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ABSTRACT

A study examined how students use their prior knowledge and experience to help them understand a text, and how that influences what they recall from the text. Subjects, 46 sixth graders from 3 elementary schools in Nashville, Tennessee, were tape recorded as they thought aloud while reading either a passage on "sugar" or a passage on "fat." Passages were of similar length and were at grade 5 level of reading difficulty. Subjects also dictated their recall of the passage. Results indicated that the majority of the children's think-aloud comments were some kind of attempt to explain or elaborate on the text, with the largest category being bringing in information from prior knowledge or experience to help understand the text. Results also indicated that: (1) the amount of information recalled from texts was very low; (2) more students included in their recalls information from sentenced adults rated as important in the text; and (3) no statistically significant correlations existed between amount recalled and reading percentile score on the subjects' Tennessee achievement test reading comprehension scores. Two case studies illustrate the relationship between what the children were doing as they read and what their recall reports were like. Individual differences evident in think-aloud protocols led to the conclusion that memory measures such as the recall report do not adequately capture the richness and depth of children's understanding of text. (A figure and a table of data are included; the think-aloud protocols and recall reports of the two case study subjects are attached.) (RS)

CHILDREN'S USE OF PRIOR KNOWLEDGE AND EXPERIENCE IN UNDERSTANDING INFORMATIONAL TEXT ON NUTRITION

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Background and Questions

In the past decade, think-aloud or verbal protocol methods have given researchers a valuable window into the thoughts and actions of adult readers as they read. Information from such methods add to the store of information on reading that researchers have gained from looking at readers' performance on other process measures such as reading time and eye movements as well as outcome measures such as recall. Recently, researchers using think-aloud methods have revealed that adults who explain and elaborate what they are reading to themselves and who have a flexible approach to solving comprehension problems remember text better and learn how to solve problems better than those who don't (e.g., Chi et al., 1989, 1994; Goldman et al., 1990, 1994; Grasser et al., 1994; Trabasso & Magliano, 1994).

Over the past few years, we in Susan Goldman's lab at Vanderbilt have been extending these findings to children. Along with other researchers and educators, we've come to realize how important it is for students to construct meaningful representations of information provided by text, by integrating what they are reading with what they already know. However, there are individual differences in whether children construct such representations and in how they go about understanding written information.

The studies reported in this paper represent ongoing work on understanding

what children and adults do to make sense of text. The questions addressed here are:

- What do students do to make sense of text? More specifically, how do they use their prior knowledge and experience to help them understand?
- How does what they do influence what they recall?

Method

Subjects. The data presented here are a subset from two studies in which a total of 46 sixth graders from three elementary schools in Nashville participated. There was a wide range of reading comprehension ability in this sample, as measured by Tennessee's standardized achievement test (the TCAP).

Materials. Two passages about nutrition were constructed, one on 'Fat' and one on 'Sugar', about 28 sentences long and similar in structure. They were at Grade 5 level of reading difficulty. The texts were presented on a computer screen using Select the Text, an application that allows students to access one sentence at a time in any order they wish and at their own pace.

Procedure. Students were trained to think aloud as they read. Neutral prompts were used if a student fell silent. Instructions emphasized talking about how they were understanding the passage, what it made them think about, and what was hard or easy to understand. Think-aloud comments were recorded on tape.

Outcome Measure. Students were instructed to read the text as if they would have to make a report on it to their classmates. After reading the text, students dictated their recall report to the experimenter.

Results

What do students do to make sense of text?

To answer the first question, we transcribed the think-aloud protocols and divided them into comments. Comments were coded as:

1. Self-explanation/elaboration
    a. Rephrase in own words, usually using general knowledge
    b. Connect to prior text information
    c. Connect to prior knowledge
    d. Reinstate prior knowledge
    e. Critique text organization
2. Extraneous association to prior knowledge
3. Paraphrase
4. Prediction
5. Monitoring

Refer to the attached graph for the distribution of think-aloud comments across the various categories for subjects reading the 'Sugar' text. The distribution was very similar for the 'Fat' text. The majority of the children's think-aloud comments were some kind of attempt to explain or elaborate on the text; these categories add up to 66% of the think-aloud comments. Of these, the largest category was bringing in information from prior knowledge or experience to help understand the text. After that came making connections across segments of the text and reinstating connections to prior knowledge that had been brought in earlier. A

few children also made editorial type comments on the style or organization of the passage.

Not quite 20% of the comments were monitoring comments. Paraphrasing made up not quite 10% and extraneous associations and predictions of what might be coming up were relatively infrequent.

These data illustrate that the children were engaging in a variety of activities and drawing on a number of sources of information to make sense of these texts.

Recall performance

The children's recall reports were scored for how many of the text sentences were included at the gist level. The criteria were relatively lenient, but the amount of information from the texts that the children included in their recalls was still very low. On average, they included the gist of 30% of the sentences in the 'Sugar' text and 26% of the 'Fat' text.

A comparison between how many of the children recalled each sentence and the importance of each sentence as rated by a group of adult subjects showed that more students included in their reports information from sentences that were rated as important in the text. The correlation was in the right direction for both texts, although it was statistically significant only for the 'Fat' passage.

We also considered whether the children's Tennessee achievement test reading comprehension score predicted how much they remembered. It didn't - for both texts the correlations between amount recalled and reading percentile score were close to zero. There was also no significant relationship between their

standardized reading score and how much elaborating and self-explaining they did while reading. The low correlations were not a surprise. They affirmed that the processes we consider important for learning from text are not necessarily tapped by such standardized tests.

What was the relationship between the representation children were constructing as they read and what they put in their reports?

The best way to illustrate the relationship between what the children were doing as they read and what their recall reports were like is with example cases. In Case 1 (see attached), a sixth grader was reading the 'Sugar' text, which starts out talking about how sugar is important because it provides energy, then it starts talking about natural and processed sugar, and finally it discusses three ways in which eating too much processed sugar can be harmful. This student spent a lot of effort over several sentences trying to understand what the two types of sugar are that the text refers to. Almost all of this student's protocol comments (98%) were attempts to explain the text content.

This student had a very good recall report. He remembered over half of the text and had a relatively well-organized report. The protocol excerpt shows his struggle with the difference between two types of sugar, his attempt to reconcile the text content with what he knows about sugar, and his conclusion that there must be carbohydrate sugar and processed sugar. This is inaccurate; the text was referring to natural and processed sugar. This aspect of the representation that he constructed shows up clearly in his report.

The student in Case 2 (see attached) also read 'Sugar' and made many elaborative comments. However, in this case, the self-explaining and elaboration did not contribute to a coherent understanding. This is reflected in the poorly-organized and impoverished recall report.

Conclusion and Summary

Most children are not passive; they actively draw on their knowledge in a variety of ways to help them understand informational text. They did a lot of self-explanation and elaboration, which often contributed to a coherent representation of the text's meaning, but not always. For some children, the connections that they made with their knowledge and experience took them further away from a coherent reppresentation of the text. In addition to integration with prior knowledge, other activities such as cross-text integration and prediction contributed to the contruction of a coherent understanding of the whole text.

Although the children's recall reports were not extensive, they did tend to include only the most important text information. In light of the range of individual differences evident in the think-aloud protocols, we concluded that memory measures such as the recall report do not adequately capture the richness and depth of children's understanding of text. In future research, we plan to use outcome measures that more accurately reflect not just what the children remember from informational texts but rather what they understand and learn from them.

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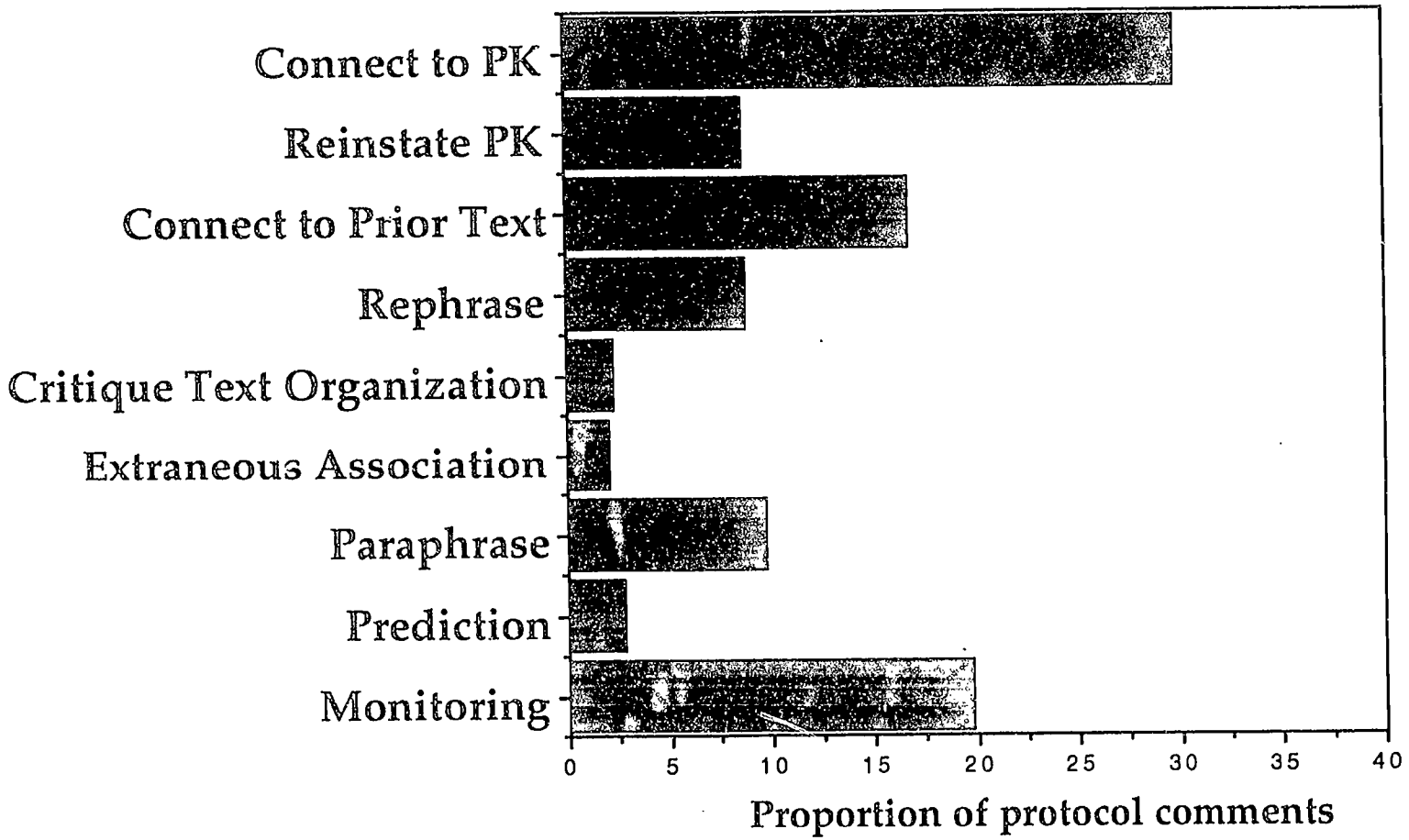
What do children do to make sense of 'Sugar' text?



Recall Reports

- On average, recall was low.

Text:	Fat	Sugar
%of text recalled:	26%	30%

- Reports included more important sentences from text.

Text:	Fat	Sugar
correlation recall/ importance:	.69	.28

- Amount recalled was not related to reading ability (correlations near zero)

Case 1: Think-aloud Protocol

[Sentence] and student's comment

4 [There are many natural sources of sugar in the foods we eat]. What foods...is sugar in all foods or just some foods? [sec#]

5 [Apples, carrots and raisins all have a lot of sugar in them]. So, sometimes people say that sugar is bad for them, but since they say apples, carrots and raisins are good for them, so, sugar must be good for them...but not a lot. [sek]

6 [Many foods have another kind of sugar in them called processed sugar]. So it's a different kind of sugar than you would make cookies with. It's probably a different kind of sugar. [sek]

7 [Some foods, like Frosted Flakes and Cocoa Puffs, have processed sugar added to them]. Ummm...what's the difference between processed sugar and the other kind of sugar? [set]

Case 1: Think-aloud Protocol (cont'd)

[Sentence] and student's comment

8 [Soft drinks and cookies also have a lot of processed sugar in them]. **Are there some drinks and cookies that don't have processed sugar in them, that have the other kind of sugar? And does diet cokes and stuff just have the regular processed sugar in it? When they say Nutrasweet ... is that what the other kind of sugar is?** [sekt]

...

11 [We also get energy from other kinds of carbohydrates such as those found in pasta, bread and potatoes]. **Is that what they put in...is that the kind of sugar...not the processed sugar, but the other kind of sugar? Like, where do they get carbohydrates sugar? Where is it found at?**

12 It takes us longer to feel the energy from these foods, but it lasts longer than the energy we get from sugar. **How long does it last for when you eat the other food? When you eat the carbohydrates? ... How longer does it last than the other sugar...from processed sugar?**

Case 1: Recall Report

There's two different kinds of sugar. One is carbohydrate sugar and another is processed sugar. Processed sugar is bad for you. Carbohydrates is not. Sugar can cause diseases like heart disease, diabetes, and I can't remember the other one. It can cause tooth decay, plaque, and cavities. And when processed sugar gets to your teeth it can soften them. And that will be able the sugar to get into the tooth and cause a cavity. And you cannot fix that yourself you will have to go to a dentist. And you can get overweight by eating too much processed sugar. Sugar only provides energy. And if you get too much energy the energy will store in extra fat and cause you to be overweight. Carbohydrates sugar and starch are both good for you. And processed sugar is not. Processed sugar is in cereals like Frosted Flakes, Cocoa Puffs, and Froot Loops. Carbohydrates sugar is in foods like pasta, spaghetti, and lasagna. Carbohydrates doesn't give you as much energy as processed sugar.

Case 2: Think-aloud Protocol

[Sentence] and student's comment

4 [There are many natural sources of sugar in the foods we eat]. **Like oranges and candy bars and all that.**

5 [Apples, carrots and raisins all have a lot of sugar in them]. **Yeah, because they probably wouldn't be any good without the sugar in them.**

6 [Many foods have another kind of processed sugar in them called processed sugar]. **It means that different kinds of foods have different kinds of sugars.**

7 [Some foods, like Frosted Flakes and Cocoa Puffs, have processed sugar added to them]. **Yeah, so that most kids probably would like them.**

Case 2: Think-aloud Protocol (cont'd)

[Sentence] and student's comment

8 Soft drinks and cookies also have a lot of processed sugar in them. **Yeah, because they wouldn't be any good without the sugars and stuff like that in them.**

...

11 We also get energy from other kinds of carbohydrates such as those found in pasta, bread and potatoes. **Yes, because it'll be good for us.**

Case 2: Recall Report

Too much sugar can harm your teeth. It can give you a disease such as diabetes, high blood pressure, too much sugar can harm your body. Different kinds of foods have processed sugars in them. Sugar has lots of acid in it. There are sugars in bread, oranges, candy bars, and many other things. Sugar has carbohydrates., I think. All sugars are good and bad. If you eat too much sugars, they might harm you.