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Aiding Preschoolers' word-learning by scaffolding lexical awareness

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Abstract

Preschool-aged children develop awareness of the words they do and do not know. Awareness of one's lexicon may encourage word learning if children pay more attention to the definition of unknown words. Here, we tested 3-4-year-old children ($N = 91$) on a word learning task embedded in an e-book. When a novel word was read, children were either asked if they knew the word, asked a question about the storyline, or asked no question. Then they were given a description without visual input and asked to identify the referent's picture from three choices. Participants who were asked if they knew a word before being provided with the definition identified more referents than children in the other conditions. Children's word learning was predicted by short-term memory.

Keywords: word learning, lexical awareness, preschoolers, object representation, memory

Introduction

Recognizing that a word is unfamiliar might help children learn its meaning. This recognition can prompt the search for a definition, or the use of context to reason about meaning. Although older children and adults are often aware of what they know and what they do not (Klin et al. 1997, Flavell, 1979), preschool-aged children are still developing this ability. The use of the word "know" emerges around a child's third birthday (Bartsch & Wellman, 1995; Montgomery, 1992), along with other words referring to mental states (Johnson & Maratsos, 1977). At the same time, preschoolers are developing their ability to monitor their uncertainty across domains (Lyons & Ghetti, 2011). Since children ages three-to-five are acquiring many words each day, researchers have investigated their ability to recognize when unfamiliar words as well as the factors that influence this recognition.

Merriman and Marazita (2004) argued that there are two components to determining whether one knows a word: recognition that the sound form is unfamiliar (word-cued awareness) or appreciation that one does not know the name for a certain type of thing (meaning-cued awareness). Merriman and Marazita (2004) described preschool children's ability to use these types of cues. They tested word-cued awareness by asking children if made up words and real words were words or not. Rejecting the made up

words and accepting the known words shows mastery of this task. Overall there was an increase in awareness of lexical ignorance from three to four. Three-year-olds accepted an average of 51% of the made-up words and 84% of the familiar words. Four-year-olds performance was more robust as they accepted 24% of the novel words and 92% of the familiar words. Their test of meaning-cued awareness mirrored this performance pattern. These results suggest there may be an increase in children's lexical awareness during the preschool years.

Children's awareness of lexical ignorance can be supported by exposure to words, actions, and objects that differ in familiarity. For example, asking children to sort words into piles of known and unknown words with a visual aid leads to greater accuracy on lexical awareness tasks (Merriman & Maritza, 2004), the pairing a novel word with a novel action (Merriman, et al. 1996) and exposure to familiar and novel objects (e.g., Hartin, Stevenson, & Merriman, 2016). This work suggests that lexical awareness in preschoolers may be work best when children are prompted to consider familiarity and novelty. One possibility is that children may benefit from being prompted to consider whether they know the meaning of an unfamiliar word prior to hearing a definition, if they do not deploy their awareness of lexical ignorance spontaneously.

One additional question is how age-related improvements in lexical awareness might be supported by cognitive and linguistic abilities. One possibility is that concomitant developments in cognitive skills may support this understanding (Merriman & Marazita, 2004) such that increased short-term memory capacity or a heightened ability to mentally represent objects may support children's lexical awareness abilities. These cognitive skills might help children recognize when they do not know words to the extent that they support search through their lexicon. Alternatively, the development of these cognitive skills might be separate from the advance of lexical awareness. We investigate these two possibilities in the current study.

Although some children are reluctant to ask adults questions about unfamiliar words, children with large vocabularies are one exception; they are much more likely to ask about the meaning of a word (Jacobson & Saylor, in prep). This suggests that children who already have large vocabularies may have an easier time gaining more vocabulary. This has been referred to as the Matthew effect

(Stanovich, 1986), or the “rich getting richer.” However, the direction the relationship is unclear: does having a larger lexicon lead you to knowing when a question should be asked (i.e. more lexical awareness leads to more question asking and vocabulary increases), or do some children have a larger vocabulary because they are predisposed to asking questions. One way to investigate these possibilities is to have adults scaffold lexical awareness by ask preschoolers questions about word knowledge.

Question asking during joint book reading is an established technique called dialogic reading (Whitehurst, et al., 1988) and it aids in word learning (Senechal & Cornell, 1993; Senechal et. al., 1995; Whitehurst et. al., 1988). The benefit of using a dialogic reading-like technique to manipulate lexical awareness is that it children can be asked about the novel vocabulary as well as other elements of the story. Asking if a child knows the meaning of novel items could scaffold awareness of lexical ignorance and lead to word learning. Another possibility is that asking any type of question heightens preschoolers’ attention to the text and promotes word learning.

In the current study we explore these possibilities by asking questions that draw attention to lexical ignorance, asking a question unrelated to the target word, or asking no questions. We will also test skills that may influence word learning and the ability to access the lexicon such as short-term memory, object representation and existing language ability. We predict that children with more robust memory, object representation, and language abilities will learn more words during our task. By testing cognitive abilities we hope to more fully explain the developmental trend in lexical awareness.

Method

Participants

Ninety-one 3-4-year olds (range 36-63 months, $M = 47$ months, 44 Females) were recruited from childcare centers and state birth records in the southeastern United States. Eight additional children were recruited and not included in the analysis for non-compliance ($n = 2$), biased responding ($n = 2$) and experimenter error ($n = 4$). Participants were typically developing, had intact hearing, and heard English in their household 70% of the time or more.

Demographic surveys revealed that 53% of mothers had a post graduate degree or some graduate school, 36% had a college degree or some college, and 6% had a technical/AA degree or a high school degree. Four participants’ parents did not respond to this question. 22% of participants’ families reported an income of \$150,000 or more per year, 25% reported an income between \$100,000 to \$150,000 per year, 30% reported an income between \$100,000 and \$50,000 per year, and 12% of families reported an income of less than \$50,000 per year. Ten participants’ parents did not respond.

Design

All participants were administered five tasks in the same order: the electronic picture book, lexical awareness task, a forward digit span, Test of Early Language Development -3 (TELD-3; Hresko, Reid, & Hammill, 1999) and an object representation task called the Vanderbilt Expertise Task-Kid (VET-Kid). Children tested in the lab completed the tasks during a single visit and most of the participants tested in child-care centers did four of the tasks on one day and the VET-Kid a few days later (Range: 0-21 days, $M = 2.55$, $sd = 3.50$).

For the electronic picture book, children were randomly assigned to one of three conditions so that ages were and distribution of males and females across conditions was equal (to be described in more detail below): *lexical awareness* ($n = 26$, 11 females), *distractor question* ($n = 31$, 14 females), *no question* ($n = 34$, 16 females) See Table 2 for mean ages by condition.

Materials

Electronic Picture Book. Participants were read an electronic picture book on a laptop that was created for this experiment. It contained six novel target words, which were names for made-up creatures. In the picture book, two people (a brother and sister) participated in various activities (e.g., playing in the garden, eating ice cream) and found novel creatures. Illustrations were presented through Microsoft Power Point on a laptop computer. An experimenter read the text from a separate binder.

For test trials, children were presented each target item with two distractors. The distractors matched the target in color but differed in location and shape (See figure 1). One of the distractors was another novel creature and one was a familiar creature in an unfamiliar color (e.g. a purple pig). The order of the target items and the order of the dimensions were counterbalanced across participants.

Lexical awareness task. A task that assessed participants’ lexical awareness was created for the purpose of this experiment. Twelve word pairs consisted of a familiar (i.e. *old*) word paired with a novel (i.e. *new*) word. The familiar words in the pairs increased in difficulty for later items (the words were from the PPVT-IV). A PowerPoint of pictures testing familiar word knowledge was also created.

Object representation task. To determine how well each participant could mentally represent an object, we administered a task that was an adaptation of the Vanderbilt Expertise Task (McGugin, Richler, Herzmann, Speegle, & Gauthier, 2012) originally designed for use with adults. This task was programed on MatLab. Images of three object types, teddy bears, toy cars and kid’s shoes were gathered from Google images and shopping websites such Ebay (See Table 1 for some example pictures).

Procedure

To begin, children were seated at a table across from the experimenter and began the electronic picture book task. There were three conditions that differed according to what

the experimenter said after a novel word was mentioned (e.g., *Grimp* in “They went into the garden to look for a *grimp*.”). In the *lexical awareness* condition, the researcher asked children if they knew what the target word meant after a novel word was mentioned (Do you know what that is?). Children were expected to say “no” as the target words were all novel, but if they said “yes” they were asked to provide a definition. Most participants then admitted that they did not know what it was. However, if they made up a definition, they were told that the word was one they did not know. In the *distractor question* condition, children were asked about an element of the story that was not target-word related (“Do you have a garden?”), and in the *no question* condition the story was read straight through with no interactive questions from the researcher to the participant.

After the target item was mentioned in the electronic picture book and participants were either asked a question, or not, the target was described in three dimensions: color, location and shape. For example, the researcher would tell the participant, “A *grimp* is orange, has a droopy nose and lives in the trees.” The descriptions were given without visual reference. Afterwards participants were asked, “Which creature did they see?” and were presented with three pictures, one target and two distractors. The placement of the target words and distractors were counterbalanced across trials and participants. There were six target words and six different target-word presentation orders for each condition.

Following this, children completed the **lexical awareness task**. Participants were told that they were going to play a game with words where they would hear two words; one was an *old* word that they had heard before and knew what it meant, for example, the word “book.” They were told the other word was going to be a *new* word that they had not heard before and didn’t know what it meant, like the word “floopydoopy.” They were then given two practice trials in which they were given word pairs (e.g. *sock* and *baloota*) and asked to say the *new* word. For each practice trial, if participants responded incorrectly (i.e. by saying the *old* word) they were asked if they knew the definition of the *old* word (e.g. *sock*) and were guided to the correct answer. Once they provided or were given the correct answers on the two practice items they proceeded to the testing phase.

Participants were reminded about saying the *new* word before each pair was presented. Additionally every four items they were reminded that *new* words were words they had never heard before. The order of familiar and novel words was counterbalanced across items.

After the pairs were administered we tested participants’ knowledge of the familiar words by presenting them with a three-option forced task in which they selected the familiar referent (e.g. a picture of a *cat*) among two distractor pictures (e.g. a picture of an oven and a frog). If the participant could not identify the familiar item when prompted then those items were excluded. The number of errors on the task (i.e. saying the known word was the word they did not know) was the measure of performance. If

participant failed to identify any particular familiar word the trial was not included as an error, because both words in the pair would have been unknown for the child.

To assess short-term memory children were given a forward digit span task. Then their language abilities were tested with the TELD-3.

The VET-Kid task tested **object representation**. For this task we tested children on three different categories: teddy bears, toy cars and shoes. Children were asked to remember three exemplars of a category (e.g., three teddy bears) in the context of story about a character named Casey who lost his three teddy bears and needed the child to help find them. During training they were shown Casey’s three teddy bears. Then they are asked, “Can you find one of Casey’s bears” when presented with an array of three teddy bears that included one of Casey’s bears.

For the first nine trials participants were asked to identify pictures of the items that were identical to the ones they were trained on (OR-Easy). They received feedback on the first 9 trials, and showing them the target item if they were incorrect. Then children completed twelve transfer trials in which children were asked to identify the target items that were shown from a different angle (OR-Hard). For the transfer trials, children did not receive feedback. Three additional study trials, as well as three catch trials where the target object was paired with unrelated distractors were interspersed to ensure participant’s attention and boost confidence. See *Table 1* for the design matrix.

Results

Preliminary analyses revealed no differences in age, lexical awareness, TELD-3, digit span, or object representation between the participants in the three conditions (see *Table 2*).

A planned comparison revealed that children in the *lexical awareness* condition ($M = 3.36$, $sd = 2.00$) learned significantly more words than children in *distractor question* ($M = 2.45$, $sd = 1.67$, $p < .05$) and *no question* ($M = 2.44$, $sd = 1.36$, $p < .05$) conditions.

To test whether children were able to identify words beyond what would be expected by chance, we conducted tests against chance for each condition. In the two control conditions word learning performance did not differ from chance, for the *distractor question* ($t(30) = 1.51$, $p = .14$) and the *no question* ($t(35) = 1.96$, $p = .06$) conditions, but the *lexical awareness* condition boosted children’s word learning above chance levels ($t(25) = 3.40$, $p = .002$).

For the purposes of the rest of the analysis we collapsed across the two control conditions (since responding in these two conditions did not differ). Bivariate correlations revealed that language and memory abilities were correlated with word learning: TELD-3 ($r(87) = .32$, $p = .002$), lexical awareness ($r(86) = .29$, $p = .006$), digit span ($r(91) = .33$, $p = .001$) and object representation ($r(87) = .37$, $p < .001$).

We conducted a multiple-regression with age, condition, TELD-3, lexical awareness, digit span and object representation as predictors of word learning. Our model was significant ($F(6,77) = 4.50$, $R^2_{\text{adjusted}} = .21$, $p < .001$) and condition was a significant predictor ($t(77) = 2.58$, $\beta = .26$, $p = .012$), as was short term memory ($t(77) = 2.16$, $\beta = .25$, $p = .03$). Object representation also emerged as a marginal predictor ($t(77) = 1.93$, $\beta = .25$, $p = .06$). See *Table 3* for regression table.

Discussion

We investigated whether adults could scaffold lexical awareness for preschool aged children by asking questions that made children consider whether they know the meaning of a novel word. We also investigated whether cognitive abilities influenced word learning, and if these skills might explain variability in learning. Our results suggest that both asking questions that highlight lexical ignorance and memory abilities affected children’s word learning success.

In this study, age, language abilities and a measure of lexical awareness did not independently predict word learning above digit span (short-term memory) or object representation. This was surprising, in part, because previous research has found age and language ability to be important predictors of word learning during shared reading (Sénéchal et al., 1995). One explanation for our results is that the current task loaded heavily on children’s memory skills because the descriptions were offered in the absence of the referent objects. Children therefore had to hold information about features in mind rather than immediately mapping a label to a visible referent. The failure of our lexical awareness measure to predict success may indicate that children do not employ their understanding automatically during the preschool period. In other words, it may be that preschoolers sometimes know that they do not know a word, but there are not sure how to act on their ignorance. This is consistent with research suggesting that practice with novel and familiar words and objects leads to greater awareness of lexical ignorance in preschoolers (Marazita & Merriman, 2004; Hartin et al, 2016).

In the current study, the lexical awareness condition may have worked in two ways: it could be drawing attention to the fact that the child does not know the word; alternatively, it could be drawing increased attention to the word form. To test these two processes separately in future work, we plan to draw attention to the phonology of the new word separately from having children think about the meaning of the word. Additionally, in future work we will more directly test word learning by asking children, “Point to the *grimp*,” instead of, “Which creature did they see?”

This research provides suggestive evidence that children may use what they do and do not know to propel their vocabulary acquisition and adults’ question asking might support preschoolers’ metacognitive abilities.

Tables

Table 1: Object Representation Task.





Example Stimuli	Trial type	# of trials
	Study	1
	Identical test	6
See above	Study	1
See above	Identical test	3
	Catch	1
	Transfer test	3
See above	Study	1
See above	Transfer test	3
See above	Catch	1
See above	Transfer test	3
See above	Study	1
See above	Transfer test	3
See above	Catch	1

Table 2: Means and standard deviations of study measures.

Variable	Lexical Awareness	Distractor Question	No Question
Age	48.44 (7.47)	45.42 (10.60)	48.69 (7.18)
Word ID	3.36 (2.00)	2.45 (1.67)	2.44 (1.36)
LA	7.80 (3.33)	8.41 (3.45)	6.72 (3.65)
TELD-3	27.09 (3.94)	26.13 (4.17)	26.03 (4.53)
Digit	6.24 (1.51)	5.90 (1.68)	6.00 (1.26)
Object Rep	13.25 (3.83)	13.15 (3.88)	11.96 (4.43)
OR-Easy	5.52 (1.71)	5.67 (1.69)	5.09 (2.14)
OR-Hard	7.73 (2.25)	7.48 (2.46)	6.86 (3.65)

Table 3: Regression predicting word learning.

Predictors	B	SE B	β
Age	-.01	.02	-.07
Condition	.97	.37	.26*
Digit-span	.28	.13	.25*
TELD-3	.02	.05	.04
Lexical Awareness	.05	.06	.87
Object Representation	.11	.06	.06^

^ = $p < .1$. * = $p < .05$.

Figures



Figure 1: Example test trial from electronic picture book.

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