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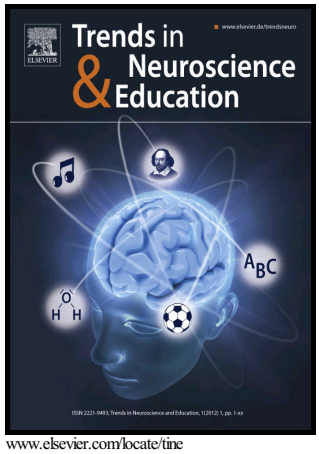

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Short-term cognitive training recapitulates hippocampal functional changes associated with one year of longitudinal skill development

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Abstract

A goal of developmental cognitive neuroscience is to uncover brain mechanisms underlying successful learning. While longitudinal studies capture brain changes following 'schooling as usual', short-term training studies can more directly link learning to brain changes. We investigated whether eight weeks of cognitive training recapitulates longitudinal changes in hippocampal engagement and connectivity. Nineteen children underwent a training program focused on improving arithmetic skills, along with fifteen children in a no-contact control group. Before and after training, or no-contact, both groups performed an arithmetic task during neuroimaging and a strategy assessment. Training increased activity in the anterior hippocampus, and gains in memory-based strategies were associated with decreases lateral fronto-parietal activity and increases hippocampus-parietal connectivity. No changes were observed in the no-contact control group. Our results demonstrate that short-term training can recapitulate long-term neurodevelopmental changes accompanying learning and identifies plasticity of hippocampal responses as a common locus of cognitive skill development in children.

Introduction

A fundamental goal of developmental cognitive neuroscience is to determine brain mechanisms underlying successful learning. However, disentangling the effects of experience and maturation on brain development is especially difficult when investigating the neural basis of academic skill learning. While longitudinal designs provide insights into brain plasticity mechanisms that accompany increasing mastery of academic skills, they cannot determine if the observed neural changes are directly related to