A New Spin on Miscue Analysis: Using Spider Charts to Web Reading Processes

A *spider chart,* a standard feature in a widely available spreadsheet application, puts a new spin on a venerable reading assessment—miscue analysis (Goodman, Watson, & Burke, 1987)—by quickly generating visual displays of reading processes. Also known as radar charts, spider charts are webs that put reading assessment data points in relationship to each other, providing a way to quickly visualize how well readers are noticing and coordinating complex linguistic systems during the process of constructing meaning for a text. This article demonstrates the usefulness of spider charts in illustrating how readers—in this case, emergent readers in kindergarten and early primary grades—coordinate various kinds of textual cues as they learn to read. An interactive version of the spider chart in this article can be found at http://e339blog.blogspot.com/2012/01/visualizing-reading-processes-with.html.

Complexity and Reading Cueing Systems

Miscue analysis offers an in-depth picture of reading that captures more complexity than other informal reading inventories, such as running records that assess word accuracy of oral reading and suggest an instructional level. In miscue analysis, teachers record miscues in oral reading and analyze individual miscues, but they use this data to consider how the three cueing systems interact. The focus is on the unfolding meaning making with a text rather than on word-by-word accuracy. To do this, teachers must consider how individual readers are simultaneously pulling together multiple threads as they coordinate all their linguistic resources: their knowledge of familiar cultural patterns of lan-

guage use, their developing sense of story, and their awareness of sounds and print.

An Overview of Miscue Analysis Procedures

Miscue analysis provides a window into children's problem solving "on the fly" as they work with text in context. Sentence-by-sentence analysis of oral reading (always informed by the child's retelling of the text) reveals whether children are flexibly using cues from syntactic, semantic, and graphophonic systems and uncovers the hypotheses and strategies a child brings to print. (For a detailed explanation of miscue analysis theory, procedures, and strategies, see Goodman, Watson, and Burke, 2005.) These cues subliminally prompt the reader to ask themselves questions:

- Syntactic cues come from knowledge of syntax or how words fit together in a sentence: *Does this sound like the language I use?*

- Semantic cues are clues that a reader fits together to understand the text's meaning: *Does this make sense, given what I know so far?*

- Graphophonic cues help a reader decode printed or written forms on the page: *Does this look or sound like other phonetic or graphic patterns or words I know?*

Learning to Conduct Miscue Analyses

As a teacher educator, I regularly face the challenge of helping preservice teachers in my early literacy methods classes untangle the complexities of the reading process and interpret the rich data they collect through a range of kid-watching assess-

ments (Owocki & Goodman, 2002). In one reading assessment, our elementary preservice teachers conduct a miscue analysis in which they listen to a K–2 student read and retell an unfamiliar book. In preparation for this assessment, we work through video samples in class together as they learn to code oral readings.

During videos of children reading, we observe children's literacy practices and record miscues on a copy of the printed pages in the child's book, a procedure common to many informal reading inventories. In miscue analysis, however, individual single-word miscues are not tallied to calculate word accuracy of oral reading in order to determine an instructional level or a match for a leveled book. Instead, miscue analysis proceeds at the sentence level; that is, we evaluate each coded sentence in the recorded reading by asking three questions (Goodman, Watson, & Burke, 2005; Owocki & Goodman, 2002):

1. Is the sentence syntactically acceptable? (Does the child's reading sound like language?)

2. Is the sentence semantically acceptable? (Does the child's reading make sense?)

3. Do the miscues in the sentence change the meaning of the sentence in relation to the book/story/article? (Does the reading change the meaning of the sentence in a way that matters in the whole text?)

Each question produces a percentage of acceptability by dividing the total number of acceptable sentences by the total number of sentences in the passage: 1) the percentage for all Yes answers to question 1; 2) the percentage for all Yes answers for question 2; and 3) the percentage of all No answers for question 3. We then return to the individual word miscues and analyze only the *substitution* miscues to see if each substituted word is similar (e.g., has matching letters or sounds) to its corresponding word in the passage. To do this, we ask a fourth question:

4. Are the miscues graphophonically similar to the text?

For example, a miscue with some graphophonic similarity might have one word part, such as a beginning letter or word part, that is similar to the corresponding printed word in the book (e.g., a child reads *beast* when the printed word is *bunny,* so the substitution and the word in the book start with the same letter but share no other letters). We calculate the percentage for graphophonic similarity by counting the substitutions that have at least some graphophonic similarity (e.g., one or more word parts similar to the corresponding word in the book), then dividing this number by the total number of substitutions.

Some Signs That a Reader Is Using Syntactic Cues

• Makes no miscues

• Makes substitution, omission, or insertion miscues that fit conventional word order

• Substitutes the same part of speech (e.g., a noun for a noun)

• Substitutes words that, while not conventional, fit the child's developing understanding of rules for language and grammar (e.g., goed for went)

Some Signs That a Reader Is Using Semantic Cues

• Makes no miscues

• Makes substitution, omission, or insertion miscues that retain the sense of the sentence (even if the miscues do not look or sound like the original words)

• Self-corrects miscues that don't make sense

Some Signs That a Reader Is Using Graphophonic Cues

• Makes no miscues

• Makes miscues that look and/or sound similar to words in the text

The goal is to understand how flexibly and efficiently the reader is *integrating* all the cues to predict, confirm, or discard hypotheses while making

meaning with a text. During this process, teachers are also learning something about reading strategies, as Owocki and Goodman (2002) point out:

> The ultimate goal of miscue analysis is to help teachers learn to listen to children read with educated miscue ears, to thoughtfully evaluate miscues and use miscue analysis to discover readers' strategies, which include
>
> - monitoring reading in order to construct a meaningful text
>
> - predicting or making educated guesses that make sense based on prior knowledge and comprehending of the text
>
> - confirming and self-correcting miscues that do not make sense using grammar and phonic cues
>
> - reading without overly long hesitations and pauses
>
> - omitting words or substituting non-words to keep reading
>
> - using pictures and illustrations selectively (p. 63)

Visualizing Reading-in-Use through Spider Charts

In the process of teaching miscue analysis to pre-service teachers, I frequently found that when I asked them to interpret the four percentages in their miscue analyses, they became preoccupied with determining whether each individual percentage was above or below some arbitrary minimum score. As a result, they tended to focus on accuracy of reading and interpreted a low percentage as an indicator of student deficit instead of seeing it in context. To respond to this, I looked for a way to refocus their attention on reading-in-use and to display their results so they could visualize the *relationships* among the three cueing systems. Spider charts provided a handy visual tool that is accessible and relatively simple.

Much complexity can be conveyed in an instant through the shape and size of the figure on the spider chart.

A spider chart generates a web-like pattern that shows data points in relationship to each other. In miscue analysis, the four percentages produce a square-like pattern when the three systems are in a somewhat balanced relationship. One influencing factor to note is that in miscue analysis, the sec-

ond and third questions can depend upon the previous question. For example, a sentence that does not sound like language (question 1) often does not make sense (question 2); thus, the percentage of syntactically acceptable sentences is often equal to or greater than the percentage of semantically acceptable sentences. Similarly, a child's reading can make sense (question 2) and change the meaning of the sentence (question 3), as in the substitution of *work* for *wolf* in "the night Max wore his wolf suit . . ."; in other words, "the night Max wore his work suit" makes sense but changes the meaning. But a nonsensical reading of a (sensible) sentence automatically changes its meaning, as in "the night Max wore his wollof suit"; thus the semantically acceptable percentage will usually be equal to or greater than the percentage of sentences with no meaning change.

Shape Tells the Story

Much complexity can be conveyed in an instant through the shape and size of the figure on the spider chart. The shape matters: square-like shapes (like Figure 1) indicate attention to and coordination of all three cueing systems; irregular or triangular shapes indicate greater attention to one cueing system over another. And the size matters. Larger squares indicate more proficient reading (on a given text); smaller shapes indicate more emergent reading, with many miscues and interruptions in reading and meaning construction. It is important to note here that the size and shape of spider charts must always be considered in relation to a particular reader's development, the difficulty of the text, the strategies apparent in the transcript of the oral reading, the completeness of the retelling, and so on. A chart that points away from graphophonics, for example, can convey one child's emergent understanding of letter–sound relationships. Alternately, a chart from another child's more proficient reading and strong use of prediction strategies, where one graphophonically dissimilar word is substituted for another without changing meaning (e.g., "a" for "the"), indicates that child is competently making meaning. (The brief discussion and examples in this article only hint at the depth of thinking involved

Figure 1. A spider chart showing balanced use of cueing systems
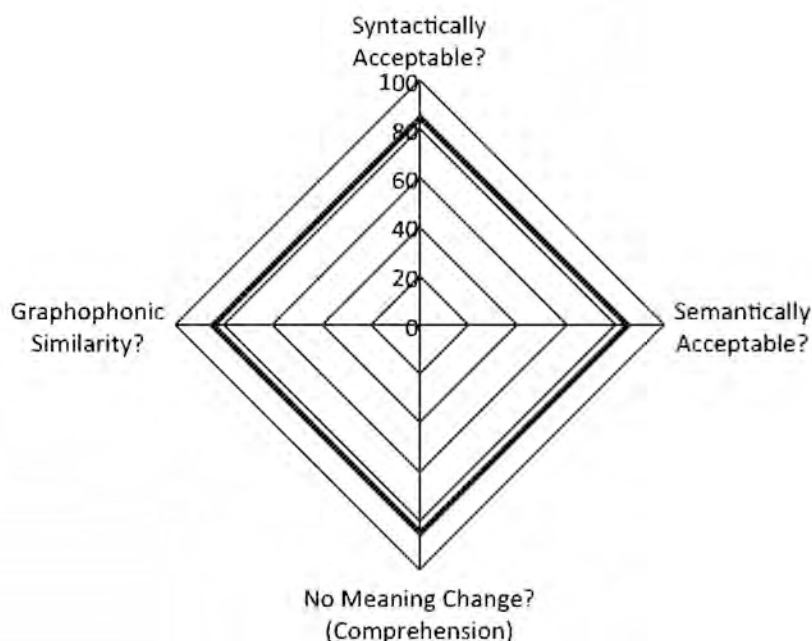
in miscue analysis, since the purpose of this article is to demonstrate the power of technology to enhance existing miscue analysis procedures. For a nuanced discussion of miscue analysis in practice, see Owocki & Goodman [2002] and Wilde [2000].)

Spider Charts: Some Examples

Imagine a developing reader who moves through a text using the three cueing systems flexibly and effectively. A miscue analysis might reveal cueing system percentages where the oral reading shows 85% of the sentences are syntactically acceptable, 85% are semantically acceptable, 85% have no meaning change, and 85% of the substitution miscues show graphophonic similarity to the original words in the text. These four percentages would be entered into the spreadsheet cells and would generate the large tilted square in the spider chart in Figure 1. (It is also important to remember that each spider chart is a snapshot of reading processes with a specific book at a specific moment in time, and that readers and readings are always changing.)

In contrast, Figure 2 shows the cueing system use in an oral reading of an entire text by a first-grade child who stops frequently for long periods

to laboriously sound out words and produces sentences that often don't sound like language or make sense. The shape is out-of-square, actually *pointing* to the reader's system of choice for decoding words: in this case, graphophonic cues. This spider chart pictures a child who is reading an adaptation of *The Box Car Children* (Warner, 1998). He is already attending to letters, sounds, and word forms in order to pronounce words correctly, but he could benefit from a meaning-oriented teaching response, such as a cloze procedure that helps him also think about whether his reading sounds right and makes sense in the context of the story (Goodman, 1999; Goodman, Goodman, & Paulson, 2009; Goodman, Watson, & Burke, 2005).

Figure 3 depicts a first-grade child who guesses at words in order to tell a sensible story and whose substitutions bear some resemblance to the words in an eight-page book, *It's a Party* (Moreton & Berger, 1998). This spider chart points to semantic and syntactic storytelling strengths in her early reading; these strengths can provide support for one-to-one matching while rereading familiar texts to call her attention to matching speech to the visual forms of the words on the page.

Figure 2. Reading focused on graphophonic cues

Miscue Analysis Percentages	%
Syntactically Acceptable?	70
Semantically Acceptable?	65
No Meaning Change?	60
Graphophonic Similarity?	100
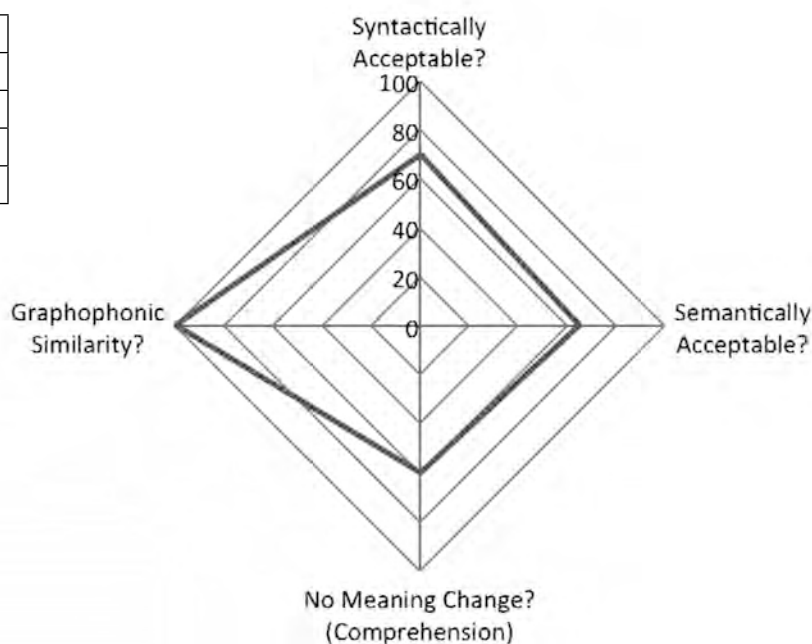
Figure 3. Reading focused on syntactic and semantic cues

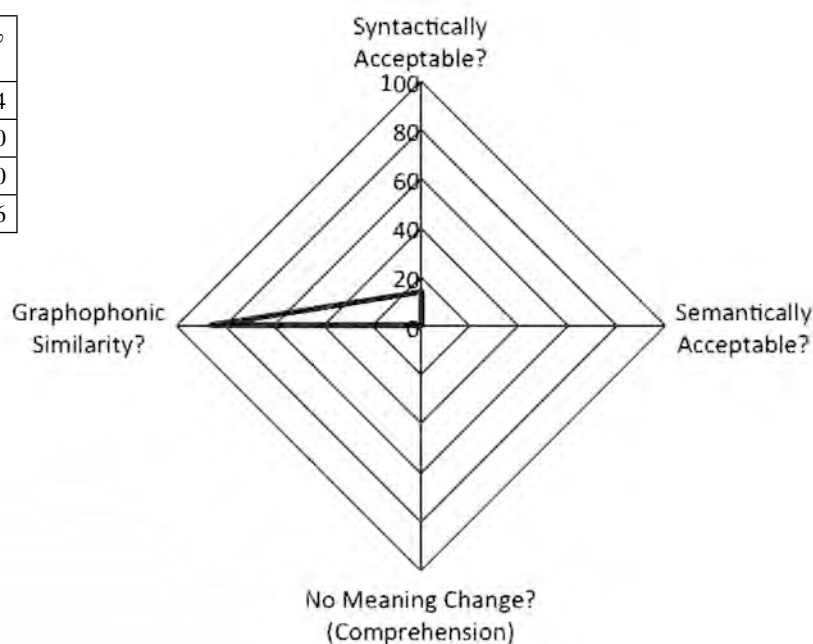| Miscue Analysis Percentages	%
Syntactically Acceptable?	86
Semantically Acceptable?	86
No Meaning Change?	57
Graphophonic Similarity?	50
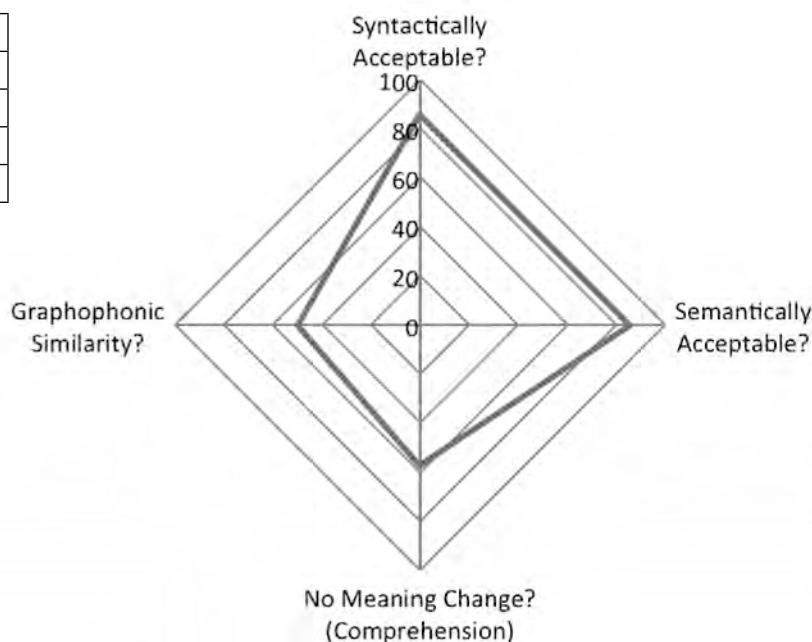
We have also used two spider charts to show multiple aspects of cueing system use for an individual reader. A very young child's reading of an eight-page text (*Baby Food* by Dunn, 1996) with three words per page looked like Figure 4 when she attempted to unsuccessfully sound out each word. However, when the preservice teacher encouraged her to read the *pictures* in the same text, this kindergartner invented a sensible narrative that fit the illustrations. Figure 5 displays her strength in

Figure 4. Reading print: A young child's first reading focused on graphophonic cues

Miscue Analysis Percentages (Reading the Print)	%
Syntactically Acceptable?	14
Semantically Acceptable?	0
No Meaning Change?	0
Graphophonic Similarity?	86

Figure 5. Reading illustrations: The same young child's second reading of the same book focused on syntactic and semantic cues

Miscue Analysis Percentages (Reading the Pictures)	%
Syntactically Acceptable?	85
Semantically Acceptable?	85
No Meaning Change?	71
Graphophonic Similarity?	0
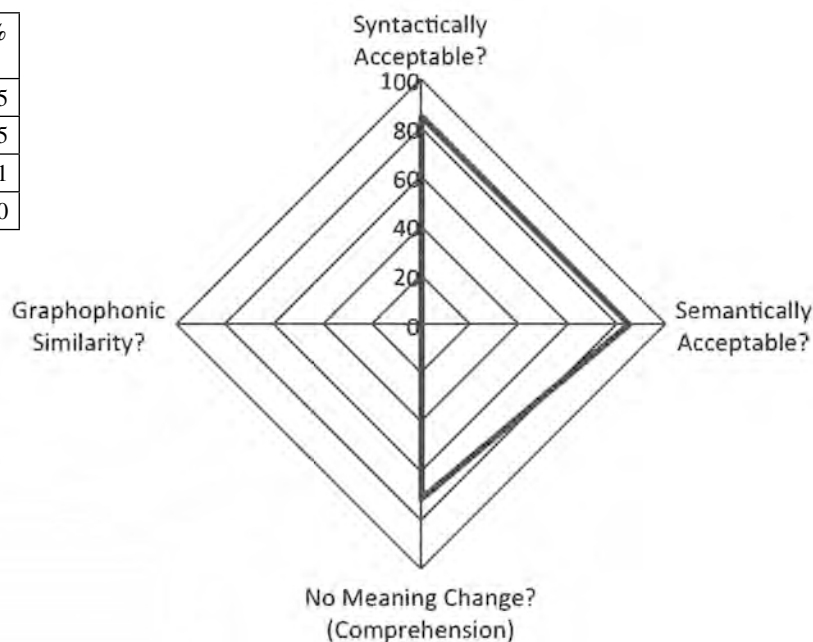
picture-reading, her use of corresponding semantic cues in the illustrations, and syntactic cues that linked to her knowledge of book language.

The contrast between the two charts shows that her use of semantic and syntactic cueing systems was much stronger when compared to her limited ability to use graphophonic cues, suggesting that picture reading could make a good foundation for sustaining reading as she develops further knowledge about print. Together, the two charts show a

picture of an early reader developing awareness of, but not yet coordinating, all cueing systems. This literacy learner benefited from using Elkonin boxes to develop her graphophonic ability, as well as opportunities to tell stories for picturebooks, including wordless books where she could add her own captions by writing sticky notes for the pictures. It's important to keep the focus on meaning and to use graphophonic information as a support for reading and writing meaningful sentences.

Conclusion

By adding spider charts to their miscue analyses, our preservice teachers could more easily see how young children were coordinating cueing systems


CREATING SPIDER CHARTS

Spider charts can be created manually by plotting the percentages on a template similar to the chart below. However, teachers may find it more convenient to enter the data into a spreadsheet that automatically produces a radar (spider) chart.

To use an online tool to create an instant spider chart, go to http://e339blog.blogspot.com/2012/01/visualizing-reading-processes-with.html. To create your own spider chart in a spreadsheet, first create a table of eight cells:

Syntactically Acceptable?	80
Semantically Acceptable?	70
No Meaning Change?	60
Graphophonic Similarity	75

Using the spreadsheet's chart function, create a spider chart (also known as radar chart).
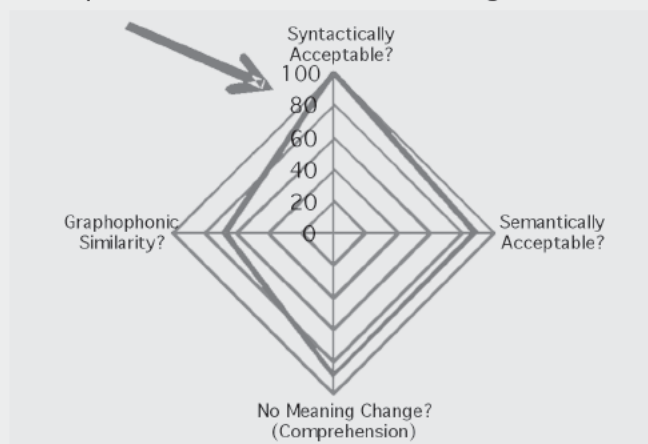
Excel 2007 in Windows*	Excel 2008 in Apple**
Highlight the eight cells, and then click on the **Insert** tab. Select **Other Charts** and choose **Radar** in the drop-down menu.	Highlight the eight cells, and then click on the **Insert** tab. Select **Chart** in the menu and click the **Radar** tab in the ribbon. Choose **Radar** chart type.
For purposes of comparison and mapping a child's progress over time, it is important to format the axis for a maximum of 100 and a minimum of 0 by clicking on the button to choose a fixed scale.	
Set the axis scale to 100 by **right-clicking** on the axis numbers (indicated by arrow) and choosing Format axis in the pop-up menu. This will open the **Format Axis** dialog window. Click the **Axis Options** tab, then click the radio button **Fixed** and set the **minimum** to **0**. Repeat to set the **maximum** to **100**.	Set the axis scale to 100 by **double-clicking** on the axis numbers (indicated by arrow). This will open the Format Axis dialog window. Click **Scale** and set the **minimum** to **0** and the **maximum** to **100**.
*These directions are for Microsoft Excel 2007 running Vista on a Windows platform. Earlier versions of Excel may not offer spider (radar) charts. Other spreadsheet software may offer similar charts.	**These directions are for Microsoft Excel 2008 running Mac OS X 10.6.7. Earlier versions of Excel may not offer spider (radar) charts.
(For practical guides on conducting miscue analysis, see Freeman & Freeman, 2000; Owocki & Goodman, 2002; Wilde, 2000; for in-depth discussion, consult the extensive body of research in this area by Goodman, Watson, & Burke, 2005).	

with far less explanation from me than needed with previous classes who conducted similar assessments. Students' spontaneous comments in their reflections on the assignment showed that this visual display was helpful: "This assignment was a really great way to put together all the parts of teaching reading" and "It helped me put the ideas together in an organized way." Although this article focuses on the use of spider charts with children in K–1 primary grades, it is likely that spider charts could also effectively show relationships among cueing systems for readers in intermediate grades or for English Language Learners; keep in mind, however, that those students may use quite different reading strategies than kindergarten and first-grade readers.

The ability to quickly visualize a student's coordination of reading cueing systems has the potential to help preservice and inservice teachers

- make decisions about appropriate teaching responses to strengthen readers' flexible strategy use.

- create a mental model to conceptualize how readers coordinate strategies, adding "miscue eyes" to Owocki and Goodman's (2002) notion of "miscue ears"—in other words, to cultivate a meaning-focused disposition to reading and to develop an ability to use informal miscue analysis in "over-the-shoulder miscue analysis" (Davenport & Lauritzen, 2002).

- communicate student learning to interested parents and administrators.

- show policymakers that reading is much more than discrete skills or test score answers.

Visualization tools like spider charts provide much-needed ways of demonstrating that reading is dynamic meaning production that requires responsive teachers who provide just-enough and just-in-time support for learners who are constantly making on-the-spot decisions to flexibly coordinate a complex set of systems. After a decade of reading policy driven by the National Reading Panel's five pillars

(phonemic awareness, phonics, fluency, vocabulary, and comprehension), there is increasing consensus among literacy scholars that this approach to reading is partial, overemphasizes constrained skills (e.g., letter recognition in Paris, 2005), and underemphasizes comprehension (Cassidy & Loveless, 2011; Dooley, 2010). In light of growing awareness of the ineffectiveness of DIBELS (Allington & Pearson, 2011) and other assessments that reduce reading to a narrow set of skills that can be easily tested, it's time to revisit and revitalize more complex measures of reading processes that capture how readers coordinate information from print and image with knowledge of cultural language patterns and the ongoing construction of meaning.

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