Dynamic assessment and word learning

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Abstract

Past studies indicate that standardized vocabulary tests may be insensitive to language impairments and may be culturally biased. Dynamic assessment may be used as an alternative or supplementary approach to measure a child's ability to learn words. Factors that may need to be manipulated in dynamic assessment include phonotactic probability (i.e., frequency of sound sequences) and neighborhood density (phonological similarity) because past research suggests that children with typical development learn common-dense sound sequences more readily than rare-sparse. Incorporating these factors into dynamic assessment is illustrated.

Biographical information

Junko Maekawa is a doctoral student interested in cross-linguistic word learning.

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INTRODUCTION

Standardized Vocabulary Tests

Word learning has been reported to be one of the factors that differentiates children with language impairment from children with normal language (e.g., Dollaghan, 1987; Kiernan & Gray, 1998; Oetting, Rice, & Swank, 1995; Rice, Oetting, Marquis, Bode, & Pae, 1994). Standardized vocabulary tests have been widely used by clinicians and researchers to assess children's word learning ability. Such traditional vocabulary tests are heavily used for several reasons. First, standardized vocabulary tests are usually easy and quick to administer. Second, standardized vocabulary tests use a wide range of normative data (e.g., ages between 2;6 and 90;11 for Peabody Picture Vocabulary Test-III, Dunn & Dunn, 1997). The normative data provide clinicians and researchers with information about children's vocabulary knowledge as compared to their peers, which is critical in justifying treatment services.

In spite of these positive aspects of standardized vocabulary tests, past studies have provided evidence of shortcomings. Specifically, standardized vocabulary tests may not be sensitive enough to identify children with language impairment. For example, Gray, Plante, Vance, and Henrichsen (1999) showed that four standardized vocabulary tests did not capture differences between children with language impairment and children with normal language. Another problem with standardized vocabulary tests is that they may be culturally and linguistically biased for two reasons. First, the construct of standardized vocabulary tests may not be adequate for children from culturally and linguistically diverse backgrounds. For example, Pen®a and Quinn (1997) observed that familiarity with test tasks affected task performance by

Puerto Rican and African American children. Specifically, these children performed better on a description task than on a one-word labeling task. Pen®a and Quinn propose that different styles of parent-child interaction may affect familiarity with test tasks for these children. Another issue relates to the test items that are potentially biased. Specifically, culturally and linguistically diverse children may not be familiar with some of the pictures or words that are on the tests, and thus respond incorrectly due to experiential difference rather than word learning difficulty.

Static versus Dynamic Assessment

Learning can be measured on the basis of its products or process. Products of learning refer to what an individual knows at the point of testing, and are often compared to the scores of other individuals in the same group (e.g., age group). On the other hand, process of learning refers to how an individual learns, allowing clinicians and researchers to predict quantity and quality of learning potential for each individual.

It has been pointed out that standardized vocabulary tests, which represent a *static* type of assessment, examine the products, but not the process of learning (Dollaghan & Campbell, 1998; Olswang, Bain, Rosendahl, Oblak, & Smith, 1986). Static assessments may not tap how the child learns new information over a period of time. Therefore, static assessments do not provide information about what type of treatment may improve learning (Olswang et al., 1986). To address these issues, *dynamic* assessment has been proposed as an alternative approach for language assessment. Dynamic assessment evaluates a child’s learning potential by comparing the child’s performance with versus without support. Because dynamic assessment focuses on performance comparison within a child, it captures individual differences in learning patterns that are evident in lexical acquisition (e.g., Maekawa & Storkel, in press). Dynamic assessment is theoretically grounded in the zone of proximal development (Vygotsky, 1978) defined as “the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers” (1978, p. 86). This notion applies to language assessment in a *test-teach-retest* paradigm. In this paradigm, a child’s learning potential is measured by the amount and/or quality of teaching required for improvement of performance (see Schneider & Watkins, 1996, for a review). Specifically, a child’s modifiability for certain aspects of language can be measured by the levels of adults’ cuing and instructions during a teaching phase. The information obtained from dynamic assessment helps clinicians to determine who needs treatment, as well as the type of cues, strategies, or instructions that may be helpful during treatment.

Dynamic Assessment and Word Learning

Pen®a, Iglesias, and Lidz (2001) examined the relationship between dynamic assessment and word learning by culturally and linguistically diverse children. Dynamic measures more accurately classified children as language delayed versus those with typical development than static measures. The results suggest that dynamic assessment may more effectively assess language ability of culturally and linguistically diverse children.

Olswang et al. (1986) compared two children with delayed language development for their modifiability of production of new words as a function of the amount of adult cuing. Although the two children looked similar in their performance on the static measure, they performed differently during the dynamic assessment and during treatment. Specifically, the child who was more responsive to cues during dynamic assessment learned the target words more rapidly during treatment than the child who was less responsive to cues in the dynamic assessment. Thus, dynamic assessment may predict treatment outcome.

PLANNING DYNAMIC ASSESSMENT IN WORD LEARNING

Factors Manipulated in Dynamic Assessment

What should we consider in planning dynamic assessment in word learning? Several factors can be manipulated to examine a child's responsiveness and learning potential. Those factors include the cues given by the adult (e.g., one-word elicitation vs. modeling), the type of child-adult interaction (e.g., child-directed vs. adult-directed), and the characteristics of the words used during the assessment. This paper will focus on two stimuli characteristics that can be used for dynamic assessment of word learning: phonotactic probability and neighborhood density.

Phonotactic Probability

Phonotactic probability refers to the frequency of individual sounds and sound combinations in a language. For example, in English, "coat" (/κoYτ/) is an example of a word with a common sound sequence, and "watch" (/ωAτΣ/) is an example of a word with a rare sound sequence. Previous studies have shown that phonotactic probability influences lexical acquisition by young children. Specifically, children from 3 to 13 years of age learn words with common sound sequences more rapidly than words with rare sound sequences (e.g., Storkel, 2001; Storkel & Rogers, 2000).

Neighborhood Density

Neighborhood density refers to the number of words that are phonetically similar to a target word. These words, referred to as neighbors, include words that differ from the target word by a one phoneme substitution, deletion, or addition (Luce & Pisoni, 1998). For example, the English word “sit” (/σIτ/) resides in a dense neighborhood with 36 neighbors such as “pit” (/πIτ/), “sip” (/σIπ/), “seat” (/σιτ/), “sea” (/σι/) and “it” (/Iτ/). The word “these” (/Διζ/) resides in a sparse neighborhood with only 9 neighbors such as “ease” (/ιζ/), “tease” (/τιζ/) and “cheese” (/τΣιζ/). Past studies have shown that neighborhood density influences how children learn new words. Specifically, Storkel (2004a) showed that infants and toddlers (ages from 8 to 30 months) learned dense words at earlier ages than sparse words.

Correlation between Phonotactic Probability and Neighborhood Density

Phonotactic probability and neighborhood density are correlated (Storkel, 2004c; Vitevitch, Luce, Pisoni, & Auer, 1999). That is, words from dense neighborhoods are likely to contain common sound sequences, and words from sparse neighborhoods tend to contain rare sound sequences. Past studies have not differentiated these two variables. Thus, young children learn words with common sound sequences from dense neighborhoods (common-dense words) more rapidly than words with rare sound sequences from sparse neighborhoods (rare-sparse words; Storkel, 2001, 2004b; Storkel & Rogers, 2000). However, children with phonological delays show an opposite pattern, learning rare-sparse words more rapidly than common-dense words (Storkel, 2004b). This suggests that children who have difficulty in processing phonological information may differ in the types of words they learn.

Application to Dynamic Assessment

Phonotactic probability and neighborhood density can be incorporated into dynamic assessment in word learning to determine the types of words children learn easily. Based on previous studies, children with typical development should acquire common-dense words more rapidly than rare-sparse words. Failure to show a common-dense advantage may indicate processing difficulty, as shown in Storkel (2004b).

Nonwords varying in phonotactic probability and neighborhood density of a word can be selected using calculators available on the internet (e.g., http://www.people.ku.edu/%7Emvitevit/PhonoProbHome.html for phonotactic probability, http://128.252.27.56/neighborhood/Home.asp for neighborhood density) or referring to lists of nonwords available in past studies (e.g., Jusczyk, Luce, & Charles-Luce, 1994; Storkel, 2001; Storkel & Rogers, 2000). In addition, nonwords should be composed of sounds within the child's production capabilities because previous research shows that production influences word learning (Schwartz & Leonard, 1982; Storkel, 2004b). Each of the selected nonwords is then paired with a novel object. Novel objects can be selected from past studies (e.g., Kroll & Potter, 1984) or visual dictionaries (e.g., *Macmillan Dictionary for Children*, 2001) or adapted from children's stories (e.g., Dr. Seuss; Mercer Mayer).

During the learning phase, the selected nonwords and novel objects are presented through a story paradigm (see Storkel & Morrisette, 2002) or a school-like lecture (see Storkel & Rogers, 2000). In some cases, it may be helpful to vary the number of exposures across story episodes or lecture units by providing a set number of exposures, testing, learning, and then repeating the process. Differential exposure can be used to examine whether a child is responsive to minimal exposure or requires many repetitions to learn. This also could be helpful in identifying children with specific language impairment, who tend to require three times as many exposures to learn new words as children with typical language development (Rice et al., 1994).

A picture-naming task can be used to measure learning of the target nonwords. For this task, children are shown one of the novel objects, and instructed to produce its corresponding name. The picture-naming task taps the ability to form a representation of the word-form and link it to the representation of its meaning or referent. Proportion of correct responses for each word type (i.e., common-dense vs. rare-sparse) at each exposure phase can be calculated and compared. The results are examined to determine which type of nonwords is learned more readily and the approximate number of exposures required to learn each type.

In the process outlined above, one may incorporate the use of different teaching methods during the second (or later) exposure phase to examine whether any specific teaching method facilitates learning of the words and whether this varies by word type. For example, certain phonological and/or semantic cues may facilitate learning of common-dense words but not rare-sparse words. In addition, the effectiveness of different teaching methods may differ across children. Therefore, the teaching phase provides clinicians with ideas regarding which treatment methods may be used for each child for each type of word.

SUMMARY

In this paper, dynamic assessment was introduced as an alternative measure of word learning because standardized vocabulary tests may be an insensitive and culturally biased measure. Incorporation of two stimuli characteristics, phonotactic probability and neighborhood density, into a dynamic assessment was illustrated. Use of dynamic assessment manipulating these characteristics may help clinicians create more precise treatment plans because specific treatment methods will be identified for different types of words.

References

Dollaghan, C. (1987). Fast mapping in normal and language-impaired children. *Journal of speech and hearing disorders, 52*, 218-222.

Dollaghan, C., & Campbell, T. F. (1998). Nonword repetition and child language impairment. *Journal of Speech, Language, and Hearing Research, 41*, 1136-1146.

Dunn, L. M., & Dunn, L. M. (1997). Peabody Picture Vocabulary Test-3rd Edition. Circle Pine, MN: American Guidance Service.

Gray, S., Plante, E., Vance, R., & Henrichsen, M. (1999). The diagnostic accuracy of four vocabulary tests administered to pre-school age children. *Language, Speech, and Hearing Services in Schools, 30*, 196-206.

Jusczyk, P. W., Luce, P. A., & Charles-Luce, J. (1994). Infant's sensitivity to phonotactic patterns in the native language. *Journal of Memory and Language, 33*, 630-645.

Kiernan, B., & Gray, S. (1998). Word learning in a supported learning context by preschool children with SLI. *Journal of Speech, Language, and Hearing Research, 41*, 161-171.

Kroll, J. F., & Potter, M. C. (1984). Recognizing words, pictures, and concepts: A comparison of lexical, object, and reality decisions. *Journal of Verbal Learning and Verbal Behavior*, 39-66.

Luce, P. A., & Pisoni, D. B. (1998). Recognizing spoken words: the neighborhood activation model. *Ear & Hearing, 19*, 1-36.

Macmillan Dictionary for Children. (4th ed.). (2001). NY: Simon & Schuster Children's Publishing.

Maekawa, J., & Storkel, H. L. (in press). Individual differences in the influence of phonological characteristics on expressive vocabulary development by young children. *Journal of Child Language*.

Oetting, J. B., Rice, M. L., & Swank, L. K. (1995). Quick incidental learning (QUIL) of words by schoo-age children with and without SLI. *Journal of Speech and Hearing Research, 38,* 434-445.

Olswang, L. B., Bain, B. A., Rosendahl, P. D., Oblak, S. B., & Smith, A. E. (1986). Language learning: Moving performance from a context-dependent to -independent state. *Child Language Teaching and Therapy, 2,* 180-210.

Pen®a, E., Iglesias, A., & Lidz, C. S. (2001). Reducing test bias through dynamic assessment of children's word learning ability. *American Journal of Speech-Language Pathology, 10*, 138-154.

Pen®a, E., & Quinn, R. (1997). Task familiarity: Effects on the test performance of Puerto Rican and African American children. *Language, Speech, and Hearing Services in Schools, 28*, 323-332.

Rice, M. L., Oetting, J. B., Marquis, J., Bode, J., & Pae, S. (1994). Frequency of input effects on word comprehension of children with specific language impairment. *Journal of Speech and Hearing Research, 37*, 106-122.

Schneider, P., & Watkins, R. V. (1996). Applying Vygotskian Development Theory to Language Intervention. *Language, Speech, and Hearing Services in Schools*, *27*, 157-170.

Schwartz, R. G., & Leonard, L. B. (1982). Do children pick and choose? An examination of phonological selection and avoidance in early lexical acquisition. *Journal of Child Language, 9*, 319-336.

Storkel, H. L. (2001). Learning new words: Phonotactic probability in language development. *Journal of Speech, Language, and Hearing Research, 44*, 1321-1337.

Storkel, H. L. (2004a). Do children acquire dense neighborhoods? An investigation of similarity neighborhoods in lexical acquisition. *Applied Psycholinguistics, 25*, 201-221.

Storkel, H. L. (2004b). The emerging lexicon of children with phonological delays: Phonotactic constraints and probability in acquisition. *Journal of Speech, Language, and Hearing Research, 47*, 1194 -1212.

Storkel, H. L. (2004c). Methods for minimizing the confounding effects of word length in the analysis of phonotactic probability and neighborhood density. *Journal of Speech Language and Hearing Research, 47*, 1454-1468.

Storkel, H. L., & Morrisette, M. L. (2002). The lexicon and phonology: Interactions in language acquisition. *Language, Speech, and Hearing Services in Schools, 33,* 24-37.

Storkel, H. L., & Rogers, M. A. (2000). The effect of probabilistic phonotactics on lexical acquisition. *Clinical Linguistics & Phonetics, 14*, 407-425.

Vitevitch, M. S., Luce, P. A., Pisoni, D. B., & Auer, E. T. (1999). Phonotactics, neighborhood activation, and lexical access for spoken words. *Brain and Language, 68*, 306-311.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.