Preschoolers' Knowledge of Repeating Patterns Over Time

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Patterns & Math

- Patterning is a spontaneous, recurrent activity of young children that is central to early mathematics education (NCTM, 2000).
- Working with *repeating patterns* (e.g., ABBABB) helps children learn to make generalizations important for algebra (Papic et al., 2011).
- Evidence is currently limited on the growth of different repeating pattern skills (Clements & Sarama, 2009; Rittle-Johnson et al., in press).

Goals

- Examine the relative difficulty of different repeating pattern skills for preschoolers.
- Develop and test a *construct map* (Wilson, 2005) that represents the continuum of repeating pattern knowledge that preschoolers are thought to progress through.
- Investigate changes in preschoolers' repeating pattern knowledge over time.

Construct Map

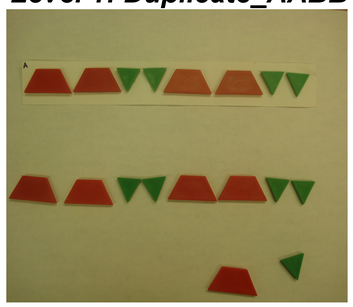
Level	Skill
Level 4: Pattern unit recognition	Identifies the pattern unit
Level 3: Pattern abstraction	Translates patterns into new patterns with same structural rule
Level 2: Pattern extension	Extends patterns at least one pattern unit
Level 1: Pattern duplication	Duplicates patterns

Based on Clements and Sarama (2009)

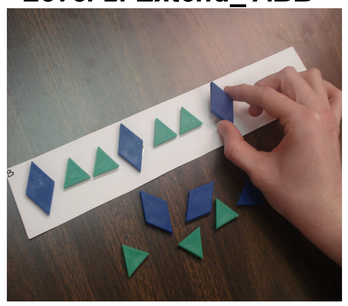
Method

***Participants*:** 64 preschoolers (4.0 to 5.3 years in Fall).
Design: Given brief pattern practice, and then assessed in Fall and Spring of school year.
Assessment: 10 items, each targeted at 1 of 4 levels of the construct map (dropped one Level 4 item).
Sample Tasks:

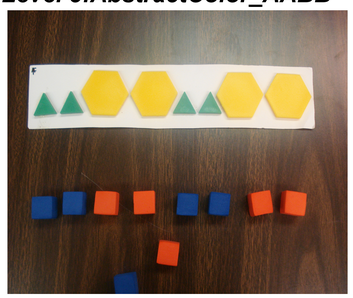
Level 1: Duplicate_AABB



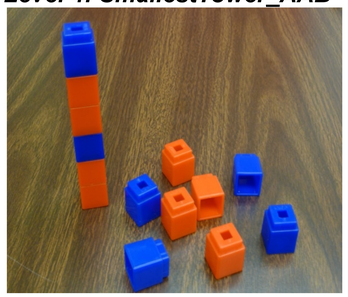
Level 2: Extend_ ABB



Level 3:AbstractColor_AABB

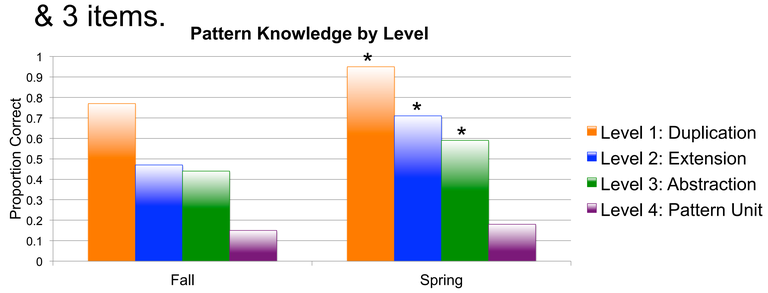


Level 4: SmallestTower_AAB



Improvements Over Time

- Large improvements in proportion correct on Level 1, 2, & 3 items.



Error Analysis

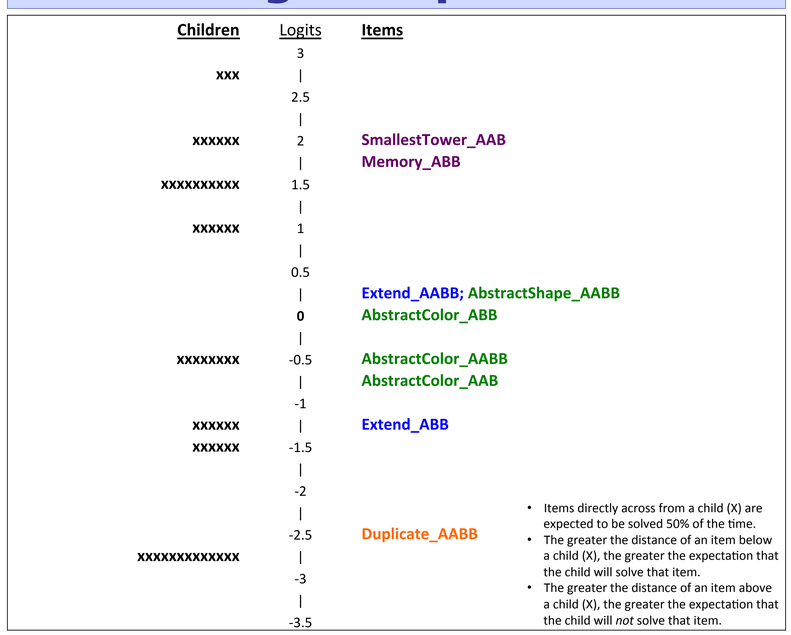
Error type	Example for ABB pattern	% Used across trials		% Children who used	
		Fall	Spring	Fall	Spring
Correct	ABBABB	46	62**	80	98*
Partial Correct	ABBAAB	12	19	60	75
Wrong Pattern AB	ABABAB	9	10	43	38
Wrong Pattern Other	AABBAABB	6	2**	42	14**
Sort	AAAABBBB	11	3**	48	17**
Random Order	ABBAA	10	3**	42	17**
Off Task	Made a tower	6	2*	20	9*

* $p < .05$. ** $p < .01$.

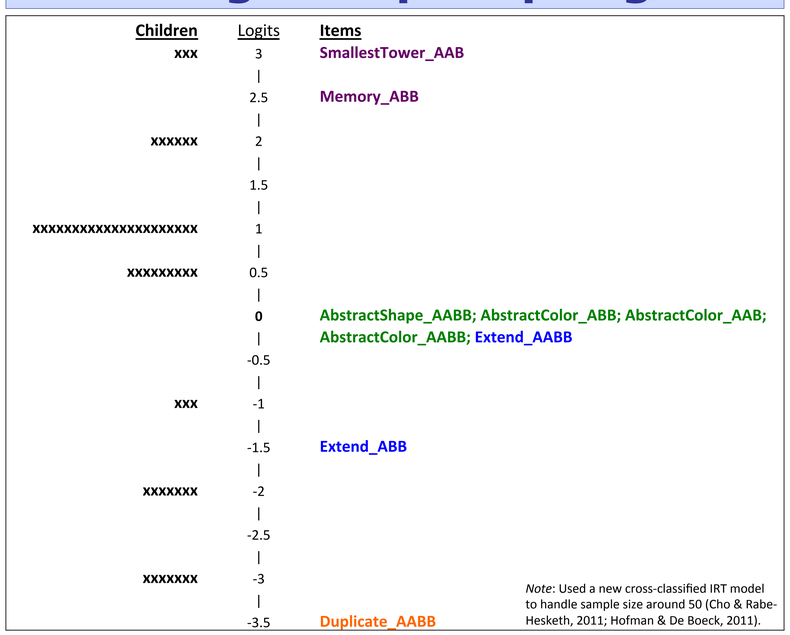
Conclusions

- 4-year-olds gain more accurate knowledge of repeating patterns over the preschool year.
  - Many advance beyond duplication and extension.
  - Learning to abstract patterns – although not being instructed in school!
  - May provide a foundation for early algebraic thinking.
- Frequency of less sophisticated errors decreased over time.
- Construct map and assessment captured shifts in pattern knowledge over the preschool year.
- Future research should identify sources of change in pattern knowledge.
  - Better understand relevant cognitive mechanisms underlying preschoolers' patterning skills.
  - Further investigate links between patterns and mathematics learning.

Wright Map – Fall



Wright Map – Spring



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