Errors that occur during text reading reflect how a novice reader is drawing from multiple sources of information including meaning (M – a range of story content and features), language structure (S – syntax and grammar) and visual (V – “letter-to-sound and sound-to-letter links” (Clay, 2016, p. 129) that is, the reader’s stored graphemic and phonological knowledge. Observing, recording, and coding oral reading errors based on MSV is an initial step in the analysis of beginning readers’ complex approaches to word solving. Our goal in this article is to explicate and warrant MSV-based approaches to word recognition instruction. First, we examine instructional and observational research that supports the use of MSV. Next, we describe change over time in children’s developing word recognition processing based on teacher observation and coding of errors. Then, we contrast recommendations to guide teachers’ responses to students’ oral reading errors. Finally, we consider the complexity of designing classroom curriculums or early intervention implementations based on research.

As teacher educators and members of the Reading Recovery® professional community, we have accumulated significant experience, research, and theoretical perspectives that connect literacy learning and instruction, most specifically, as it relates to children who struggle with initial literacy learning (Doyle, 2018; Schmitt et al., 2005; Sirinides et al., 2018). Based on observations, both formal and informal, we are eager to engage in dialogue among basic and applied researchers, teachers, and other educational professionals to develop new knowledge and that will move the field forward (Solari et al., 2020).

**Instructional Research**

Psychology has a long history of research on the process of reading and implications from this research have been used to support the development of literacy curriculums and instructional practices (Pearson, 2004; Shanahan, 2020). This influence on policy and practice was greatly enhanced by the inclusion of the term “scientifically based reading research” in the Reading First legislation (U.S. Department of Education, 2002). It is defined in Section 1208(6) as research that

(A) applies rigorous, systematic, and objective procedures to obtain valid knowledge relevant to reading development, reading instruction, and reading difficulties; and

(B) includes research that —

(i) employs systematic, empirical methods that draw on observation or experiment;

(ii) involves rigorous data analyses that are adequate to test the stated hypotheses and justify the general conclusions drawn;

(iii) relies on measurements or observational methods that provide valid data across evaluators and observers and across multiple measurements and observations; and

(iv) has been accepted by a peer-reviewed journal or approved by a panel of independent experts through a comparably rigorous, objective, and scientific review.

Observation and experimental procedures are given equal weight in this definition of scientific research. Laboratory experimental studies and the meta-analytic procedures used to identify reliable patterns across these experiments provide causal evidence
that can be used to test theories and evaluate alternative processing models (Castles et al., 2018; National Reading Panel, 2000; Petscher et al., 2020; Rayner et al., 2001; Tunmer & Nicholson, 2011). Still, this basic research can provide only tentative implications for practices that need to be tested in real-world effectiveness studies (Institute of Education Sciences, 2016; Solari et al., 2020).

When the focus shifts from a theory-based “science of reading” to a practice-based “science of literacy” instruction, different types of research are required to test the effectiveness of the implementation and to specify the characteristics of students, teachers, conditions, and systems that contribute to demonstrated effects (Shanahan, 2020; Seidenberg et al., 2020; Solari et al., 2020). The Reading Recovery scale-up evaluation (Sirinides et al., 2018) is an example of a real-world instructional research, which showed substantial results in word reading and comprehension measures (Boulay et al., 2018). This evaluation includes both a regression discontinuity analysis and four independent randomized experimental trials, thus providing the replication of results essential to the accumulation of scientific knowledge (Institute of Education Sciences, 2016; Solari et al., 2020).

Shanahan (2020) references Reading Recovery as an example of “instructional practices, supported by pedagogical research but inconsistent with basic research findings” (p. 242). He likens Reading Recovery to a hummingbird:

What physicists and engineers knew about aerodynamics was not consistent with the flight behaviors they could observe in hummingbirds (Ransford, 2008). That led them to a great deal of study of hummingbirds, expanding what we now know about flying and hovering. Instead of assuming that the basic knowledge of aerodynamics was complete and correct, researchers decided that it was worth probing those instances where practice was not in accord with empirically grounded theory. (p. 243)

As with the hummingbird’s flight, it is worth probing more deeply into the seeming contradiction between instructional implication drawn from basic science and findings from instructional research. Shanahan (2020) points out that the Reading Recovery evaluation was not designed to demonstrate the effectiveness of particular instructional components. While the study did not isolate active ingredients, the independent research team (May et al., 2016) did conduct extensive interviews and observations to identify factors that might contribute to variations in effectiveness across teachers and sites. They identify instructional strength as a major source of variation, specifically naming teachers’ deliberateness and instructional dexterity. “In Reading Recovery, deliberateness is understood as an encompassing commitment to thoughtful practice; instructional dexterity is defined as the flexible application of deep skill” (p. 91).

Reading Recovery teachers engage in extensive professional learning activities to support their deliberateness and instructional dexterity as they work with individual children on all the components of a typical Reading Recovery lesson (Clay, 2016). These components include

- reading of familiar text;
- oral reading assessment and instruction on the text introduced in the previous lesson;
- letter identification (including name, sound, and formation);
- word study using known words;
- writing (including composing a message, spelling using sound to letter expectations, and development of writing vocabulary);
- reconstructing a cut-up version of the child’s written message; and
- the introduction and reading of novel text.

A major focus of the teachers’ professional learning activities centers on the observation, analysis, and possible teaching decisions in response to the child’s oral reading errors, that is, their MSV patterns. The demonstrated effectiveness of the Reading Recovery intervention (Schwartz, 2018; Schwartz & Lomax, 2020; Sirinides et al., 2018) warrants further consideration of how this aspect of instructional strength contributes to student learning. In the next section, we examine the observational research that forms the basis for teachers’ analysis and decision process.

Observing Children’s Oral Reading Errors

Marie Clay laid the foundation for her subsequent development of the Reading Recovery intervention with a year-long observational study of
Clay (1968) indicated that, “When a child gave a reading response that was not an acceptable pronunciation of the stimulus word for the linguistic environment in which it occurred, an error was recorded. The errors corrected by a child without prompting were called self-corrections” (p. 435). Across the year she recorded a total of 10,525 errors of which 26% were self-corrected (Clay, 1968). Each error was analyzed for the kinds of information used (or neglected) up to the error (Clay, 2013).

- Did the meaning/message influence the error? (M)
- Did the sentence structure (syntax) influence the response? (S)
- Did visual information from the print influence any part of the response? (V)

Based on an end-of-the-year standardized reading test, she divided her sample into four quartiles. Students in the highest quartile showed a self-correction rate of 35% compared to 11% by the lowest quartile students.

This observed difference in the self-correction rates, growth, and change over time between high-progress beginning readers (top quartile) and striving readers (lowest quartile) played a key role in Clay’s subsequent development of her literacy processing theory (Clay, 2015a, 2015b; Doyle, 2018) and early intervention procedures (Clay, 2016). Clay observed that, from the beginning, children who became proficient readers used their oral language knowledge as a way of predicting words and detecting errors. Gradually, over time, visual perceptual learning—including, letter, letter-sounds associations, word, and the efficient use of word parts and syllables—would eventually dominate the word recognition process (Doyle, 2018).

In a study of beginning readers’ word recognition errors, McGee et al. (2015) reviewed the findings of previous observational studies and added their own analysis of 1,362 error episodes. The participants in their study were selected for Reading Recovery intervention support based on a literacy screening measures administered in the fall of first grade (Schmitt et al., 2005). According to Elliott’s (2020) discussion of common conceptions of dyslexia, these striving readers would qualify as the lowest-performing students on the screening measure, similar to Clay’s lowest quartile students at the end of their first year in school. McGee et al. subdivided the intervention group based on end of first grade measures into those now performing at average levels (74%) and those still reading below grade level (26%). The latter group fits another of Elliott’s (2020) conceptions of dyslexia as students showing persistent intractability to high-quality intervention.

McGee et al. (2015) classified errors as single action, when a student made an error and kept on reading, versus action chains in which the student noticed the error and either self-corrected or made multiple attempts to solve the word recognition difficulty. McGee et al. examined differences in error behavior across these groups and as text complexity increased across text levels 5, 7, 9 to 12 (Pearson & Hiebert, 2014). They found that students in both groups at the lowest text level made a number of single action errors (34%) based on contextual information (M and S). As students moved to reading more complex texts at their instructional level (greater than 90% accuracy), they increased their use of letter-sound information (V) and the combination of letter-sound and contextual information (MSV). A major difference between the two groups of students was that “RR students who ended the year reading at the first-grade level increased their use of these action chains, whereas RR students who ended the year reading below this level did not” (McGee et al., 2015, p. 263). This shows a difference between groups in the tendency to notice and take action on their own errors.

**Change Over Time in Word Recognition Processing**

Word recognition models that include self-correction as a critical component of change over time must include processing related to “searching” and “monitoring” (Clay, 2015b; Doyle, 2018; Schwartz 1997, 2005, 2015; Schwartz & Gallant, 2011). When reading texts, children search information sources to generate an initial attempt to read an unfamiliar word. They may then use additional information to monitor the attempt and initiate further searching if needed. Since correct responses fit all
possible information sources, studies analyze errors to infer the types of information readers are using for monitoring and searching.

Like Seidenberg et al. (2020), we find Kahneman’s (2011) perspective on processing helpful in thinking about how beginning readers might coordinate information sources for monitoring and searching (Schwartz, 2015). Kahneman describes two types of processing: The fast intuitive processing (System 1) used in most everyday situations and the more deliberate and effortful processing (System 2) that can be used to monitor and correct errors resulting from intuitive processing. The following problem demonstrates how these processing systems typically function (2011, p. 44).

A bat and ball cost $1.10.

The bat costs one dollar more than the ball.

How much does the ball cost?
The intuitive answer given by 50–80% of college students is 10 cents. These respondents fail to invest the additional System 2 processing required to check whether their answer fits all the information (i.e., If the ball cost 10 cents and the bat cost a dollar more than the ball, the bat alone costs $1.10, so together the bat and ball cannot cost $1.10).

Given this view of processing, it is not surprising that novice and striving beginning readers generate many single-action word recognition attempts based on contextual information (M and S) and fail to monitor these attempts as they read instructional level texts (McGee et al., 2015; Schwartz, 2015). For example, when reading a book about objects that are either hard or soft, a child might say “bunny” instead of “rabbit” in the sentence “A rabbit is soft.” Kahneman describes this type of processing as the law of least effort.

If there are several ways of achieving the same goal, people will eventually gravitate to the least demanding course of action. In the economy of action, effort is a cost, and the acquisition of skill is driven by the balance of benefits and costs. (2011, p. 35)

The child has achieved the goal of providing a meaningful response to the printed page, matched a word in oral language to each word in print, used the language structure of the book, and correctly identified the known words “A” and “is.” Prompting the child to monitor this response by visual (V) information may activate System 2 processing, reduce the types of information the child needs to consider, and result in the child rereading the sentence, noticing the error, and perhaps self-correcting.

Clay (2015a) describes children as ‘using ‘predict and check’ in many cases as a substitute for letter-sound decoding, in situations where their print knowledge was inadequate. These intermediate skills enable a reader to use prediction to narrow the field of possibilities and to reduce the decoding load” (p. 254). Direct instruction, along with reading and writing experience, increases print knowledge and the ease of access to stored letter-sound relationships. Prompting striving beginning readers to use this developing knowledge to monitor their word recognition attempts can refine their processing. As McGee et al. (2015) found, orthographic information begins to play a more dominant role in single action errors, with students showing rapid progress continuing to refine the types of information they were able to monitor.

If children’s processing followed a simple progression, it would be easy to base instructional decision on an analysis of error behavior. Multiple factors, however, influence the type of processing a child might demonstrate at point of difficulty. These factors include the child’s (a) current language ability; (b) item knowledge related to letters, sounds, orthographic patterns, and words; (c) the syntax and position of a word within a sentence; (d) the overall complexity of the text; and (e) relative difficulty of the text for a child (Briceño & Klein, 2019; Clay, 2015b). These factors contribute to complex error patterns. Siegler (2007) explains this type of developmental pattern as overlapping wave theory. The theory maintains that early strategic approaches to cognitive tasks coexist and are gradually replaced by more advanced processing. The onset and uptake of new strategic approaches can be slow or more rapid, thus leading to waves with gradual or steeper crests. Several waves may eventually give way to the mature form of processing which approaches near 100% use.

In reading development, the mature form of processing would be the automatic word identification described by Ehri (2020). The waves represent changes in monitoring and searching as readers become more efficient at using information from the text and their knowledge of letter-sound connections. Multiple waves coexist and may be displayed at points of difficulty. Despite the complexity of children’s error patterns, Reading Recovery teachers attempt to foster progress by careful analysis of change.
over time in these patterns (Clay, 1998, 2015b; Doyle, 2019; McGee et al., 2015; Schwartz & Gallant, 2011). This analysis establishes a teacher’s deliberate orientation to respond to particular types of errors and dexterity in responding to these errors when observed.

We agree with Petscher et al. (2020), Seidenberg et al. (2020), Ehri (2020), and the large body of research that demonstrates that skilled readers identify almost all words automatically without letter-by-letter sounding out or contextual guessing. We also concur with Petscher et al.’s concern that contextual guessing, even if integrated with some partial graphophonemic information, may not provide the orthographic learning needed to support automatic word identification.

Instruction fostering students’ monitoring of word recognition attempts by visual information, however, addresses both of these concerns. Ehri (2020) describes several studies in which orthographic mapping goes from sound-to-letter connections rather than the letter-to-sound connections. Sound-to-letter connections are frequently employed in writing programs to support spelling and to develop a writing vocabulary (Castles et al., 2018; Ehri, 2020; Richgels, 2001).

Still, we would not expect striving readers to make progress toward mature word recognition processing without considerable direct instruction to build letter-sound knowledge. The Reading Recovery intervention includes direct instruction in letter-sound connections during the letter, word, and text reading components of the lesson, along with phonemic awareness and phonics instruction during the writing component using Elkonin boxes to scaffold this learning. This is why Adams (1990) noted, “The Reading Recovery program has been methodically designed to establish and secure that whole complex of lower-order skills on which reading so integrally depends” (p. 421).

Instructional Decisions
Scanlon and Anderson (2020), Davis et al., (2020), and Duke (2020) all present recommendations that classroom teachers can use to help beginning readers search for information to make a word recognition attempt when they encounter a word that is part of their oral language, but unfamiliar in print. Davis et al. and Duke both recommend searching procedures based on sounding the letters of the word in sequence. Davis et al. suggest a process of saying and blending the sounds of the letters. Duke’s process emphasizes sliding through the sounds within the word to avoid extraneous vowel sounds that result from trying to produce individual consonants in more traditional “sound it out” procedures. Both sets of recommendations include monitoring these visual attempts by meaning and language structure.

Davis et al. (2020) and Duke (2020) recognize that beginning readers may use M and S to generate some word recognition attempts, especially “when they have not yet acquired enough alphabetic knowledge to kickstart the processes of orthographic mapping” (Davis et al., 2020, p. 8). Since monitoring by visual information is not part of their system, it is unclear how they expect teachers to respond to word recognition errors based on M and S but undetected by the child. Prompting children to monitor these types of errors using sound-to-letter expectations would likely advance their goal of having beginners “attend closely to the letters in words and their associated sounds” (Duke, 2020, p. 3).

Scanlon and Anderson’s (2020) word recognition approach includes using meaning clues from pictures or context; structure clues from rereadi-
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Selecting the prompt that fits the observed reading behavior demonstrates instructional dexterity and is grounded in the teacher’s deliberate analysis of previous running records of text reading. This type of contingent teaching is complex even in a one-to-one teaching context.

If the child has completed the sentence without showing signs of having noticed the error, a prompt with high support would be, “That makes sense. Check to see if it looks right” (referring to the whole sentence, not pointing to the error). A lower level of monitoring support might ask, “Were you right?” As the child rereads the sentence and says “home,” phonics knowledge creates the expectation of seeing an “m” near the end of the word. Notice the conflict between sound-to-letter expectations and the print is a first step in creating a new wave of visual monitoring.

Selecting the prompt that fits the observed reading behavior demonstrates instructional dexterity and is grounded in the teacher’s deliberate analysis of previous running records of text reading. This type of contingent teaching is complex even in a one-to-one teaching context.

Looking at a different type of contingent teaching, Phillips and Smith (1997) reported that intervention teachers responded to 95% of student errors, but only fostered post-error self-monitoring 34% of the time. Teachers maximize their instructional dexterity by basing their responses to students’ errors first on whether the student has noticed their error (monitoring) and then on the type of information sources used to generate the initial attempt.

Complexity in Research and Practice

Most children (80–90%) do not require the procedures developed for early intervention with striving beginning reader and will learn to read in classroom programs of many different kinds. High progress students...
learn the components emphasized by the selected approach and infer any additional processes needed to construct an effective literacy processing system. This makes it difficult to identify the critical element of any comprehensive literacy program or intervention (Clay, 2015b, 2016).

Word recognition instruction that includes M and S information as part of early processing has been critiqued because basic research clearly shows this is not how skilled readers identify words (Ehri, 2020; Seidenberg et al., 2020; Stanovich, 2000). It is equally true, however, that skilled readers do not sound out words letter by letter. Supporting change over time in children’s word recognition processing (Clay, 2015b; Seidenberg et al., 2020; Ehri, 2020) requires a deeper understanding of beginning reading. Classroom curriculums and early interventions should reflect this complexity.

Petscher et al. (2020) argue that an early emphasis on letter-to-sound processing of words is necessary to promote the orthographic mapping that supports skilled word identification. We argue that sound-to-letter processing to monitor word recognition attempts can also support change over time in students’ searching strategies and orthographic mapping. Ehri’s (2020) research has shown that both paths can facilitate learning. The common goals are that children (a) identify most words automatically, (b) solve “challenges including multisyllabic words within more difficult texts at speed, working with clusters of letters” (Clay, 2016, p. 47), and (c) show evidence of becoming self-extending readers and writers (Clay, 2016; Share, 2008).

Seidenberg et al. (2020), Shanahan (2020), and Solari et al. (2020) each describe the complexity of moving from basic science to instructional practice. Unfortunately, attempts to bring research-based practices to scale have too often lost their effectiveness in translation (Balu et al., 2015; Boulay et al., 2018; Gamse et al., 2008). An exception to this pattern is the independent evaluation of the Reading Recovery scale-up that demonstrates effectiveness and replication of effects with striving beginning readers over four large independent samples in standard school settings (Schwartz & Lomax, 2020; Sirinides et al., 2018).

Shanahan (2020) likened Reading Recovery effectiveness to a hummingbird’s unexpected success in flying. Scientists needed to conduct considerable research to explain how it managed to fly. We offer this discussion of word recognition processing to engage basic researchers and educators in a dialogue to advance our understandings of how to help children having difficulty learning to read take flight.

References


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