: 2-6; *M* = 2.42 (*SD* = 1.27) assessments

Education: ISCED 0-2: 38.2% women; 33.3% men; ISCED 3: 34.5% women, 36.6% men; ISCED 4-6: ISCED 4-6: 27.3% women, 30.1% men

Attrition: 3.4% died over the course of the study (older, more likely male, less likely higher educated)

IEO: between *r* = 0.298 and *r* = 0.312 in the 1960-63 cohorts of the Netherlands and Denmark, and *r* = 0.641 and *r* = 0.652 in the 1940-49 cohorts of Portugal and Italy.

Main mixed (random-effects) models

Impact of IEO: Higher IEO associated with:

- In men, lower immediate recall, verbal fluency (immediate recall: Coeff. -0.94, CI -1.50, -0.38; verbal fluency: Coeff. -1.79, CI -2.74, -0.84), but delayed recall *n.s.*
- In women, lower immediate recall, delayed recall, verbal fluency (immediate recall: Coeff. -1.23, CI -1.97, -0.48; delayed recall: Coeff. -0.97, CI -1.78, -0.16; verbal fluency: Coeff: -0.39, CI -0.53, -0.24)

Impact of IEO on decline (IEO*age):

- In men, slower decline in immediate recall (Coeff. 0.48, CI 0.32, 0.65), delayed recall and verbal fluency *n.s.*
- In women, steeper decline in delayed recall and verbal fluency (delayed recall: Coeff. -0.17, CI -0.32, -0.02; verbal fluency: Coeff: -0.39, CI -0.53, -0.24), rate of decline in immediate recall *n.s.*

Note. Coefficients and confidence intervals of the model adjusted for age, age squared, practice, education, cohabitation status, current job situation, self-rated health, number of chronic conditions, number of depressive symptoms.

Interaction analysis of IEO x sex x education

- Main effect of IEO: negative for verbal fluency (Coeff. -1.73, CI -2.76, -0.71), immediate and delayed recall *n.s.*
- Women had lower cognitive scores in all three measures if schooled in higher-IEO contexts
- Women of higher educational levels schooled in higher-IEO contexts performed higher on the three cognitive tests compared to women of lower educational level on all three outcomes (e.g., immediate recall: IEO*female*ISCED 3: Coeff. 0.80, CI 0.46, 1.14; IEO*female*ISCED 4-6: Coeff. 0.83, CI 0.47, 1.19).

Discussion

Main findings

- Higher IEO at time of schooling could have profound consequences, particularly for lower-educated women of the cohorts under investigation
- Most associations hold in subsample with childhood information and after controlling for competing contextual determinants

Limitations:

- Availability of historical macro-level indicators, which ones are relevant confounders?
- Longer follow-up needed of this mid-aged cohort to detect (clinically relevant) cognitive decline

Thank you!

anja.leist@uni.lu

@AnjaLeist

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