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Cognitive consequences of structured education in a connectionist model of analogical reasoning

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Abstract

Education has a profound impact on human cognition. People who have participated in education are better at solving abstract reasoning tasks, can flexibly transfer knowledge across domains and are better at explaining their solutions. However, the properties of education that are responsible for these cognitive changes are poorly understood. We explore the hypothesis that a structured education consisting of a cumulative, compositional curricular learning regime using culturally constructed concepts and tools can account for many of these observations. In particular, we demonstrate that a connectionist model that learns to solve difficult analogical reasoning problems using a structured education is better at knowledge reuse, while simultaneously providing explanations for solutions. We predict that premature progression through a curriculum, before proficiency in a foundational stage has been established can fundamentally limit the potential for subsequent abstract reasoning performance or knowledge transfer ability.