The Relationship between Phonological Working Memory, Phonological Sensitivity, and Incidental Word Learning

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Vijayachandra Ramachandra, Ph.D
Marywood University

Lynne E. Hewitt, Ph.D
Tim Brackenbury, Ph.D
Bowling Green State University

Abstract

Although young children are able to rapidly acquire new words incidentally, the mechanisms underlying this skill are unknown. The Phonological Loop Model (Baddeley and colleagues) and the Lexical Restructuring Model (Metsala, 1999) are two proposals that implicate different cognitive/phonological skills in incidental word learning. To test these models, the roles of phonological working memory and phonological sensitivity on novel word learning were investigated.

Tasks related to phonological working memory (nonword repetition), phonological sensitivity (rhyming and phoneme alliteration), and incidental word learning (an illustrated story that included pre-recorded novel words) were administered to forty 4-year-olds. A multiple regression analysis revealed that phonological sensitivity scores did not contribute significantly to incidental word learning. Phonological sensitivity scores, on the other hand, were significant predictors of incidental word learning. These findings provide support for the Lexical Restructuring Model, in which phonological knowledge plays a more important role than phonological memory in lexical acquisition.

Incidental Word Learning

The acquisition of new words, based on minimal exposures and no direct teaching. The initial mapping made between a spoken form and a referent.

Generally accepted as how children learn most new words, although the mechanisms for doing so have not been clearly specified.

We explored the influences of phonological memory and knowledge on incidental word learning.

The Phonological Loop Model (PLM)

Working memory is a multi-component system that consists of the central executive, the visuo-spatial sketchpad, and the phonological loop.

The ability to store and analyze spoken forms for the short term occurs in the phonological loop and is typically measured via nonword repetition tasks.

Prediction on word learning:

Phonological working memory (i.e., nonword repetition) is an important contributor to vocabulary development, over and above other aspects of phonological knowledge.

Support for PLM

In 5-year-olds and younger:

- Nonword Repetition correlated with vocabulary size and predicted subsequent vocabulary development.
  - (Gathercole et al., 1992)
- In both adults and children:
  - Nonword Repetition correlated with controlled word learning tasks.
  - (Gathercole & Baddeley, 1990a)

Evidence Contradicting PLM

In children older than 5 years:

- Nonword Repetition was not a significant predictor of future vocabulary.
- Vocabulary was a significant predictor of NWR.
  - (Gathercole et al., 1992)

The Lexical Restructuring Model (LRM)

Vocabulary development leads to reorganization of the mental lexicon from holistic to a more segmental representation (Metsala, 1999).

Support for LRM

When Age and IQ were controlled:

- Both Nonword Repetition and Phonological Sensitivity were significant predictors of vocabulary.
  - (Metsala, 1999; Bowey, 2001)

Evidence Contradicting LRM

When IQ and Nonword Repetition were correlated:

- Phonological Sensitivity was a significant predictor of vocabulary.
  - (Metsala, 1999; Bowey, 2001)

When IQ and Phonological Sensitivity were correlated:

- Nonword Repetition was not a significant predictor of vocabulary.
  - (Metsala, 1999; Bowey, 2001)

Nonword Repetition is not as strong as Phonological Sensitivity in predicting vocabulary.
  - (Metsala, 1999; Bowey, 2001)

Research Questions

1. Does Phonological Working Memory alone have any unique contribution in predicting performance on Incidental Word Learning?
2. Does performance on Phonological Sensitivity alone have any unique contribution in predicting performance on Incidental Word Learning?
3. Does a measure of performance on both nonword repetition and phonological sensitivity tasks contribute significantly and independently to an incidental word learning task?

Methods

Participants:

40 typically developing 4-year-old children, all passed hearing and language screenings.

Procedures:

I. Phonological Working Memory

- Nonword repetition task

II. Phonological Sensitivity

- Alliteration and Rhyming Tasks
  - (Burt, Holm, & Dodd, 1999)

III. Incidental Word Learning

- Novel words embedded into two illustrated stories that were played on a laptop computer.
  - Followed by a test for comprehension of the novel words.
  - (modified from Brackenbury and Fey, 2003)

Summary of Findings

Nonword Repetition did not emerge as a significant predictor of Incidental Word Learning.

Both Rhyming and Alliteration tasks were significant predictors of Incidental Word Learning.

Discussion

Results of this study support a view of word learning as a complex process requiring a range of cognitive abilities and attainments.

Nonword repetition is a fairly complex task that shares certain linguistic and cognitive processes with word learning. Yet it appears not to be sufficient to assess the type of phonological knowledge needed to succeed at incidental word learning.

Phonological Sensitivity tasks entail some abilities similar to Nonword Repetition. They also require other skills and knowledge, including metacognitive processing, and thus entail both processing and memory aspects.

The findings of the current study accord with recent work on the role of receptive phonological knowledge in language development (Hunston, Edwards, & Beckman, 2005), and supports a model of lexical acquisition in which phonological knowledge plays an important role.
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References


Contact Information
Vijayachandra Ramachandra
Marywood University
Dept. of Communication Sciences & Disorders
2300, Adams Avenue,
Scranton, PA-18509
vijay.chandra2002@gmail.com