Importance of Executive Function for Learning About Patterns

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Patterning

- Repeating patterns (e.g., ABBABB) are important for children's mathematics development (NCTM, 2000).
- Yet, it remains unclear how pattern knowledge develops in early childhood.

Cognitive Skills

- Understanding relations among pattern elements is likely influenced by a combination of experience and cognitive ability.
- Analogical reasoning: drawing comparisons among objects/experiences on the basis of parallel similarities.
- Executive function (EF): cognitive abilities involved in the control of action and thought (working memory, inhibitory control, cognitive flexibility).

Goal

- Clarify the extent to which experience, analogical reasoning, and EF contribute to preschoolers' understanding of repeating patterns.

Pattern Skills

<table>
<thead>
<tr>
<th>Level</th>
<th>Skill</th>
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<tbody>
<tr>
<td>Level 4</td>
<td>Pattern unit recognition</td>
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<tr>
<td>Level 3</td>
<td>Pattern abstraction</td>
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<tr>
<td>Level 2</td>
<td>Pattern extension</td>
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<tr>
<td>Level 1</td>
<td>Pattern duplication</td>
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Method

**Participants:** 124 preschoolers (53 female, \(M = 4.59\) years, \(SD = 0.44\) years, range: 4.00 to 5.82 years).

**Procedure:** Day 1: pattern pretest, FIST, Hand Game. Day 2: Backward Digit Span, pattern posttest, Match-to-Sample. Practice on 10 abstract patterns between sessions.

**Measures**

**Pattern Assessment:** Rittle-Johnson et al. (2013). 5 items at pretest (Levels 1-3), and 8 items at posttest (Levels 1-4).

**Level 1:** Duplicate_AABB  
**Level 2:** Extend_ABB

Working Memory: Backward Digit Span (Wechsler, 2003). Verbally repeat a single-digit number series in reverse order. Correct trials, with 2 trials/digit length, \(M = 1.64, SD = 1.31\).

Inhibitory Control: Hand Game (Hughes, 1996). Make a fist when experimenter points finger, and point finger when experimenter makes a fist. 10 trials, \(M = 4.83, SD = 2.31\).


- Choose two pictures that match one way, and then choose two pictures that match another way. 9 trials, \(M = 6.24, SD = 2.36\).

Conclusions

**Results**

- Preschoolers have a range of repeating pattern knowledge extending across tasks of varying difficulty.
- Analogical reasoning, working memory, and cognitive flexibility all contributed to pretest pattern knowledge.
- Working memory was the only unique predictor of posttest pattern knowledge, controlling for age and prior patterning knowledge.

**References**