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Investigating Inferences: Constructing Meaning From Expository Texts

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Generating inferences during and after reading is a complex task; yet, one that is essential for complete understanding of texts. This report highlights the types of inferences four students in grades 2-5 drew while constructing meaning from expository passages. An analysis of their think alouds and recommendations for comprehension instruction are included.

IMAGINE THAT YOU ARE CONFERENCING with students who are reading a text about mountain gorillas. The third paragraph in the text begins, "Mountain gorillas live in groups" (Thompson, 1998, p. 4). At this point, you stop and ask each student to tell what s/he is thinking about while reading this sentence. Since you are conducting individual conferences, none of the children hears what the others are saying. Here are the students' responses:

George responds: "That's kind of making me think about whales because whales always are in groups called pods."

Lee reflects: "Now I'm thinking how many are in a group?"

Michelle answers: "So there's like the black group of the—a black group, a brown, a white, a tan."

Keith states: "All the mountain gorillas live together."

What do these responses reveal about how the students interact with texts to construct meaning? George went well beyond the author's words and combined information from his own knowledge base with information in the text to make text-to-world connections. Lee posed a question. Michelle listed the types of gorillas there could be, although the book gave no indication that these exist. Keith's responded with words that were close to the words used by the author. He maintained the author's original meaning. Yet, George, Lee and Michelle went beyond the author's intended meaning. They put pieces together to create a richer understanding of the text. When readers supply implicit information, they generate inferences.

Inferences occur, according to Van Den Broek, Fletcher and Risen (1993) "when the reader activates information that is evoked by, yet goes beyond, the information that is provided explicitly in the text" (p. 170). Put in a slightly different way, Devine (1987), quoting a middle school teacher, described inferences as, "things the writer didn't say but which we know are probably true" (p. 116). Notably, Keene and Zimmermann (1997) added another dimension to this understanding. They noted that the inferences readers make are "circumscribed" by the

reader's background knowledge and the words the author uses. They remind us that the words carry with them "constraints," which limit the range of possible/plausible responses to any one piece of writing. In sum, readers make inferences by blending their background knowledge and experience with information from the text. They must "read between the lines" and go beyond the literal meaning. Furthermore, they must keep in mind their responsibility to maintain the author's intended message, by balancing their prior knowledge with explicit information in the text. It is this balance that leads to appropriate inferencing.

What Factors Contribute to Successful Inferencing?

We know that generating inferences during or after reading is a complex task; yet, one that is essential for complete understanding of texts. Students are expected to demonstrate their ability to make inferences not only in authentic reading situations but also on high stakes standardized tests. Students are unlikely to do well on these tests unless they can make inferences: predict, draw conclusions, elaborate, explain, make analogies, and so forth.

Over the past several years, a number of empirical studies have provided us with information about this process. Trabasso and Magliano (1996), for example, conducted a study with eight college students and found that the vast majority of inferences made by these accomplished readers were explanations, as opposed to predictions, elaborations, or associations. Although it was generally thought that reading was a predictive activity, it now appears that this is not usually the case. Accomplished readers tend to construct meaning by actively interpreting the meaning and putting it into their own words.

Cote (1994) reported on another study by Trabasso and Magliano (1994) in which they found that readers used background knowledge and information from earlier parts of the text to explain and understand what was just read. Most of us would probably expect that to happen. Interestingly, however, McCormick (1992) noted that students who bring too much of their background knowledge and experience to the reading situation may use this prior knowledge rather than the information provided in the text to construct meaning. In doing so, they may move

further away from the author's intended meaning rather than closer to it. She cautions that either "underutilization" or "over reliance" on prior knowledge can be problematic. Tierney and Pearson (1981) identify these types of responses as "too text based" and "too reader based," respectively.

Not only do students need to balance information in the text with their prior knowledge, they need to integrate these ideas effectively. Yuill and Oakhill, (1991) found that "the skilled children seemed to integrate ideas and construct a coherent mental model, whereas the less-skilled comprehenders tended to generate a representation closer to the verbatim text" (p. 111). It appears, then, from the body of existing research, more accomplished and less accomplished readers rely on different strategies while trying to comprehend texts.

Developing a Common Vocabulary

It is clear that there are many different types of inferences that readers rely upon to construct meaning from text. In this section of the paper, we will highlight some of the strategies the students used, provide a definition for each, and give an example of how students used these strategies. When teaching comprehension skills, especially inferencing skills, it may be helpful for teachers and students to speak a common language – to share a terminology. Having a familiar language can make some of the abstract strategies more concrete.

As indicated in the introduction, George, Lee, Michelle, and Keith had very different responses to the same sentence: "Mountain gorillas live in groups" (Thompson, 1998, p. 4). Each student used a distinct strategy to make sense of the text.

George responded, "That's kind of making me think about whales because whales always are in groups called pods." In this example, George made a *text-to-world connection* by linking new information about gorillas to his prior knowledge about whales. Lee responded, "Now I'm thinking how many are in a group?" In this case, Lee *asked a question*, a strategy that helped him to process the new information. Michelle responded, "So there's like the black group of the—a black

Sentence: "Then he decided to be a painter," (Vázquez, 1998, p. 10).

Response: Maybe once he decided he wanted to be – he wanted to be a painter he probably would start taking classes and then he got really good at it so he became famous.

Draw conclusions: to provide a rationale for something; sometimes signaled by "so," "because," "since," or "therefore."

Sentence: "They made a fire to keep warm and to use for cooking," (Glasscock, 1998, p. 6).

Response: That's telling me that they didn't have stuff like stoves and stuff to cook stuff and they had to do it by fire.

Paraphrase: to rephrase the sentence, using similar words, but preserving the author's intended meaning.

Sentence: "They made a fire to keep warm and to use for cooking," (Glasscock, 1998, p. 6).

Response: It's just telling that they made a fire to keep warm and they used the fire to cook, too.

Elaborate: to add new information to what is presented in the text.

Sentence: "Some die because of pollution," (Thompson, 1998, p. 3).

Response: Some die of pollution because they might eat it and it might be toxic and they might die.

Make text-to-self connections: to link an idea in the text to personal experiences.

Sentence: “Many people go on whale watches to see them,” (Thompson, 1998, p. 7).

Response: Cause like a couple years ago when I went to Martha’s Vineyard my grandpa, ma and my mom went on a whale watch...

Make text-to-text connections: to link an idea in the text to idea(s) in other text (from the same book, or a different text.)

Sentence: “They made a fire to keep warm and to use for cooking,” (Glasscock, 1998, p. 6).

Response: They made a fire to keep warm and to cook food that their father hunted. The student connected information in sentence 20 with information from sentence 11: “He farmed and hunted for food to feed his family,” Glasscock, 1998, p. 4).

Make text-to-world connections: to link an idea in the text with background knowledge.

Sentence: “Others die because they are losing the habitat they live in,” (Thompson, 1998, p. 3).

Response: Because people are putting more new homes in a new town and so the animals don’t have places to live.

Affective connections: to link an idea in the text with personal feelings about that idea.

Sentence: “They were hunted for their skins,” (Thompson, 1998, p. 4).

Response: And I think of how nice their skins would be and how nice it would look.

In the remainder of this article, we will explore some of the strategies four students in grades 2-5 used to construct meaning from print. In order to do this, we will begin by providing a context for this investigation.

Subjects

The four students we will highlight in this article were participants in a larger study of twelve students (three each from grades 2nd, 3rd, 4th, and 5th). The original study investigated the types of inferences students made while orally reading expository texts. Students were chosen for this study if they met the following two criteria: they were reading on a low fourth grade level according to the *Informal Reading-Thinking Inventory* (Yuill and Oakhill, 1995), and their teachers confirmed that this was an accurate determination. Having everyone read on the same level allowed us to examine responses from more accomplished second graders, from students who were reading “on or about grade level,” and from slightly less accomplished fifth graders. Six boys and six girls participated in the original study.

Materials

Van Den Broek, Fletcher, and Risdén (1993) noted that longer passages tend to invoke more inferences than shorter passages. In addition, they acknowledged the results from studies in which “experimenter generated” texts were used and suggested that these studies may not “generalize to normal reading situations” (p. 173). In order to provide students with the optimum materials for creating inferences, we decided to have them read passages from longer, authentic texts. For this study, we used four *Pair-It Books*[™]: *Gail Devers: A Runner’s Dream*; *Laura Ingalls Wilder: An Author’s Story*; *Animals In Danger*; and *Diego Rivera: An Artist’s Life*. Each passage ranged from 41 to 48 sentences in length, with the average length of 45 sentences.

Following a procedure used by Hansen (1981) and McCormick (1992), literal and inferential comprehension questions were presented to the participants at the end of each session. There were three literal and three inferential questions. Each question was written on a separate index card.

Data Collection

After spending time modeling the procedures that would be used in this study, one of the researchers met with each student once a week for four weeks. For the past two years, this researcher spent one day a week working in the building on a grant-based project, so the students were familiar with her.

During each session, students read aloud approximately 45 sentences from the beginning of each book. The children had not read the books before. Using a think aloud format similar to one used by Trabasso and Magliano (1996), the children read each sentence and then stopped to tell what they were thinking.

Running records were kept to ensure that comprehension and decoding skills were not confounded. In other words, we wanted to be certain that poor decoding skills would not adversely affect the think alouds (Cromer, 1970 as cited in Yuill, 1991, p. 29). In addition, no time limits were given. This was done to encourage deeper processing of ideas and “to increase the likelihood of inference generation” (Van Den Broek, Fletcher, and Riden, 1993, p. 175). Each session was tape-recorded and protocols were transcribed.

Taking a Closer Look

It was interesting to discover the range of strategies the students used both within and across texts and the impact these strategies had on comprehension. Although twelve students were involved in the original study, we will focus on four students in this article. We chose to highlight the protocols of these students because their think alouds proved to be fairly consistent within and across texts and because each one approached the texts in unique ways. We will begin with George. (All names are pseudonyms).

George

George was a quiet, serious, reflective third grader who was able to integrate ideas from different texts. He also integrated text ideas with his experience and prior knowledge. He flexibly used *many* effective comprehension strategies including text-to-self, text-to-text, and text-to-world connections (Keene and Zimmermann, 1997; Harvey, 1998).

Notice how George used *visualization* in the following verbal protocol, using the book *Animals in Danger* (Thompson, 1998). Sentence 10 reads, “Long ago, there were many mountain gorillas,” (p. 4). George responded, “Right there I had a picture in my head of gorillas like on mountains and stuff.” He knew that he should have a “picture in his head” while reading.

It is interesting to see how George used multiple strategies within and across texts. He pondered, drew conclusions, confirmed predictions, made relevant connections, explained what he was reading in his own words and often integrated several of these strategies at one time. His ability to integrate experiences, knowledge, and text information was evident in the following examples: (S = sentence number from text; G = George’s think aloud)

Pondered: (while reading about Diego Rivera)

S# 1: “Diego Rivera was born in 1886 in a town called Guanajuato,” (Vázquez, 1998, p. 3).

G: I was thinking what his life was like back in 1886.

Drew a conclusion: (while reading about Gail Devers)

S# 40: “Coach Kersee told Gail to watch the United States women’s track team carefully,” (Mead, 1998, p. 10).

G: Like she could watch them so she could learn more.

Confirmed a prediction: (while reading about Diego Rivera)

S# 19: “He drew on the chairs, on the walls, on the floor, or on paper,” (Vázquez, 1998, p. 6).

G: That’s telling me my prediction was right.

Made text-to-world connections: (*Animals in Danger*)

S# 17: “Mountain gorillas live in groups,” (Thompson, 1998, p. 4).

G: That’s kind of making me think about whales because whales always are in groups called pods.

Made a text-to-text connection: (*Animals in Danger*)

S# 28 & 29: “New laws were passed to keep the whales safe, but some people have not obeyed those laws. That is why there are few Beluga whales left today,” (Thompson, 1998, p. 7).

S# 40: “Laws were made to try to stop the hunters from killing elephants,” (Thompson, 1998, p. 8).

G: That’s going to be like Beluga whales because they’re endangered too. [He remembered and integrated the information from sentences 28 and 29 to construct a rich mental model at this point in the reading.]

Explained a sentence and made a text-to-self connection: (*Laura Ingalls Wilder*)

S# 40: “It [their dugout house] was built into the side of a hill by a creek,” (Glasscock, 1998, p. 11).

G: That’s saying it wasn’t underground but in a hill. There might have been like a doorway and then they dug

out part of the hill and that's where they lived – but I don't think that I'd like it in there because part of the hill might collapse on you.

Consistent with other studies, George relied heavily on explanations as a way to construct meaning. In addition, he seemed to make what we termed “*affective connections*” while reading. For example, after reading, “In 1906, some of his [Diego Rivera] paintings were put in an art show,” (Vázquez, 1998, p. 12) George responded, “That's making me think that how good it might make him feel.” One of our favorite responses came when George read, “His [Diego Rivera] parents were very happy when the twins were born,” (Vázquez, 1998, p. 3). George responded, “Right there I was thinking who wouldn't be happy?” He easily connected emotions and responded personally to what he read. On the comprehension questions, George correctly answered 8.5 of the 12 factual questions and 11 of the 12 inference questions (81.3 percent accuracy). It may be that his ability to apply various strategies enhanced his comprehension of the text, especially when higher-order thinking was required.

Lee

Lee was a curious fourth grader. His responses to the text were generally in the form of questions. Many think-alouds started with “Now I'm wondering...” or “Now I'm thinking if...”

Lee possessed a great deal of background knowledge about three out of the four book topics. Prior to reading *Animals in Danger* (Thompson, 1998), each student was asked, “What do you know about mammals?” Lee responded, “They're warm blooded animals and, well, they give birth to mammals alive.” When asked if he knew the meaning of “habitat,” he answered, “Yeah, habitats are like places where they live that like it's well a good habitat would be like a place where they don't have enemies.”

Lee's strategy of asking questions throughout the think-alouds was at times helpful, and at times ineffective. In *Gail Devers* (Mead, 1998, p. 6), sentence 27 reads, “She was still training on her own, without a

coach.” Lee responded, “I’m thinking did she become the best without a coach?” In this case, Lee recalled information from earlier in the passage (sentence 4) and combined it with information from sentence 27. Sentence 4 reads, “This is the story of a woman who has always wanted to be the best,” (p. 3). His question reflects an understanding that there is a connection between these sentences.

At times, Lee asked irrelevant questions that took him away from the authors’ intended meaning. For example, in *Diego Rivera* (Vázquez, 1998), sentence 29 reads, “When Diego was ten years old, he started using paints to add colors to his drawings” (p. 10). Lee responded, “Now I’m thinking how did they make paint?” Lee became concerned with a tangential issue, which is a diversion from the author’s intended point – that Diego Rivera primarily drew as a child, but then began to paint at age ten.

Unlike the other students, Lee consistently asked questions and pondered about the vast majority of sentences in the texts. This was by far Lee’s most often used strategy. He used it almost to the exclusion of other strategies.

Lee was successful at answering the literal comprehension questions that followed the reading of each book. He scored 87.5 percent accuracy on these questions. He was less successful with the inference questions; he scored 62.5 percent accuracy. This suggests to us that his questions may have distracted him from seeing the authors’ intended inferences in some cases. It may be helpful for Lee to understand that asking questions is only one of many available strategies to use to construct meaning from texts. He also needs to focus his questions so that they are always enriching the mental model that he is constructing.

Michelle

Michelle was a gregarious second grader who loved to talk and to express her ideas. She was a very active reader who asked questions and made predictions. She sometimes drew conclusions (accurately and inaccurately) and connected ideas from one part of the text with current ideas. She seldom paraphrased while reading. Strikingly, she relied

heavily on her experiences and background knowledge. In many instances, her overreliance on schema pulled her away from the author's intended meaning, rather than drawing her deeper into the information in the text (McCormick, 1992).

As noted in the introductory paragraph, Michelle read about the mountain gorillas living in groups and then responded that she was thinking there would be all different groups of gorillas: "a black group, a brown, a white, a tan group." An illustration in the book showed a group of black gorillas, but there is no indication anywhere (text or illustrations) that gorillas may be anything but black. Her reliance on her own ideas may have distracted her from the real content of the book. She seemed to add her own interpretation to the text fairly consistently, as the following example from *Animals in Danger* (Thompson, 1998) illustrates:

S# 14: "These gorillas live high up in the mountains of central Africa" (p. 4).

M: Cause they usually just live in Africa cause it was hot and they [live] – I think maybe – Asia and maybe some in Japan – I don't know.

There isn't anything in the book (illustrations or print) to suggest that it was hot high in the mountains of central Africa, nor did the text refer to other countries in any way.

It was interesting to notice that Michelle's imagination also influenced her response to the comprehension questions. In one case, she read about Gail Devers, an Olympian track athlete (Mead, 1998). After reading, Michelle was asked the following question:

Why couldn't Gail train with other classmates when she was in high school? Readers could piece together the correct answer from the following two sentences:

S# 15: "Gail's high school didn't have a track team"
(p. 4).

S#16: “There was no one to teach her about running and winning races” (p. 4).

Michelle, however, answered the comprehension question in this rather unique way:

because they didn’t want to and because some people really, really didn’t like her at all cause maybe she was – maybe they were mean to her and maybe she had glasses...

Again, there was no evidence in the text to support the idea that Gail wore glasses or that she was not liked.

You may have noticed that Michelle often included “because,” “cause,” or “so” in her verbal protocols. The transcription of the fourth (last) session of this study indicated that Michelle used these words in 24 of the 48 think alouds. It may be that she was trying to understand the text by drawing conclusions and attaching a reason (or cause) to what was happening. Although Michelle was able to offer reasonable explanations and drew appropriate conclusions in many cases, attaching reasons or making personal connections seemed in many cases to force her to come up with explanations that sometimes relied more heavily on her experience or imagination than on evidence from the text. Answers to the comprehension questions revealed that Michelle correctly answered seven of the twelve factual questions and four of the twelve inference questions (45.8 percent accuracy).

Keith

Keith was an active reader who attempted to make sense of the text by using a number of strategies.

In the following example, Keith provided an explanation for the sentence and integrated this with his background knowledge. Sentence 37 of *Animals in Danger* (Thompson, 1998) reads, “African elephants used to be hunted for their ivory tusks” (p. 8). Keith responded with, “So I think their ivory tusks might could be used for spears or something –

like the Indians would kill – like the Native Americans would kill them to get this stuff.”

He drew conclusions in the following example from *Animals in Danger* (Thompson, 1998). The text about mountain gorillas reads as follows:

S# 19: “Each group has a male leader” (p. 4).

S# 20: “He tells the group where to go and what to do” (p. 4).

S# 21: “He also protects them” (p. 4).

K: So he’s probably the stronger one and the most wise one I think.

Keith was successful in putting together the information gleaned from these three sentences and drawing a logical conclusion.

Not only did Keith draw conclusions, he also elaborated to construct a clear mental model for himself. This is evident in the following example. Sentence 22 from *Diego Rivera* (Vázquez, 1998) reads, “Sometimes he drew on the walls of his bedroom” (p. 8). Keith’s think aloud was, “So he might draw – instead of wallpaper he could draw on his walls to make it look like wallpaper.” In this example, Keith communicated an idea that was an elaboration of the idea presented in the text.

Many of Keith’s responses revealed that he was aware of the new information he was taking in. For example, in sentence 7 of *Laura Ingalls Wilder* (Glasscock, 1998), the text states, “On February 7, 1867, Laura Ingalls was born in the big woods of Wisconsin” (p. 4). Keith reflected, “So now I know she lived in Wisconsin.” Sentence 8 goes on to read, “Life there was hard” (p. 4). Keith responded, “...so now I know she’s been working a lot – she must have worked a lot.”

Keith's use of a variety of strategies seemed to have helped with his comprehension. He answered both the literal questions and the inference questions with 91 percent accuracy, correctly answering 11 of the 12 literal questions and 11 of the 12 inferential questions.

Defining "Reading"

At the end of the study, the students were given a short survey. The last item on the survey was designed to see if the students' use of strategies matched what they thought good readers did while reading. In a sense, we were trying to determine how the students defined "reading." The survey item looked like this:

Directions: Below are some strategies that readers use while reading. Decide which strategy would be most important for students to use to help them understand what they are reading. Place #1 on the line before this strategy. Look for the next most important strategy. Place #2 before this strategy. Keep going until you put #5 in front of the least important strategy to use.

_____ Ask yourself questions about what you are reading.

_____ Think about how the information in the book is similar to or different from information you already know.

_____ Refer to the book, remember the language the author uses and try to remember exactly what the author wrote.

_____ Make predictions, using your own experiences and information from the book.

_____ Supply a reason, purpose or cause for what happened in the book.

Lee selected the first strategy as being the most important: *Ask yourself questions about what you are reading* and the second one as

least effective: *Think about how the information in the book is similar to or different from information you already know*. Interestingly, the strategy Lee employed most often was the one he identified as being most important to readers (asking questions).

Michelle identified the third strategy as most important: *Refer to the book, remember the language the author uses and try to remember exactly what the author wrote*. The least effective, according to Michelle was the first one on the list: *Ask yourself questions about what you're are reading*. Michelle, who often went beyond the literal meaning of the text, thought that good readers worked hard at remembering the exact language of the author (the third statement, which she rated "most important"). Moreover, even though she frequently assigned a cause in her think alouds, she identified this as the next to least important strategy.

George thought the most important strategy was the fourth one on the list: *Make predictions, using your own experiences and information from the book*. According to George, the least effective strategy was the last one: *Supply a reason, purpose or cause for what happened in the book*. Keith agreed with George on the most and least effective strategies, although they varied slightly on the potential value of the others, as Figure 1 indicates. Although they felt that supplying a reason was the least effective strategy, they often used this strategy in their think alouds. George thought that remembering the author's language was the second most important strategy. However, he rarely paraphrased in this think alouds.

It was interesting for us to note that in most cases, the students did not use the strategies that they thought good readers employ while reading.

George	Lee	Michelle	Keith
3	1	5	2
4	5	2	3
2	2	1	4
1	3	3	1
5	4	4	5

Figure 1. Students' Responses to Final Survey Question

Where does all this information lead us? How can we use the information gleaned in this inquiry project to inform our instruction? What implications can be drawn? Based on this study and empirical studies from the recent past, it seems reasonable to offer the following ideas for consideration:

- Engage in teacher and student think alouds, where the teacher or student models his/her thoughts and strategies.
- Label each strategy so that all students and teachers speak a common language. In other words, if you are modeling “drawing conclusions,” let the students know you are drawing conclusions.
- Introduce the Question Answer Relationship (QAR) model designed by Taffy Raphael (1986) to help readers understand that there are four different levels of questions, from literal to creative: “Right There,” “Think and Search,” “Author and You,” and “On Your Own.”
- Activate background knowledge, but also emphasize the role that background knowledge plays in comprehension. Although we may often assume that students are not successful because they do not have adequate background knowledge or that schema they do have has not been activated, McCormick (1992) demonstrated that an over reliance on background knowledge may be equally problematic.
- Encourage students to visualize what is happening while they are reading.
- Let students know that you expect them to go beyond the literal words on the page and model how you do this. Research by Yuill and Oakhill (1991) suggested that less skilled readers can make inferences, but they need to understand why it is important to do so (p. 74). Relying on information explicitly presented in texts may leave students with “inert knowledge,” which cannot be actively applied in reasoning or problem-solving situations (Cote, 1994).
- Model each strategy with students over an extended period of time.
- Remember that not all strategies are appropriate for all sentences. On a case-by-case basis, choose a strategy that will help students to process the text and then encourage students to

monitor their own comprehension by gradually applying the strategies independently.

Final Thoughts

Although this study revealed some interesting findings, they are certainly not conclusive in nature. The number of students and the number of protocols in this study were small. In addition, the findings in the study were based primarily on how the students responded in the think aloud situation and are somewhat limited by this feature. Long and Bourg (1996), for example, stated that “the need to provide a verbal report may lead readers to process the text more elaboratively than they would otherwise” (p. 330). Although it is important to recognize these limitations, the protocols shed new light on the range of strategies elementary grade students use to construct meaning. By making these strategies known to students, perhaps we can help enhance comprehension of expository texts.

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