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Learning and Individual Differences 15 (2004) 35–52

Learning and  
Individual Differences

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## Constructing domain-specific knowledge in kindergarten: Relations among knowledge, intelligence, and strategic performance

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Received 3 March 2004; received in revised form 6 July 2004; accepted 13 July 2004

### Abstract

Thirty kindergarten children from two classrooms participated in a 3-week curricular unit on dinosaurs designed to teach taxonomic relations and distinguishing features aligned with 15 dinosaur species. Both domain-specific learning and strategic performance on a Twenty Questions game were assessed twice throughout the curriculum, as well as during a postcurriculum assessment involving the comparison domain of birds. Performance on all knowledge measures improved significantly across the 3 weeks, with more substantial knowledge gains for higher-aptitude children. Ninety percent of children asked strategic questions that eliminated multiple items while playing Twenty Questions: Domain-specific knowledge was related to strategic questions focused on the features or behaviors taught during the curriculum, while IQ scores were related to strategic questions that did not pertain to curricular content. Because children did not demonstrate metacognitive awareness of their strategic questioning, we suggest that the curricular content prompted implicit changes in strategy use.

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*Keywords:* Domain-specific knowledge; Intelligence; Strategic performance; Twenty Questions

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## 1. Introduction

Domain knowledge can be acquired both through explicit instruction in school, as well as through naturally unfolding individual interests. Variations in domain-specific knowledge can lead to marked differences in cognitive performance. At high levels of expertise, knowledge can even trump marked differences in age, as in the case of child chess experts outperforming less knowledgeable adults in their memory for chess positions (Chi, 1978). Although domain knowledge clearly is a driving force in cognitive development (Carey, 1999; Ceci, 1991; Flavell, Miller, & Miller, 2002), the complex interplay between knowledge and cognitive aptitude in determining task performance is not well understood, particularly for young children's strategic performance. Such analyses typically have been constrained to cross-sectional comparisons between experts and novices (Alexander, Johnson, & Schreiber, 2002; Schneider, Bjorklund, & Maier-Brüker, 1996). While informative, the external validity of conclusions drawn from such studies is weakened by the selective nature of expert recruitment, and it is unclear whether converging patterns of relations would emerge even at earlier points along the continuum of knowledge acquisition.

The objective of the present study was to evaluate relations among domain knowledge, cognitive aptitude, and strategic question generation among kindergarten children who were exposed to a 3-week curricular unit on dinosaurs. Two specific questions were addressed. First, we were interested in determining the extent to which children's cognitive aptitude influenced their domain-specific learning during exposure to the curriculum. Second, we evaluated the relative contributions of domain-specific knowledge and verbal intelligence to children's strategic question generation in the referential communication game of Twenty Questions.

There has been only one other curriculum-based study designed to address questions related to strategic performance with young children. DeMarie-Dreblow (1991) administered a curricular unit on birds to college students and to children in grades 2 through 5. Although domain knowledge increased for all participants, neither recall performance nor strategy sophistication on a memory task improved. DeMarie-Dreblow hypothesized that some restructuring of knowledge into a recruitable form for strategic tasks might be necessary before knowledge could be used to facilitate recall. It is important to note that DeMarie-Dreblow did not explicitly teach the organizational structure of the domain to the students. In contrast, the present study was specifically designed to increase performance through explicit instruction regarding the organizing features and taxonomic relations aligned with the target domain of dinosaurs. Below, we first review literature related to effects of knowledge and intelligence on domain-specific learning and strategic performance. We then review studies that have used the Twenty Questions game to evaluate strategy use. Finally, we consider potential relations between domain knowledge and strategic question generation in children.

## 2. Knowledge, intelligence, and strategic performance

Hambrick and Engle (2002) point out that the *knowledge-is-power* hypothesis is one of the most significant ideas to emerge in the history of cognitive psychology. The essence of this hypothesis is that domain-specific knowledge is most predictive of success on cognitive tasks, whereas "basic" cognitive abilities play a less important role. Both the literatures on children's cognitive development and adult cognition are replete with examples of superior performance when domain-specific

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