Memory Self-Efficacy Predicts Responsiveness to Inductive Reasoning Training in Older Adults

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Rationale
Aging is associated with monotonic declines in fluid and executive cognitive abilities. Yet, there is potential for cognitive enrichment with advancing age [2], with studies finding evidence for plasticity among older adults in response to a wide variety of interventions [6]. Component-specific cognitive training interventions involve the direct training of isolated cognitive components such as speed, memory, and reasoning [1]. While these training regimes produce clear improvement in trained abilities [1,2], there are substantial individual differences in the effectiveness of training. The goal of the current study is to examine whether individual differences in self-efficacy beliefs about memory capacity are associated with responsiveness to the targeted training of inductive reasoning.

Methods
Participants
• 105 community-dwelling older adults.
• Age: 66-94 (M = 73.9; SD = 7.7).
• Education: 15.5 years (SD = 2.7).
• Randomly assigned to inductive reasoning training program (N = 47) or a waitlist control group (N = 58).

Training Program
• 16-week program.
• Logic puzzles and games interleaved with an IR training program [5], adapted from the ACTIVE trials [1].
• Basic Series and “Everyday” Serial Problems.

Retention
• 80.1% retention in training. Of the 9 who dropped, 4 returned for post-test.
• 91.4% of control participants returned for post-test.
• No evidence for significant differences between drops and retained on any of the key variables.

Measures
Inductive Reasoning (x = .90)
Letter Sets
• Number sets
• Caller Series
• Word Series
• Everyday Problem Solving
• Memory self-efficacy: Memory capacity beliefs subscale (x = .86) from Metamemory in Adulthood Scale.
• Daily log of the amount of time allocated to training materials.

Analysis
• Intent-to-treat analyses [3]: participants who dropped from the program were invited back.
• Second Order Latent Change Score Models (LCSM): Multiple measures of IR were used to define two latent factors:
  1. Latent Intercept: initial individual differences in IR at the first occasion of measurement.
  2. Latent Slope: amount of individual change in IR from pretest to posttest.
• Constraints for strict measurement invariance.
• Latent MSE factor specified using parcels, built with item-to-construct technique [4].
• Hierarchical Linear Models (HLM): Additional analysis on the number of weeks spent on the training materials.

Results
Effects of Training on Change in Inductive Reasoning
• Group membership was a significant predictor of change in IR (sMLE = .87, z = 2.73, p < .01; d = .44).
• Control Slope: (MLE = 1.03, SE = .47, z = 2.15, p < .05).
• Intervention Slope: (MLE = -.33, SE = .31, z = 1.07, p > .10).
• Training effects were localized to IR.

Figure 1. LCSM of Effects of Training on Changes in Inductive Reasoning

Figure 2. % Accuracy in IR Tasks

Figure 3. Standard Unit Change in Cognition

的效果 of Training on Change in Inductive Reasoning
• Age was negatively related to initial IR (sMLE_I0regret = −.61, z0 = −3.53, p0 < .001; sMLE_I0regret = −.52, z = −2.96, p < .01) and change in IR (sMLE_c = −.49, z0 = −2.34, p0 < .05; sMLE_c = −.44, z = −2.16, p < .05).
• MSE significantly predicted gains in IR within the training group (sMLE = .47, z = 2.27, p < .05) but not control (sMLE = −.03, z = −.14, p > .10).

Figure 4. Standard Unit Change in IR as a Function of MSE

Figure 5. LCSM of Effects of Age and MSE on Change in IR

Conclusions
• Self-efficacy beliefs are associated with the degree to which individuals can gain from the targeted training of a specific fluid ability.
• Findings are consistent with recent research showing positive relationships between older adults’ MSE beliefs and performance in goal-based situations [6,7,8,9].
• Extends prior findings by showing that MSE beliefs predict change in performance in a non-memory domain. Thus, the relationship between MSE and change in cognition may not be limited to memory but may rather be reflective of change in fluid abilities more generally.

References