Abstract Title Page
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Title:
Taxonomic organization scaffolds young children's learning from storybooks: A design experiment

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Abstract Body

Limit 5 pages single spaced.

Background/context:

Compelling research studies converge on the important of children's vocabulary knowledge as the foundation for their literacy achievement (Dickinson & Neuman, 2006; Neuman & Dickinson, 2001). Children who enter school with well-developed vocabulary skills—a foundation for reading acquisition—are likely to become successful in learning to read. Studies of economically disadvantaged children, however, indicate wide disparities in oral language and vocabulary knowledge from their more economically advantaged peers (Hart & Risley, 2003; Neuman & Celano, 2006). Economically-disadvantaged children know about 5,000 words on entry into first grade, whereas economically-advantaged children know approximately 20,000 words (Snow, Burns & Griffin, 1998). These differences are particularly distressing considering that vocabulary size is an effective predictor of reading comprehension not only in the elementary grades but throughout high school as well (Chall, Jacob, & Baldwin, 1990; Cunningham & Stanovich, 1997).

Although children may benefit greatly from vocabulary interventions and instruction (Marulis & Neuman, 2010), there is surprisingly little emphasis on vocabulary instruction in most early childhood classrooms. Books, however, are an important source of vocabulary and conceptual knowledge. Given that many early childhood teachers devote classroom time to shared book-reading, books may be a potentially powerful source for children's learning.

Research has tended to focus on how the quality of the teaching, such as the style and content of the reader's extra-textual comments during shared-reading, influences children's learning (Mol, Bus, & de Jong, 2009). However, the books themselves may also impact child outcomes. Children's expressive and receptive learning may be influenced by how the to-be-acquired information is organized (Baddeley, 1997). Taxonomies—hierarchical structures based upon shared superordinate categories (Tversky, 1985)—may be an especially powerful means of organizing information. Because taxonomic categories are hierarchically-nested, familiarity with a taxonomic category allows children to make inferences to be made that go beyond their first-hand knowledge or experience. As such, taxonomic organization may facilitate children's learning (Blewitt & Toppino, 1991) and ability to make inferences about new category members (Gelman, 2003). Given this, we investigated whether taxonomic organization might improve children's word learning and concept development from storybooks.

Purpose / objective / research question / focus of study:

Description of what the research focused on and why.

The purpose of this design experiment was to research, test and iteratively design a set of taxonomically-organized storybooks that served to scaffold young children's word learning and concept development.

Specifically, Phase 1 of the design experiment asked: 1) What are the effects of taxonomic organization on children's ability to acquire vocabulary from storybooks? 2) What are the effects of taxonomic organization on children's storybook comprehension? 3) What are the effects of taxonomic organization on children's understanding of which types of information can be generalized to new exemplars?

Phase 2 explored whether children's preexisting background knowledge influenced the effects of taxonomic organization on their vocabulary and concept learning . We asked: 1)

What are the differential effects of taxonomic organization on children's ability to acquire vocabulary from storybooks when their preexisting background knowledge varies? 2) What are the differential effects of taxonomic organization on children's storybook comprehension when their preexisting background knowledge varies? 3) What are the differential effects of taxonomic organization on children's understanding of which types of information can be generalized to new exemplars when their preexisting background knowledge varies?

Setting:

Description of where the research took place.

Subjects were recruited from 19 preschools in a large metropolitan area. The preschools represented a range of socioeconomic settings: 8 were Head Start, 5 were state-sponsored pre-kindergarten programs for at-risk children and 6 were university-affiliated private preschools.

Population / Participants / Subjects:

Description of participants in the study: who (or what) how many, key features (or characteristics).

Phase 1: Participants were 327 children (M = 57.90 months, SD = 4.59; 177 boys and 150 girls) from a range of preschools: 98 children were enrolled in Head Start; 132 were enrolled in state-sponsored pre-kindergarten; and 135 were enrolled at a university-affiliated preschool. All children were English speakers with an ethnicity distribution of 61.5% European-American, 21.2% African-American, 8.9% Asian, 2.8% Hispanic, 2.5% Middle Eastern, and 3.1% bi-/multi-racial.

Phase 2: Participants were 157 children (M = 59.30 months, SD = 4.31; 66 boys and 89 girls) from a range of preschools targeting at-risk populations: 79 were enrolled in Head Start and 78 were enrolled in state-sponsored pre-kindergarten. All children were native English speakers with an ethnicity distribution of 67.3% European-American, 23.7% African-American, 5.1% Hispanic, 3.9% bi-/multi-racial.

Intervention / Program / Practice:

Description of the intervention, program or practice, including details of administration and duration.

Phase 1 examined the effects of taxonomic organization on children's word learning and storybook comprehension. Children were read one of two storybooks about four unfamiliar entities (i.e., cupido, faroe, kona, moa). The two storybooks shared a common plot about four entities searching for their hats in order to play outside in the snow. In the *taxonomic storybook*, children's knowledge of a familiar taxonomic category (i.e., birds) was induced to structure the presentation of new information about members of the category (i.e., four unfamiliar birds). In the *traditional storybook*, an ad-hoc thematic category (i.e., things that live in a house) was used to present new information about members of the category (i.e., four things that live in a house).

Phase 2 examined whether children's preexisting background knowledge influenced the effects of taxonomic organization on their word learning and storybook comprehension. Children were read one of two storybooks about four unfamiliar entities; once again, the storybooks shared a common plot. In the *familiar taxonomic storybook,* children possessed varying amounts of preexisting background knowledge about the taxonomic category. Their knowledge of this relatively familiar taxonomic category (i.e., birds) was induced to structure the presentation of new information about members of the category (i.e., four unfamiliar birds). In the *novel taxonomic storybook*, none of the children possessed preexisting background knowledge; that is, their knowledge was constant. A novel taxonomic category (i.e., wugs) structured the presentation about members of the category (i.e., four unfamiliar wugs).

The procedure was identical for Phases 1 and 2. Children were randomly assigned to a condition and then assessed by a trained assessor in a one-on-one setting. The assessor read the storybook three times, resulting in a total of nine exposures to each of the four target vocabulary words. Importantly, the experimenter did not provide any extra-textual comments throughout the book-reading; children only heard the storybook text. Immediately following the book reading, children completed four assessments (see below). Shared-reading and testing lasted approximately 25 minutes total.

Research Design:

Description of research design (e.g., qualitative case study, quasi-experimental design, secondary analysis, analytic essay, randomized field trial).

This study was a between-participants design experiment.

Data Collection and Analysis:

Description of the methods for collecting and analyzing data.

For both Phases 1 and 2, children were read the storybook and then completed four assessments that were administered in a set order. First, the target vocabulary test was an 8-item measure that assessed children's knowledge of the target vocabulary words. Children's knowledge of the target words was measured twice: one in a contextualized manner (4 items) and once in a decontextualized manner (4 items). Second, the literal comprehension test was a 6-item measured that assessed children's comprehension of critical story events. Third, the generalization test was a 8-item (Phase 1) or 12-item (Phase 2) measure that assessed children's generalization of storybook information to new exemplars. Half of the items were taxonomic category properties that could be generalized to other category members; the remaining half were thematic category properties that could not be generalized. Lastly, children's general vocabulary knowledge was assessed with the Peabody Picture Vocabulary Test-III (PPVT-III) (Dunn & Dunn, 1998).

Children's responses were recorded and scored for accuracy by trained assessors. For the target vocabulary, literal comprehension, and generalization tests, children's responses were scored dichotomously (i.e., correct or incorrect), summed to yield an overall score, and then converted into a proportion score. For the PPVT-III, standard scores were used for data analysis.

Data was analyzed with SPSS 17.0 statistical software. To address the research questions, we conducted a series of analysis of covariance (ANCOVA) (Phase 1) and a series of hierarchical regressions (Phase 2).

Findings / Results:

Description of main findings with specific details.

This study examined the effects of taxonomic organization on children's learning through an iterative design. Phase 1 addressed whether taxonomic organization served to scaffold children's word learning and storybook comprehension. Phase 2 addressed whether children's preexisting background knowledge impacted the effects of taxonomic organization on children's outcomes.

Phase 1

We first examined children's target vocabulary acquisition by conducting a one-way analysis of covariance (ANCOVA) on the target vocabulary test with condition as a between-participants independent factor. Because children's existing vocabulary knowledge is often related to their acquisition of new vocabulary (Stanovich, 1986), PPVT-III was included as a

covariate. The covariate was significant ($F(1, 324) = 17.63$, $p < .0005$) and thereby retained in the analysis. The ANCOVA did not reveal a significant main effect of condition ($F(1, 324) = 1.59$, $p = .208$). Contrary to our initial hypothesis, when PPVT-III was taken into account, children who were read the taxonomic storybook did not learn a significantly greater proportion of the target vocabulary than children who were read the traditional storybook.

To examine children's comprehension, we conducted a one-way ANCOVA on children's literal comprehension with condition as a between-participants independent factor. Because children's comprehension is often related to their existing vocabulary knowledge (Beck, McKeown, & Kucan, 2002), PPVT-III was included as a covariate. The covariate was significant ($F(1, 324) = 47.21$, $p < .0005$) and retained in the analysis. The ANCOVA revealed a significant main effect of condition after controlling for general vocabulary knowledge ($F(1, 324) = 6.90$, $p = .009$). The taxonomic storybook significantly enhanced children's ability to understand the text. This effect was modest but educationally meaningful (Cohen's $d = .23$).

We next sought to understand whether taxonomic organization scaffolded children's understanding of which category properties can be generalized to new exemplars. We conducted a 2 (Type of Category Information) x 2 (Condition) mixed-model ANCOVA with children's performance on the generalization test (i.e., generalization of taxonomic and thematic category properties) as dependent factors. Because children's existing vocabulary knowledge may be related to their conceptual knowledge (Gelman, 2003), PPVT-III was included as a covariate. The covariate was significant ($F(1, 324) = 29.71$, $p < .0005$) and thereby retained in the analysis. There was a significant within-participants main effect of type of category information ($F(1, 324) = 10.53$, $p = .001$), such that taxonomic properties were more likely to be generalized than thematic properties. This effect was large (Cohen's $d = .82$) and indicates that children demonstrated some understanding of which category properties could be generalized to new exemplars. However, there was not a significant interaction between type of category information and condition ($F(1, 324) = .06$, $p = .808$). Regardless of whether they were read the taxonomic or traditional storybook, children appeared to understand that taxonomic properties could be generalized, whereas thematic properties could not be generalized to new exemplars.

Phase 2

We first asked whether children's preexisting background knowledge differentially impacts the effects of taxonomic organization on their word learning. The first hierarchical regression examined children's target vocabulary knowledge when their background knowledge was variable (i.e., familiar taxonomic storybook). Possible covariates (gender, age) were entered at the first step and general vocabulary knowledge (PPVT-III) was entered at the second step. When background knowledge was variable, PPVT-III significantly predicted children's target vocabulary knowledge. The second hierarchical regression examined children's target vocabulary knowledge when their background knowledge was held constant (i.e., novel taxonomic storybook). Possible covariates were entered at the first step and PPVT-III was entered at the second step. When background knowledge was held constant, PPVT-III did not predict children's target vocabulary knowledge. In Phase 1, children's general vocabulary knowledge significantly influenced their acquisition of vocabulary from taxonomically-organized storybooks. When Phases 1 and 2 are considered together, it appears that children with larger vocabularies may learn more words from taxonomic storybooks when their background knowledge about the taxonomic category is variable. However, when children's background knowledge about the taxonomic category is held constant, children with smaller vocabularies may acquire target vocabulary as readily as children with larger vocabularies.

We next asked whether children's preexisting background knowledge differentially impacts the effects of taxonomic organization on their storybook comprehension. The first hierarchical regression examined children's literal comprehension when their background knowledge was variable. Possible covariates were entered at the first step and PPVT-III was entered at the second step. When background knowledge was variable, PPVT-III significantly predicted children's literal comprehension. The second hierarchical regression examined children's literal comprehension when their background knowledge was held constant. Possible covariates were entered at the first step and PPVT-III was entered at the second step. When background knowledge was held constant, PPVT-III significantly predicted children's literal comprehension. Collectively, these results indicate that children with larger vocabularies demonstrated greater comprehension of taxonomically-organized storybooks than children with smaller vocabularies, regardless of whether they possessed preexisting knowledge about the taxonomic category.

Finally, we examined whether children's preexisting knowledge differentially scaffolded their understanding of which category properties could be generalized to new exemplars. When background knowledge was held constant, PPVT-III did not predict children's generalization of taxonomic properties to new exemplars. This result indicates that children's understanding of which properties could and count not be generalized did not appear to be influenced by their general vocabulary knowledge above and beyond their knowledge of the taxonomic category.

Conclusions:

Description of conclusions and recommendations based on findings and overall study.

Although taxonomic organization did not appear to impact children's ability to learn new words, Phase 1 suggests that taxonomic organization may significantly impact children's literal comprehension of storybook narratives. The effect size was modest; however, this is consistent with other storybook interventions (Elleman, Lindo, Morphy, & Compton, 2009; Mol et al., 2009). Consequently, it appears that taxonomic organization may provide a modest but meaningful scaffold for children's comprehension. Overall, children demonstrated some understanding that taxonomic properties can be generalized to new exemplars, whereas thematic properties cannot; however, taxonomic organization did not appear to further scaffold this understanding.

Phase 2 suggests that children's preexisting background knowledge and general vocabulary knowledge may interactively influence the effects of taxonomic organization on children's learning. When children's knowledge of the taxonomic category was held constant, children with smaller vocabularies learned as many words from taxonomically-organized storybooks as children with larger vocabularies. However, children with larger vocabularies demonstrated greater storybook comprehension than children with smaller vocabularies, regardless of whether they possessed preexisting knowledge of the taxonomic category. Taken together, these results suggest that taxonomic organization may impact children's learning about novel categories, but it may be insufficient to level the playing field for children with more limited general vocabulary knowledge. This suggests that future interventions may need to simultaneously develop children's vocabulary and conceptual knowledge.

Appendices

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Appendix A. References

References are to be in APA version 6 format.

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Appendix B. Tables and Figures
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