Helping children learn vocabulary during computer assisted oral reading

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Help children learn vocabulary by reading

Vocabulary is fundamental to reading. As elementary students cross over from learning to read into reading to learn, vocabulary knowledge becomes increasingly important. The massive amount of vocabulary a student must learn precludes large amounts of time spent on any single word (Carver 1994, Schwanenflugel et al. 1997), except perhaps for some words that the student will read and write many times over the course of a lifetime. Therefore students must learn vocabulary from text.

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Project LISTEN's Reading Tutor listens 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 out loud, and responds with help in recorded human voices. When the Reading Tutor has heard the student read every content word, the Reading Tutor shows the next sentence. Besides reading, the student may click *Go* to see the next sentence, *Back* to move back, on a word or on *Help* to hear the word read by the Tutor or get other help, or *Goodbye* to log out.

To learn new words from interacting with the Reading Tutor, a student must:

- spend time reading,
- read new material hard enough to have new words, and
- learn the meaning of new words when encountered.

We excluded the first factor -- time on task -- as outside the scope of this thesis. We addressed the second factor by modifying the Reading Tutor to take turns picking stories with students, to expose students to more new material than they would have read if they picked all the stories themselves. We addressed the third factor by designing, implementing, and evaluating ways to augment stories with extra help -- such as synonyms or glossary definitions -- to make the most of encounters with novel words.

How to get kids to read more new material? Take turns picking stories

Prior to the 1999-2000 version, the Reading Tutor let the child choose any story he or she wanted, although it did try to guide the student to a story of appropriate difficulty.

In a four-month study in Spring 1998, children were reading new material as little as 40% of the time. Reports from teachers and other observations indicated that some kids tended to just re-read familiar stories rather than choose new material. We wanted to revise the story choice policy to not ensure that every student read new material.

We made the Reading Tutor take turns picking stories:

1. Every day, decide randomly whether the student or the Reading Tutor will pick the first story.
2. After the first story of the day, take turns picking stories.

Informal usability and acceptance testing at an urban elementary school and at CHIkids 1999 confirmed that kids would tolerate taking turns with the Reading Tutor. We included the new turn-taking story choice policy in the Fall 1999 Reading Tutor, deployed at two elementary schools. We measured new material read as percent of novel sentences encountered out of all sentences encountered. Analysis of variance and post-hoc testing (SPSS 1999; used here and throughout this paper) revealed that the Fall 1999 kids with the mixed-choice Reading Tutor read about 7% more new material than the Spring 1998 kids with the student-choice Reading Tutor (rate of new material normally distributed; $F=4.67$, $p=.033$; 65.7% vs. 58.5% new material by estimated marginal means).

How to help kids learn new words? Augment stories with extra vocabulary help

Next we present an experiment to test if augmenting text with information about words would help children learn the meanings of those words better than they would have from the text alone. We modified the Reading Tutor to augment some words in stories the child was reading with synonyms (X means Y), antonyms (X is the opposite of Y) or hypernyms (X is a kind of Y). For a given child, some of the words were augmented and others were left augmented to serve as a control group. The next time the child logged in (typically the next day) the computer presented multiple-choice vocabulary probes. Sometimes, the expected answer in the multiple-choice question was the same as the comparison word shown the previous day, and sometimes the expected answer was a different word.

We analyzed the results for three groups of words encountered during fall 1999: all of the words, the subset of words with only one sense in WordNet (Fellbaum 1998), and a set of words which would allow detection of a non-lexical effect (giving the help "X means Y" and then asking a multiple-choice question with expected answer Z). We built a loglinear model for each subset, using FACTOID (whether a word received help or not), ID (student), ANSWER (right or wrong), and FACTOID*ANSWER (to test for effect of factoid on answer). No significant effects of FACTOID on ANSWER were found. Why?

Help not helpful. Perhaps the factoids were not informative enough.

Questions too hard. Some of the automatically constructed questions were hard even for adults to answer.

Questions confusing. The questions contained answers that were taken from different senses of the target word, archaic vocabulary, and rare meanings.

Kids may have ignored the help or the question. The existence of some poor help or poor questions may have led some students to ignore ALL of the vocabulary assistance.

Target words were too easy. Perhaps students already knew the words that the Reading Tutor was giving them help on. We identified a set of words that were rare and thus more likely to be unknown to the students before the experiment began. We chose as the "rare" criterion any word that occurred 15 times or less in the Brown corpus (Kucera and Francis 1967), using the MRC psycholinguistic database available at
http://www.psy.uwa.edu.au/MRCDataBase/uwa_mrc.htm.
For these rare words:

1. All words: N=1753, FACTOID*ANSWER=0.19 +/- 0.10 (significant at 90%)
2. Single-sense words: N=319, FACTOID*ANSWER=0.30 +/- 0.23 (not significant)
3. Non-lexical effect: N=894, FACTOID*ANSWER=-0.04 +/- 0.15 (not significant)

These results should of course be considered suggestive, due to the relatively low (90%) level of confidence. However, an overall picture is emerging for when automatically generated factoids may help kids learn vocabulary: Give help on words with a single sense that are rare enough that they are likely to be new to the student.

Conclusion

We have described progress towards increasing children's encounters with novel words, and also towards increasing children's learning from encounters with new words. What remains?

During 1999-2000, a separate study is comparing children's learning with human tutors to children's learning with the Reading Tutor. We expect the human-tutored children to do better than the computer-tutored children. Since the human tutors and the computer tutor are using the same stories, we can analyze the human tutors' story choice patterns for ways to improve the Reading Tutor's story choices.

Besides synonyms, what else may help kids learn words from context? Having kids write definitions for words may encourage them to think deeply about the meaning of words, at a large additional cost in time for younger students. Human-written glossary definitions may also help, for both single-sense words and for words with more than one sense. We can test whether human-written and narrated glossary definitions help kids learn words better than just reading a story alone.

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