

An informal model of vocabulary acquisition during assisted oral reading and some implications for computerized instruction

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1 Learning vocabulary

Vocabulary is critical to reading comprehension (Yap 1979). Intensive study of specific vocabulary words, such as a 1983 study which taught fourth graders 104 words over a five-month period (McKeown et al. 1983), results in solid knowledge of the taught words. However, such intensive study of about 100 words cannot approach the almost 3000 words per year that a good elementary school student learns (Carver 1994; for a dissenting view, see Zechmeister et al. 1995).

2 Learning vocabulary from assisted reading

Direct instruction is effective but time-consuming. What are alternate methods that are perhaps less effective but much quicker? Assisted reading may spur vocabulary growth, if children read material hard enough to contain 2 to 4 new words per 100 words of text (Carver 1994). Children can learn words from written contexts (Nagy et al. 1985, McKeown 1985, Gipe & Arnold 1978), but the process is incremental. Thus the effect of one exposure may be small, but the net effect is large (Eller et al. 1988).

Can kids be taught to learn words from context? Kuhn & Stahl (1998) suggest that practice helps, not teaching a specific strategy: "Ultimately, increasing the amount of reading that children do seems to be the most reliable approach to improving their knowledge of word meanings, with or without additional training in learning words from context." As Schwanenflugel et al. (1997) say, "... the vast majority of a person's word growth can be accounted for by exposure to words in written and oral contexts, not through direct instruction of some sort, but individual encounters with a word in a natural context are not likely to yield much useful information about that word."

Can the context in which a word appears be augmented to make it more useful for learning the word? Typical definitions may not suit the learner's needs (McKeown 1993). In fact, good example sentences may help students learn the meaning of verbs where definitions don't (Scott & Nagy 1997). Learner-friendly definitions work bet-

ter; presenting context-specific definitions in computer-mediated text can be helpful for vocabulary acquisition (Reinking & Rickman 1990.)

3 Learning vocabulary during computer-assisted oral reading

Project LISTEN's Reading Tutor uses automated speech recognition to listen to children read aloud, and helps them learn to read (Mostow & Aist CALICO 1999). The Reading Tutor shows the child a story one sentence at a time, listens to the child read all or part of the sentence at a time, and responds expressively using recorded human voices (Aist & Mostow CALL 1997). Children have used successive versions of the Reading Tutor in classrooms, public libraries, and reading clinics.

How many words a student learns from reading with the computer depends on how much reading they do: how many days a student has a session with the computer, and how many minutes are allocated per session. For present purposes we will treat as constant the number of days allocated per year and the number of minutes allocated per day. Students are nominally assigned to use the Reading Tutor for twenty minutes per day, every day that school is in session (approximately 180 days per year.)

We can describe how many words a student learns in a day as follows:

$$\text{New words learned per day} = \text{Stories read per day} \times \text{New words seen per story read} \times \text{New words learned per new words seen}$$

Assuming that the number of minutes per session is constant, several factors may affect the number of stories read per day. First, time spent logging in or picking stories will decrease the number of stories read. Second, fast readers will finish more stories than slower readers. Third, excessive system delays could decrease the number of stories read. Fourth, time off task (and thus not reading) could reduce the number of stories read. Finally, time spent in other educational activities, such as writing or answering comprehension questions, will decrease the number of stories finished.

What affects new words seen per story read? A previously read story will not have any new words. An easy story will have few new words; a hard story will have more.

What affects new words learned per word seen? First, a large prior vocabulary will help a student learn a new word (Shelfbine 1990). Second, a student who can switch from reading text for fluency to reading text to extract the meaning of a novel word will learn a new word better than a student who can't. Third, not all contexts are equal (Beck et al. 1983). Rich context helps more. Finally, a story that is too difficult will lead to frustration, not necessarily learning.

Most of the factors affecting the number of stories read per day are related to the student's abilities or attitude (reading rate, distractibility), have engineering solutions (rewrite code to reduce delays), or are the subject of entire industries (include interesting stories for children to read.) We therefore focused on two factors. First, students must encounter new words. We have modified the Reading Tutor to take turns picking stories, to increase the amount of new material kids read. Second, kids must learn the meaning of new words when they encounter them. We are exploring ways

of augmenting text -- with good hand-written definitions, synonyms, or otherwise -- to help kids make the most of encounters with new words in the Reading Tutor.

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