It's a Pattern! Growth in Preschoolers' Pattern Knowledge

Abbey M. Loehr, Bethany Rittle-Johnson & Emily R. Fyfe

VANDERBILT UNIVERSITY

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BACKGROUND

- Most early mathematics research focuses exclusively on numeracy (Sarama & Clements, 2004).
- However, patterning is a common activity for young children and a central component of early math knowledge (Ginsburg, Lin, Ness, & Seo, 2003; NCTM, 2000).
- Pattern understanding is important for math achievement (Kidd et al., 2014; Lee et al., 2011; Warren & Cooper, 2007) and may help children make generalizations important for algebra (Papic et al., 2011).

STUDY 1

How does preschoolers' repeating pattern knowledge change over the course of the preschool year?

Method

Participants*:* 65 preschoolers (4.0 to 5.3 years old in Fall; 35% racial or ethnic minorities) from 6 classrooms at 4 preschools (1 publicly funded pre-K program)

Design*:* 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; Rittle-Johnson, et al., 2013)

Construct Map

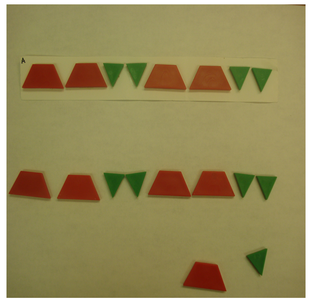
Increasing Sophistication

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.

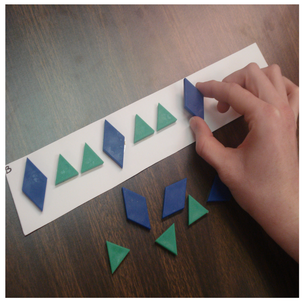
Based on Clements and Sarama (2009)

Sample Assessment Tasks

***Duplication* – Level 1**

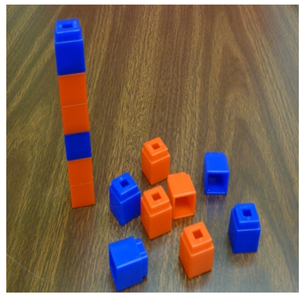


***Extension* – Level 2**



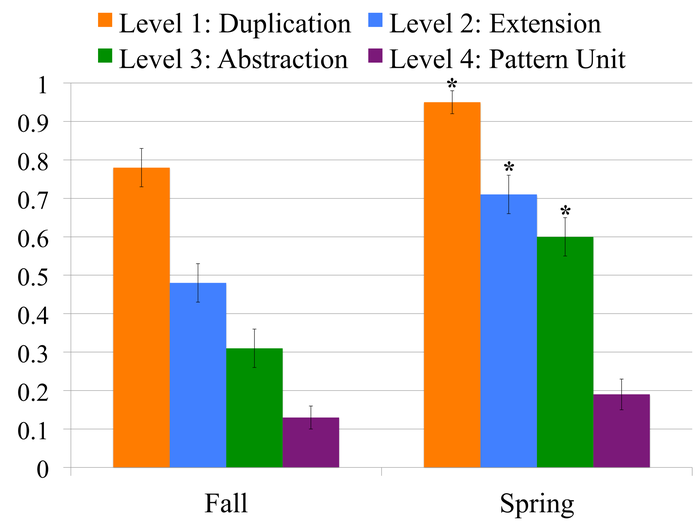
***Abstraction* – Level 3**

***Pattern Unit* – Level 4**



Results

Improvements in Pattern Knowledge from Fall to Spring by Level



Conclusions

- Children showed growth in pattern knowledge between the Fall and Spring
  - Many go beyond duplicating and extending
- Growth in abstracting patterns indicates young children are able to pay attention to the overall structure of the pattern
- At the same time, children did not improve in more explicit pattern unit recognition
  - May reflect minimal attention to this skill by parents and teachers

STUDY 2

What are potential sources of growth in preschoolers' pattern knowledge?

- Research on numeracy indicates that home and school numeracy experiences help predict numeracy knowledge and development (Anders et al., 2012; LeFevre et al., 2009).
- Engagement in pattern activities at home and in school likely supports pattern knowledge.

Method

Participants*:* 20 racially diverse parents or guardians of children in Study 1 completed the parent survey (31% response rate). 5 of the 6 teachers from Study 1 were interviewed.

Design: Surveyed parents and preschool teachers near the end of the pre-K year about frequency of math activities, including patterning

Materials:

- *Parent survey*: based on home numeracy environment surveys (Skwarchuk, Sowinski, & LeFevre, 2014) with additional items on patterns
- *Teacher structured interview*: importance of pattern skills and frequency of pattern activities

Parent Report on Frequency of Mathematics Activities

	Median Frequency				
Activity	Rarely or never	1-3 times a month	Once a week	2-4 times a week	Almost daily
Notices patterns in the world on his or her own					x
Read books or watch TV shows that show and talk about patterns				x	
Make or copy patterns with objects or sounds			x		
Figure out what comes next in a pattern			x		
Play computer games that include patterns			x		
Discuss patterns in days of the week, months of the year, or seasons			x		
Play hand or movement games or board games that involve patterns		x			
Count objects					x
Identify shapes or colors				x	
Talk about number facts (such as 2+2=4)				x	
Sort objects into groups based on size or color			x		
Play board games that involve counting		x			

Results

At home, pattern activities almost as common as other math activities

- Frequency of pattern activities moderately correlated with children's pattern knowledge, $r(16) = .43$, $p = .07$.

At school, teachers believed patterns were very important relative to other math skills and frequently engaged children in pattern activities

- All named patterns, created patterns with objects or sounds, and figured out what comes next
- Some engaged in pattern abstraction or identifying the pattern unit

Conclusions

- Engagement in pattern activities at home and in school may support children's pattern knowledge. Some children not exposed to pattern abstraction or identifying the pattern unit.
- However, small and convenient sample limits generalizability

DISCUSSION

- Patterns are a pervasive and important, but understudied, component of early mathematics education.
- Unlike copying and extending patterns, pattern abstraction requires attention to the structure of patterns, and children are largely successful at these tasks by the end of pre-K. Teachers should encourage pattern abstraction.
- Children struggled to explicitly recognize the pattern's unit of repeat, supporting the hypothesis that unit recognition is the most difficult repeating pattern task for children.

References

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