

Insight from the Eyes

The Science of Effective Reading Instruction

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and
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Foreword by Kenneth S. Goodman

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Chapter 4

Making Sense of Text: Eye Movements and Miscue Analysis

So far we've talked about several important aspects of reading that are demonstrated by the science of eye movement recording and analysis. Namely, that readers skip lots of words while they read and that where they do look—and how long they look there—is a function of the process of creating meaning from the text. It's a very fast process, so it's difficult to feel yourself doing it while you read, but nevertheless, eye movement research shows that the reader's eyes go to where the reader wants to gather information on a moment-by-moment basis.

At this point, you may be wondering about comprehension—how do we know that the readers we've been discussing are understanding the text they're looking at? After all, if they have no idea what they're reading, the eye movements could just be random. Eye movement researchers have struggled with this problem for years; Just and Carpenter (1984) pointed out that to have really effective eye movement data, it's useful to combine it with something else that lets you know what else the reader is doing in addition to moving her eyes.

For this reason, since at least the early 1920s (Buswell 1922), researchers have recorded readers reading aloud while their eye movements were recorded. It isn't until recently, however, that a method of analyzing the oral reading has been systematically applied to readers reading aloud in front of the eye tracker. In the last few years, there have been several dissertations and studies published that have combined eye movement analysis with miscue analysis, an approach that has been termed EMMA (Eye Movement Miscue Analysis) in those publications (e.g., Paulson 2000, 2002; Freeman 2001; Duckett 2001, 2002).

Miscues are unexpected responses to the text that readers produce when reading a text aloud—usually substitutions, omissions, repetitions, and insertions. Substitutions involve a reader replacing a word in the text with a different one and are signified in miscue analysis by writing the reader’s word above the word it replaced, like this:

substitution
word.

Nonword substitutions—places where a reader replaces a text word with a word that doesn’t exist—are signified by a \$ sign directly in front of the nonword substitution. Omissions describe a reader’s exclusion of a word from the text, verbally “skipping over” that word, and are denoted by placing a circle around the omitted word:

word.

As the name implies, repetitions refer to when readers repeat a word, phrase, or more and are indicated by the symbol ® with a line drawn under the words that were repeated:

® this is an example of a repetition.

When readers verbally put in a word that is not in the written text, that is called an insertion. Insertions are signified by a caret placed where the word was inserted, pointing to the inserted word:

insertion
word ^ word.

For a thorough introduction to miscues and miscue analysis, see Goodman, Watson, and Burke (1987) or Wilde (2000). In Figure 4–1, Jazmin provides an example of substitution-type miscues, including two nonword substitutions (indicated by the symbol \$). Jazmin read aloud, “‘You’re see, you’re like your new school,’ her mother said. But her mother’s safe, rearsing vocie didn’t seem to convince María Isabel.”

What causes these miscues? Is it “carelessness,” as Ekwall (1981) believes, or “failure of [the] pupil to scan the word thoroughly enough to identify the order of the letters and to be certain that the word is a particular word and not another” (Dechant 1981, 333)? A lack of enough visual input seems to be the commonly held understanding for

back to Tim's example in Chapter 1, there are several candidates for miscues, since he skipped 28 percent of the words. Below (Figure 4-2) is an excerpt from that example, showing the first two lines. Tim orally omitted two words in the first two lines. Based on visual explanations, which two do you predict he omitted?

All the doors are locked, fight? And all the windows, ditto.
Okay, then. So I feel like an idiot, trying to stay up all night.

Figure 4-2

Candidates would seem to include *all*, *are*, *and*, *the*, *idiot*, *up*, *night*, and others that were not fixated. However, Tim read all of those words verbatim! The two words he omitted were *all* (second sentence) and *then* (third sentence)—two words he looked right at! Now let's take a look at the miscues on the rest of his example (see Figure 4-3; a larger reproducible can be found at www.heinemann.com/paulsonfreeman).

All the doors are locked, fight? And all the windows, ditto.
Okay, then. So I feel like an idiot, trying to stay up all night.
Well, sitting here in the living room is a lot better than doing what we're
I did the last time Bill was away overnight! Looking myself in the
bathroom and staying there until dawn, for heaven's sake-
Oh, the furnace clicked on, that's all that was! Calm
down, girl, calm down! The trouble with you is, you read all
the papers. You should read the comics and stop there.

Figure 4-3

Tim made 8 miscues in this section, which comes out to about 8.5 miscues per hundred words—not at all unusual for a teenage reader. Three of his miscues were omissions, and they were all fixated. Tim made three insertions, twice inserting *all* after the word *read* and once inserting *in* between *staying* and *there*. Each time he inserted a word, he looked directly at at least one of the words adjacent to the insertion, and in the case of *in*, he looked right at the space between the words where he inserted *in*. Two of his miscues were substitutions: *we're* for *well* and *it* for *that*, and the word *that* was fixated, albeit right on the end of the word. The only miscue in this section that is not fixated is his substitution of *we're* for *well*—and, interestingly, that was the only miscue that he corrected! After making a return sweep from the previous line, Tim first fixated on the *s* of *sitting*, then on the *g* of *sitting*, then the *t* on *the*, then uttered “we’re.” Then, realizing something was not quite right, he looked back at the comma after *well*, corrects his miscue by saying *well*—then continued with the rest of the sentence. We could do a lot more analysis here that would provide a lot of information about Tim and his reading (for example, was the insertion of the second *all* part of Tim’s efforts to maintain parallel construction in the text?). But let’s consider readers other than Tim—is there a similar pattern of readers actually looking right at the words they miscue?

Let’s look briefly at the eye movements for Jazmin’s miscue example we introduced at the beginning of this chapter, where she makes six substitutions:

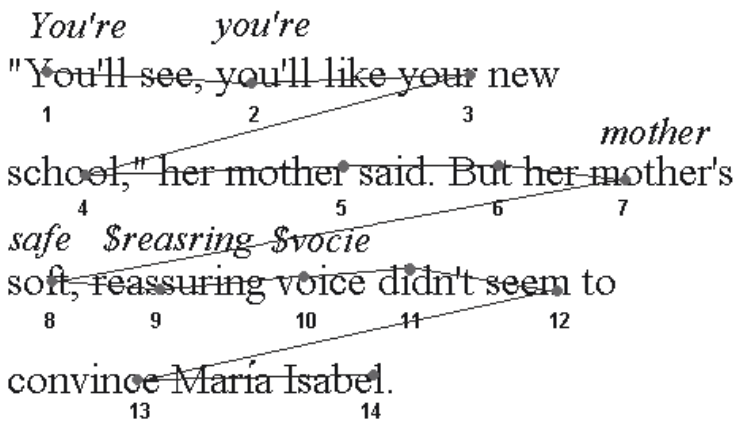


Figure 4-4

In Figure 4–4 above, Jazmin substitutes *you're* for the text item *you'll* each time it appears. On the second line she substitutes *mother* for *mother's*. On the third line, Jazmin makes three miscues. She substitutes *safe* for *soft* and then makes two nonword substitutions, *rearsing* for *reassuring*, and *vocie* for *voice*. Although several words in that sentence were not fixated, all of these miscued words were fixated.

In Jazmin's example as well as Tim's excerpt, we see that the miscued words are not simply skipped, and eye movement research indicates that these examples are not flukes. For example, in one study, "readers were as likely to fixate a word they orally substituted or omitted as they were to fixate a word they produced verbatim to the text . . . the results of this study suggest that readers are likely to look directly at words they omit or substitute for an ample duration" (Paulson 2002, 62). Recent studies (Freeman 2001; Duckett 2001) and earlier research (Fairbanks 1937) have found similar results.

Freeman (2001), for example, found similar results when analyzing the miscues and eye movements of fourth-grade bilingual readers. "The data suggest that readers sample more visual information in both English and Spanish at places in the text where they miscue than at places where they don't miscue" (203). Freeman also found that "more time was spent on fixations on miscued words in both the Spanish and English texts than on non-miscued words" (218).

But what about very young students who are just beginning to learn to read? Duckett (2001), who studied beginning readers' use of pictures and print as they read age-appropriate picture books, found that even the first graders in his study spent time on miscued words. Duckett found that the readers in his study "fixated miscued words well beyond their personal average fixation duration prior to producing a miscue 94 percent of the time" (206).

So when your student makes an oral reading miscue, it is likely that he looked at that word and looked at it for a sufficient amount of time. Miscues are not caused by a lack of visual information. The answer to the question, What causes miscues? is beyond the scope of this book. For directions miscue research has taken, see Brown, Goodman, and Marek (1996). More useful for our purposes here is to move toward understanding what readers do while making a certain kind of miscue.

In the next section, we take an in-depth look at what goes on during a common oral reading miscue: repetitions.

What Readers Do When They Make Repetitions

In the sentence in Figure 4-5 below, Sam, a teenage reader, repeated the word *for*:

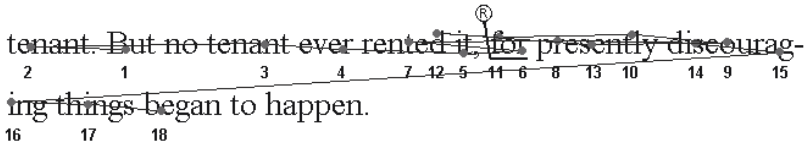


Figure 4-5

Sam fixated FOR, then said “for” for the first time. He then regressed to RENTED, fixated forward to PRESENTLY, fixated forward to DISCOURAG-, regressed to refixate PRESENTLY, regressed again to refixate FOR, and regressed once more to RENTED. Sam then repeated “for.” So between oral utterances of *for*, Sam produced a series of regressions and refixations. In this way, the repetition served as a place marker for Sam as he sampled the text heavily. After his repetition of *for*, Sam’s eye movements were all forward-moving and he made no miscues during the remainder of the sentence. His relatively dense sampling of the text between repetitions of *for* seems to have been for confirmation and disconfirmation purposes. Apparently he was troubled by the use of *for* as a conjunction (meaning “because”), as he checked the expected syntax of the sentence; after the repetition, it was smooth sailing. In this example he fixated the repeated word and made an interesting regressive sequence between oral repetitions; that gives us insight into his process of assigning syntax to the sentence.

Words the reader orally repeats are fixated more often than other, nonmiscued words (Paulson 2000), an event that may in part be due to a high degree of tentativeness with that section of the text in general. This idea is supported by the unique miscue–eye movement relationship of repetitions (orally repeating a word) to regressions (looking back at a part of the text already viewed). That relationship is characterized

by the fact that most repetitions involve a regressive sequence that takes place between oral utterances of the repeated word, an indication that repetitions are used for a specific purpose. Repetitions may be a type of cognitive strategy for dealing with a difficult or unexpected portion of text. In this sense, repetitions may be seen as an indication of comprehension processes at work.

Miscue research reveals that “the position, extent, and frequency of repetitions reflect the reader’s lack of efficiency and confidence. Examining points in the text where the reader’s repetitions diminish or increase may indicate the predictability and complexity of the passage” (Goodman, Watson, and Burke 1987, 151). What is less clear is whether the complexity lies in the word or phrase that is being repeated or in the text surrounding the repetition.

The answer may be both. Some repeated words and phrases receive direct regressions and multiple fixations, which indicates it is the repeated portion of the text that is causing problems for the reader. For example, in Figure 4–6 below, Mike fixates BARGE, and then says “barge,” fixates the space between CANAL and THERE, refixates BARGE, and verbally repeats “barge,” then finishes the sentence without any more regressions.

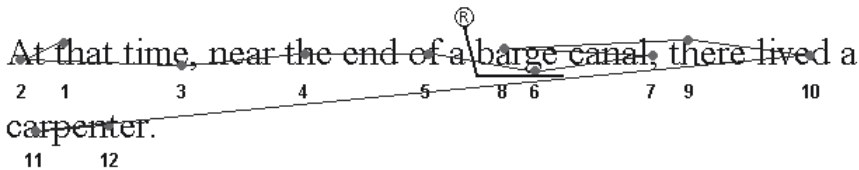


Figure 4–6

Clearly, Mike’s repetition of the unusual type of canal is part of his strategy for processing the repeated word itself. He verbally produces “barge,” fixates forward for a short period, then regresses and directly refixates BARGE. After he finishes his regressive sequence, he repeats “barge” and moves on. This type of repetition, where the only regressions refixate the repeated word, seems to be a method of comprehending the repeated word, although it may also show the reader confirmed that what he thought he saw was right and decided to go on even though “barge canal” made little sense to him.

In contrast to the confirmation-type repetitions exemplified by Mike’s example, other repeated words and phrases are never fixated, even on regression. This is further evidence that repetitions are not necessarily signs of processing the miscued word itself. That is, since traditionally, fixating a word is usually considered evidence of processing that word, *not* fixating it would support the idea that that word is not being actively attended to by the reader. Vera provides an example of a repeated word that does not receive a fixation in Figure 4–7 below:

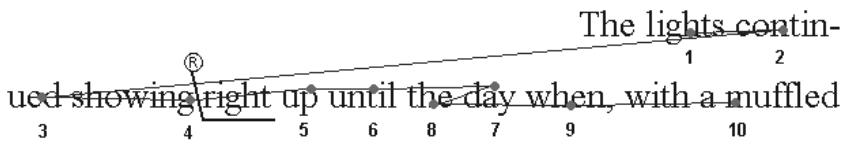
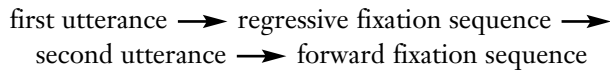


Figure 4–7

Here Vera verbalizes “right,” fixates UP, fixates UNTIL and DAY, regresses to THE, then verbalizes “right” again. She is not spending time processing the word *right* but is processing the text after it. There is an indication of tentativeness, as if a prediction has been disconfirmed. Repeating the word allows Vera to return to a known area of the text before continuing to construct her parallel text. The following pattern, which we’ll call a “regression sandwich,” is an overwhelmingly prevalent pattern, existing in 96 percent of the repetition miscues in a recent study (Paulson 2000):



In the following excerpt (Figure 4–8), Astor provides another example:

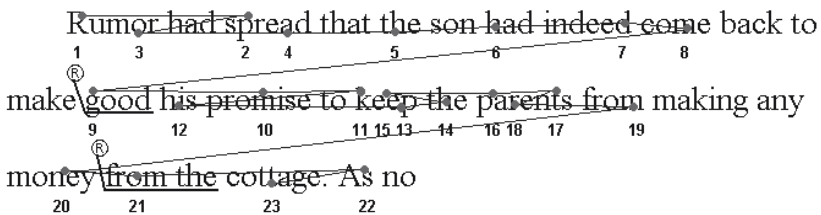


Figure 4–8

The eye movement and miscue time course of these two repetitions are very similar to Vera's. Astor fixates GOOD, verbalizes "good," fixates PROMISE and KEEP, regresses to HIS, then repeats "good." On the third line, he fixates MONEY, and FROM, verbalizes "from the," fixates the first word in the following sentence, regresses to COTTAGE, then repeats "from the" (note that he never fixates *THE* although he verbally produces it twice). In both of these repetitions, Astor produces the "regression sandwich" combination of fixations and speech found in almost all instances of repetition.

In this sequence, *all* regressive eye movements are produced *before* the repeated word is uttered for the final time, so the very tentative sampling of the text takes place between oral repetitions. As we saw with Astor's examples, the regressive sequence can take place to the right of the repeated word—one or two forward fixations, then a regression or series of regressions. The repeated word thus acts as an anchor for the reader. This is an important concept because the repeated word is sometimes assumed to be a trouble word for the reader when, in fact, these eye movement and miscue analysis data show the reader using that word as a known word. From this known word, the reader anchors himself as he examines a trouble spot, then returns to the known word to resume reading.

After probing an area of the text that doesn't match their predictions, readers can use the oral repetition to attempt that area of difficulty from a springboard of confidence—the repeated word—before diving into the less easy portion of the text. It is similar to the idea of a running start that has been discussed in miscue analysis, in which readers, after encountering an area of the text that gives them problems, return to the beginning of a phrase or sentence that did not present them with difficulty in order to try the problematic area "from the top."

Summary

In this chapter we combined eye movement recording with miscue analysis in order to add another dimension of data to how we understand reading processes. We provided Tim's oral reading to go along with the eye movement record we have referred to throughout the

previous three chapters. Contrary to what we might expect, when readers make oral miscues while reading aloud, they don't skip the word or fail to look at it long enough; the opposite is true. Readers are likely to look right at words they miscue, and for a longer than average duration. We also discussed what happens when readers orally repeat words while reading aloud and what the purpose of that repetition may be. In the next chapter, we again look at Tim as a reader, but this time, we thoroughly explore a new instructional strategy that relies on using a reader's eye movements and miscues through examining how the strategy worked for Tim.

Extension Questions

1. In addition to miscue analysis, what are some ways to understand how well your students comprehend what they are reading?
2. When readers make oral reading miscues, more often than not they look directly at the word they omit or substitute. Yet, they rarely make an oral reading miscue on words they don't fixate. What in the reading process accounts for this phenomenon?
3. We've discussed some of Tim's specific miscues in this chapter. Look again at the miscues he makes (in Figure 4-3), specifically the insertions of *all* in two places and the omission of *should* in the last sentence. What do those miscues (and his others) tell you about his reading process and *how* he read this passage?
4. Now that you've become familiar with Tim's eye movements and miscues, how would you work with him to help him become a more efficient reader?
5. Based on what we've discussed in this chapter about repetitions, what do you think is going on when you hear your students repeat words as they read aloud? What should you do, if anything, to improve a student's reading if he or she very often repeats words while reading aloud?
6. In this and previous chapters, we discussed some intuitions about reading that readers—we, you, educators, and so on—may hold about reading that turn out to be unsupported by eye movement research. Some would say that this is the reason research is done: to examine our preconceived notions to see if they stand up under

scrutiny. Others would say that anything that doesn't support intuitive understandings about reading must be wrong. Where do you come down on this debate—is there room for research in reading, or do we already know everything we need to know?

Eye Movement Links to Reading Instruction

By examining what readers' eyes do when they miscue or when they orally repeat portions of text, we are better informed about what strategies they use to successfully make sense of text. One very important observation that comes out of the combination of eye movement and miscue analyses (EMMA) is the amount of eye movement activity that takes place when readers pause during oral reading. One clear example of this is what we've shown readers do in the silence between oral repetitions, where they make at least one regressive sequence before continuing with their oral reading. Without an eye tracker, it's difficult to tell exactly what a reader is working on when she pauses during oral reading, but the research has shown us that this is decidedly not a time of inactivity. When readers are silent, their eye movements show continued activity as they make sense of text.

Wait Time: An Approach

A simple but very useful strategy that is supported by our EMMA research is to provide wait time for readers who are reading text aloud. With young readers we are often tempted to jump in and supply the next word when the student pauses. By looking at various eye movement examples, however, we see that readers are working very hard during these pauses. Remember our examples in Chapter 3 when Victoria took a few seconds to reread a section of text around the word *touted* and when Andrea paused to look back at the words *Mary Lopez*, which were printed in italics? A pause does not necessarily mean that a reader is stuck on the next word. Teachers can help students by providing wait time and by expecting that other students in the class will

also respect this silent time when the reader is using strategies to work through the text.

In a recent presentation, Yetta Goodman repeated a metaphor—the “football metaphor”—used frequently by Dorothy Watson that may illustrate our point. In football practice, if the coach gets on the field too often, the players won’t learn how to play without him once it’s game time. Since the coach often knows more about the game than his players, he naturally wants to get out on the field and help them out, but the players need to go through the process of learning how to play, just as their coach once did. So the coach needs to learn to stay on the sidelines when appropriate—just as the teacher needs to know when to let readers read and figure things out for themselves. Many educators believe thirty seconds is a good general amount of time to wait before offering assistance to the reader.

Four Strategies

Many teachers we have shared these data with are surprised to see that when readers miscue, they tend to have spent quite a bit of time looking right at the portion of text they miscued. A simple strategy for educators based on this information is to avoid telling students to look at the word when they produce a miscue. As we discussed in this chapter, EMMA research shows that they probably have looked at the word, and for quite awhile! Instead, it is helpful to acknowledge the strategies readers are using to make sense of text and to help the readers themselves become aware of what strategies they use. Together, teachers and students can determine which strategies are most helpful. As discussed in Chapter 3, the Strategy Ruler is one tool that can be used to help accomplish this. In the following section, we describe four more strategies for helping readers make sense of text and become aware of their reading process and strategies.

Adoption Day at the Animal Shelter

This strategy helps engage students in thought and discussion about the role of prediction in reading. Students will discuss how readers can miscue even when they are looking right at the words in a text. They will then explore their own process of making predictions during reading as

they read an adaptation of Hazelwood's *Day at the Zoo* (Goodman, Watson, and Burke 1996, 81), called "Adoption Day at the Animal Shelter" (adapted by Ann Hinkle).

Preparation: Make an overhead of Miscues on Pack (Figure 4-9) and "Adoption Day at the Animal Shelter." (Full-size reproducibles of these can be found at www.heinemann.com/paulsonfreeman.)

Adoption Day at the Animal Shelter

The day was rainy and cold—a good day to be inside at the animal shelter. Meowing and barking filled the rooms.

"Look at that cute little one," said Beth.

"Quick, try and get his attention, maybe he'll do something cute," shouted Jason.

"Okay. Oh, he's looking right at us! Sometimes they act just like cute little people!"

"He's coming closer. Is he interested? Does he like us? What should I do?"

"The doors are opening. Others are coming in! Last one down is a scaredy-cat!" Beth challenged as she leaped to the floor from the shelf at the top of the cage.

"Oh, Beth, wait for me," pleaded Jason. "Adoption Day at the animal shelter is the very best time of the week. I hope somebody picks us!"

Procedure: Place Miscues on Pack on the overhead. Explain to your students that these three readers all made the same miscue when they read this section of text. Because their eye movements were recorded as they read aloud, we can see that all three readers looked right at the word **PACK** but read *backpack* aloud. Ask the class how it is possible for these readers to have looked right at **PACK** and read *backpack*. Discuss with students the strong role our predictions play in reading.

Next, place "Adoption Day at the Animal Shelter" on the overhead and ask students to read the story to themselves quietly. Invite students to turn to a neighbor when they are done reading and retell the story. They should discuss anything that might have been tricky about the story. During these discussions, students will begin to talk about the surprise ending to the text. Ask the class what they predicted Beth and

Miscues on Pack

Andrea:

she had walked back and forth
~~backpack~~ 1 2
 with the pack on her shoulders and
 3 4 5 6

Juan Antonio:

she had walked back and forth
~~backpack~~ 2 3 4
 with the pack on her shoulders and
 5 6 7 8

Angel:

she had walked back and forth
~~backpack~~ 2 3 4 6
 with the pack on her shoulders and
 7 5 8 9 10 11

Figure 4-9

Jason to be as they started reading and why. How did their background knowledge about animal shelters affect their reading? Were their predictions confirmed or disconfirmed as they read on? Ask the students to talk about which sections of text helped them comprehend who the characters were. This strategy will help readers understand how much our background knowledge affects what we expect to read. It will also help readers understand that prediction plays an important role in the reading process.

Prediction Guide

This guide can be used with readers of all ages to help focus on the process of prediction and is essentially a formal way to structure a talk about prediction. Effective prediction helps ensure comprehension of text and encourages a focus on comprehending the story. Using the Miscues on Pack eye movement example and discussion, as explained previously, works well as a lead-in to this strategy.

Preparation: For all ages, you will need a large board and markers for writing class predictions. Teachers should use a transparency of the Prediction Guide to guide whole-class discussions with younger readers, while older readers may also benefit from having their own copy of the guide to use independently. (A full-size reproducible can be found at www.heinemann.com/paulsonfreeman.) Select a short story that your students have not read.

Procedure: Explain to your students that you will be sharing a strategy that will help them with their reading by focusing on predicting what will come next in a story. Read the title of the story you have selected and ask the students to predict what the story will be about. You may prompt the students by asking questions such as Who will be in it? or Will it be happy or sad? Write students' predictions on the board or overhead transparency. Next, read the first two paragraphs of the story aloud to the class. After reading this section, ask the students to refine their original predictions. Cross out or add to the list of predictions on the board. Next, have the students think about the information that they know so far and ask: What will happen next? Where is the story going? Again, list students' predictions on the board. Continue this pattern as you read the story to the class. Students

Prediction Guide

Read the title and predict what the story will be about. Who will be in it? Will it be happy or sad?

WRITE YOUR PREDICTIONS HERE:

Read the first two paragraphs and stop. Think about the information that you know so far. What will happen next? Where is the story going?

WRITE YOUR PREDICTIONS HERE:

Continue to stop reading after every two to four paragraphs and make predictions about what will happen next.

Don't forget to continually ask yourself if your predictions were accurate or if the story is going in a totally different direction.

It's not necessary to continue to write down your predictions after every two to four paragraphs unless you find that you forget your predictions or have trouble articulating them.

should focus on whether their predictions were accurate after you have read each section.

Ask students to share how this activity was helpful for understanding the story. For older students, provide copies of the Prediction Guide and encourage them to use the guide as they read independently. Explain that the point of the guide is not to spend time writing down predictions, but to get in the habit of paying attention to what has happened in the story and always guessing what will happen next in the story.

Retrospective Miscue Analysis

One of the most effective ways to help students understand the reading process is to have them reflect on the miscues that they make as they read. This strategy is called Retrospective Miscue Analysis, or RMA (Goodman and Marek 1996b).

Preparation: Make an overhead of Miscues on Pack. Select a book for the students you will be working with that is a little more difficult than what they usually read independently. Make an enlarged photocopy or typescript of the story so that there is room for you to write in miscues. You will also need a tape recorder with a good microphone and a tape.

Procedure: Begin with a discussion of the Miscues on Pack overhead. Have students talk about why they think all three of these readers made the same miscue. Ask your students why they think these readers did not go back and correct their miscues. Were these good miscues? If reading is making meaning of text, did these readers make an *error* when they read “backpack”?

Next, tape-record a student reading the text you have preselected. Later, listen to the tape and record the miscues you hear on your copy of the text. Read through your work and select a couple of miscues that were good miscues. Find those sections on the tape. Next, meet with the student a second time. Have a copy of the text for the student. Ask the student to listen to her reading and to stop the tape when she hears something that is different than what she sees on the page. To build the student’s confidence, have her begin at a section where she

has produced a good miscue. Listening and discussing a good miscue that makes sense could help a student realize that an *error* isn't necessarily *bad*, because getting the meaning is more important than getting all of the words right. When the student comes to miscues that do not make sense, you can remind her of the importance of reading for meaning.

In general, the RMA proceeds on a two-day cycle. On day one, the reader is audiotaped while reading a text aloud and retelling the text. After that session, in preparation for the second session, the instructor listens to the tape, marks and codes the miscues the reader made, and holistically assesses the retelling. The instructor then plans which miscues to discuss during the RMA session on the subsequent day. During the RMA session—day two of the RMA cycle—the instructor uses two tape recorders, one to play the reader's oral reading from the day before and one to tape-record the RMA session itself. Using questions like "Does the miscue make sense?" and "Did the miscue affect your understanding of the story?" as discussion prompts, the instructor and reader discuss the reader's reading, retelling, and miscues in a way that engenders an understanding of the reader's reading and the reading process in general. (More specific question guides are provided in the next chapter.) At the end of the RMA session, the reader may read another text for use in a subsequent RMA session.

For a complete how-to book on RMA, see Goodman and Marek (1996a). RMA has been conducted successfully with students as young as second grade. As students engage in RMA, they begin to realize that reading always needs to make sense. In the next chapter, we discuss in detail an adaptation of RMA that involves students discussing their eye movements as well as their miscues.