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Retrieval, Automaticity, Vocabulary Elaboration, Orthography (RAVE-O): A Comprehensive, Fluency-Based Reading Intervention Program

Maryanne Wolf, Lynne Miller, and Katharine Donnelly

Abstract

The most important implication of the double-deficit hypothesis (Wolf & Bowers, in this issue) concerns a new emphasis on fluency and automaticity in intervention for children with developmental reading disabilities. The RAVE-O (Retrieval, Automaticity, Vocabulary Elaboration, Orthography) program is an experimental, fluency-based approach to reading intervention that is designed to accompany a phonological analysis program. In an effort to address multiple possible sources of dysfluency in readers with disabilities, the program involves comprehensive emphases both on fluency in word attack, word identification, and comprehension and on automaticity in underlying componential processes (e.g., phonological, orthographic, semantic, and lexical retrieval skills). The goals, theoretical principles, and applied activities of the RAVE-O curriculum are described with particular stress on facilitating the development of rapid orthographic pattern recognition and on changing children's attitudes toward language.

The RAVE-O (Retrieval, Automaticity, Vocabulary Elaboration, Orthography) reading intervention program is a direct outgrowth of the implications of the cumulative work that has attempted to understand the phenomenon of naming-speed deficits in severely impaired readers. The central purpose of the RAVE-O program is the development of fluency and automaticity in these readers. In this article, we first briefly describe the research context from which the RAVE-O program emerged. It is hoped that readers unfamiliar with this literature will read the other articles in this special issue first, particularly the review by Wolf, Bowers, and Biddle. Second, the goals and major theoretical principles that guided program design are discussed. Third, we present an overview of the program's instructional structure with selected examples of methods that illustrate how the various components are implemented in

the classroom. The purpose of this article, therefore, is to give a theoretical description—rather than an empirical study—of the first major application of this conceptualization of reading disabilities.

Background

Stemming from original studies by Geschwind (1965), Denckla (1972; Denckla & Rudel, 1976a, 1976b), and Spring and Capps (1974), convergent evidence over the last 2 decades has demonstrated that the majority of children with reading disabilities (RD) across all languages and ages tested have naming-speed deficits (Ackerman & Dykman, 1993; Badian, 1995, 1996a, 1996b; Bowers, Steffy, & Tate, 1988; Denckla & Rudel, 1976a, 1976b; Grigorenko et al., 1997; Lovett, 1992, 1995; McBride-Chang & Manis, 1996; Meyer, Wood, Hart, & Felton, 1998;

Snyder & Downey, 1995; Spring & Capps, 1974; Spring & Davis, 1988; Swanson, 1989; Wolf, 1979; Wolf, Bally, & Morris, 1986; Wolff, Michel, & Ovrut, 1990; Wood & Felton, 1994). As discussed in this special issue, we have demonstrated that naming-speed deficits and the better known phonological deficits represent two separable sources of reading failure whose co-occurrence leads to profound reading disability. The extensive research on phonological deficits amply supports the view that learning grapheme-phoneme correspondence rules in early reading acquisition is based on the more basic phonological ability to analyze the sounds within words (Shankweiler & Liberman, 1972; Stanovich, 1986; Torgesen, Wagner, & Rashotte, 1994).

The relationship between reading failure and the processes underlying naming speed appears more complex. As discussed by Wolf, Bowers, and Biddle (in this issue), naming speed is

conceptualized as the end product of an ensemble of both lower level perceptual, attentional, articulatory, and lexical retrieval processes and higher level cognitive and linguistic processes, each of which requires extremely rapid rates of processing. This is particularly the case for alphanumeric stimuli that reach automatic-like levels of processing. We argue that many of these same processes are also used in word recognition processes in reading. Thus, in many instances, deficits in processes underlying naming speed also affect processing speed in naming and word recognition. The degree of dysfluency in particular aspects of word recognition (e.g., word attack or word identification processes) is dependent on where the underlying deficits occur and how systemic they are (see Wolf & Bowers, 1999, in this issue). The result is that deficits that impede rapidity in naming speed, particularly for alphanumeric stimuli, also impede the lower level requirements necessary for fluent word recognition processes that, in turn, affect reading comprehension.

Recently, Bowers and Wolf (1993; Wolf & Bowers, 1999, in this issue) have articulated a reconceptualization of dyslexia, the *double-deficit hypothesis*, to emphasize the separate roles that core deficits in processes underlying naming speed and underlying phonology play in reading failure. Three subtypes of reading disabilities are predicted in this hypothesis, with readers having (a) phonological deficits, (b) rate or naming-speed deficits, and (c) double deficits, which are accompanied by the most pervasive form of reading disabilities. The most important implication of this hypothesis is that it provides a new theoretical direction for intervention. For example, using the aforementioned subtypes, children with single phonological core deficits would be well served by current phonologically based treatments; however, children with either single processing-speed deficits or double deficits would be only partially served by such treatments and would require

particular emphasis on building fluency in reading skills and, potentially, building automaticity in lower level processes subserving these skills. By working to better understand the role of fluency in reading development and incorporating this dimension in current phonologically based treatment models, we hope to better meet the needs of more children, particularly those children described by Torgesen, Alexander, Wagner, and Rashotte (1998) and by Blachman (1994) as "treatment resisters." We hypothesize that many such resisters are found in the naming-speed and double-deficit subgroups.

Although some notable exceptions are discussed in a later section, fluency is largely unaddressed in most current reading interventions that have rightly focused on what the RD field knows best (i.e., the phonological sources of reading disabilities). Research in the phonological areas represents more than 20 years of the most systematic, well-conceptualized work the RD field has ever conducted (Blachman, 1997; Bradley & Bryant, 1983; Brady & Shankweiler, 1991; Bruck & Treiman, 1990; Catts, 1996; Foorman, Francis, Shaywitz, Shaywitz, & Fletcher, 1997; Kamhi & Catts, 1989; Lyon, 1995; Olson, Wise, Connors, Rack, & Fulker, 1989; Perfetti, 1985; Shankweiler & Liberman, 1972; Siegel & Ryan, 1988; Stanovich, 1986, 1992; Stanovich & Siegel, 1994; Torgesen, Wagner, & Rashotte, 1994; Tunmer, 1995; Vellutino & Scanlon, 1987; Wagner, Torgesen, & Rashotte, 1994). As discussed by Torgesen, Rashotte, and Wagner (1997) and by Lyon and Moats (1997), phonologically based intervention, with its emphasis on phonemic awareness and decoding skills, has resulted in considerable progress in most reading behaviors among at-risk readers, with the exception of fluency-related skills:

Improvements in decoding and word-reading accuracy have been far easier to obtain than improvements in reading fluency and automaticity. This persistent finding indicates there is much we have

to learn about the development of component reading skills and how such skills mediate reading rate and reading comprehension. (Lyon & Moats, 1997, p. 579)

The double-deficit hypothesis' two-fold emphasis on phonological skills and on fluency and automaticity builds on past treatment models of phonological awareness and decoding skills, but it adds to them a new stress on rate of processing in each component skill and reading outcome. This point is embodied in the way that the RAVE-O program is conceptualized as one half of a treatment package. At no point is RAVE-O envisioned as an independent treatment; that is, it is explicitly designed to follow and expand a systematic phonological analysis and blending program, which serves as its foundation. This dual emphasis enables investigators to explore many unresolved questions concerning the relationship between accuracy and fluency in early word recognition processes. Although various phonological programs could in principle be used to teach phonological awareness and decoding skills, our own work has combined RAVE-O with the Phonological Analysis and Blending (PHAB) program described by Lovett et al. (1994) and based on SRA Reading Mastery I/II Fast Cycle (Engelmann & Bruner, 1988). In its current status, RAVE-O is designed as a secondary prevention program for children identified as at-risk readers in Grade 1 and 2. Although the program was designed to address reading difficulties associated with a naming-speed deficit and fluency issues, children with primary phonological deficits will also be assisted by the practiced instruction of the sublexical units.

As alluded to earlier, there are many basic questions in the area of fluency that are largely unanswered and critical to confront in future work. At the fore are questions about what is meant by fluency and by automaticity. In the past, we have used work in reading theory and cognitive sciences (e.g.,

Logan, 1988; Perfetti, 1985; Spring & Davis, 1988; Stanovich, 1990) to define *automaticity* cautiously as a continuum in which processes are considered automatic when they are fast, obligatory, and autonomous and require only limited use of cognitive resources (see discussions of automaticity in Logan, 1988; Stanovich, 1990; Wolf, 1991). In the present article, we use the term automaticity as just defined, but only in relationship to underlying component processes; we use *fluency* to refer to the acquisition of smooth rates of processing speed in reading outcomes (e.g., word identification, word attack, and comprehension). This somewhat arbitrary distinction helps us distinguish reading outcome from component skills in this program's design; however, we are aware that both these terms are used interchangeably in the literature. Regardless of definition, large theoretical questions remain unaddressed. Is automaticity for lower level, sublexical processes a necessary prerequisite for reading fluency, or can fluent reading be attained by practice and attention directed solely to the lexical or word level? Are there large individual differences in the development of fluency and automaticity? What is the relationship between fluency and accuracy in phonological awareness and decoding skills?

The double-deficit hypothesis, as presently articulated, offers no immediate answers to these questions. Rather, it provides a framework in which these questions can be addressed if optimal forms of fluency-based intervention are to evolve. In the absence of immediate answers with regard to the relationship between fluency and automaticity, the present form of the RAVE-O program was designed to treat *both* fluency in overt reading outcomes (Goal 1) and automaticity in underlying component skills (Goal 2). It is hoped that future studies in which one or the other of these areas is the basis of treatment will allow us to compare the efficacy of each approach, particularly for different reader subtypes.

Goals and Theoretical Principles

The RAVE-O program was designed as a small-group, intensive pull-out program for second and third graders at risk for reading failure. There are three overarching, interconnected goals that motivated the selection and design of activities within the program. This section describes each of the goals and some of the theoretical principles that guided their selection. It is important to underscore that in this program's design all three goals are conceptually and practically interwoven with no one goal predominating.

Goal 1

First, the ultimate goal of the program is the development of fluency in reading outcome behaviors, including word identification, word attack, and comprehension. This is a shared goal with the few other existing fluency programs, most of which emphasize the importance of practice, wide reading, and repeated reading in the achievement of fluency (Samuels, 1985; Samuels, Schermer, & Reinking, 1992; Stahl, Heubach, & Crammond, 1997). Stahl et al. (1997), for example, redesigned a basal reading program for a Grade 2 classroom in order to stress repeated reading, partner reading, choice reading, and home reading. Their use of practice and wide reading resulted in significant gains in fluency for most average readers and for one half of the children who had not been at the primer level. Bowers and her colleagues (Bowers, 1993; Young & Bowers, 1995; Young, Bowers, & MacKinnon, 1996) employed an assisted repeated reading technique, where the child reads simultaneously with a fluent reader in order to model not only pronunciation but also prosodic features of the text. Young, Bowers, and MacKinnon (1996) found gains in fluency and comprehension through repeated reading practice regardless of prosodic modeling (for a more complete review of this

literature, see Meyer and Felton, 1999). In all of these studies, the emphasis to date has been largely at the level of practicing connected text.

Goal 2

RAVE-O's second set of goals incorporates lexical and sublexical levels and represents a significant departure from previous programs' work at the level of connected text. An emphasis on the interconnectedness of sublexical and lexical processes is, we believe, important for achieving fluency in the variety of impaired readers. If there are, as we have described in other articles (see Wolf & Bowers, 1999, in this issue; Wolf, Bowers, & Biddle, in this issue), widely differing reasons for slow rates of processing in dysfluent readers, then it is important to attack a range of possible sources in our interventions. For example, at the sublexical level, RAVE-O activities emphasize the development of increased processing speed or automaticity in such underlying component skills as (a) vision-related processes such as left-to-right scanning, letter recognition, and, in particular, orthographic pattern recognition and (b) auditory processes that include faster initial and final phoneme and rime identification.

The theoretical rationale for attending to the rate of underlying sublexical processes is grounded in work in the cognitive sciences. Seidenberg and McClelland (1989), for example, posited that automatic letter pattern recognition is based on rapid visual and auditory perception, rapid visual-auditory matching, and sublexical pattern segmentation for the most frequent letter patterns. (To be discussed later, each of these underlying processes has become the basis of several RAVE-O subgoals and corresponding activities.) Within the RAVE-O program, it is important to note the centrality of the child's ability to perceive, segment, and recognize rapidly the most frequent orthographic multiletter patterns in the language (see the extensive work of Berninger, 1994, on the

role of orthography.) This set of abilities is seen as key to acquiring orthographic-level fluency, which, in turn, is seen as key to fluency in word recognition.

At the lexical level, the program places simultaneous emphasis on more fluent lexical retrieval skills alongside directly instructed semantic development. The latter work in vocabulary includes the systematic introduction of *core words*, each of which possesses (a) systematically introduced phonemes in the PHAB program, (b) connected orthographic patterns (e.g., rimes, consonant blends) that employ these phonemes, and (c) multiple meanings and rich associations attached to each meaning.

The theoretical rationale connecting phonemes and common orthographic letter patterns is that rapid word identification is facilitated by the ability to perceive and use multiletter units rather than by relying on often laborious letter-to-letter decoding. In her description of the "consolidated alphabetic" phase in reading acquisition, Ehri (1997) writes:

Repeated experience reading a letter sequence that symbolizes the same phoneme blend across different words yields a consolidated unit in which several graphemes become bonded to a blend of phonemes. Consolidation allows readers to operate with multiletter units that may be morphemes, syllables, or parts of syllables. . . . Knowing letter chunks is particularly valuable for learning multisyllabic words. (p. 178)

Our explicit emphasis on multiple exposures of the most common sublexical units in English (e.g., rimes, initial blends, and affixes) is to provide a lexicon of "sight" letter chunks to facilitate speed of word recognition processes (see also Juel & Solso, 1981).

The theoretical principle for connecting lexical retrieval and vocabulary skills is that rapid word retrieval is facilitated by the child's familiarity with and amount of knowledge about the word (see Beck, McKeown, & Omanon, 1987; Beck, Perfetti, & McKeown, 1982; German, 1992; Kameenui, Dixon,

& Carnine, 1987; Lahey & Edwards, 1996; Lorschach, 1982; Snyder & Godley, 1992; Wolf & Segal, 1999). Indeed, some work by Ferraro and his colleagues (Kellas, Ferraro, & Simpson, 1988) suggests that the speed of word recognition is facilitated by the number of meanings available for a given word. In other words, the child retrieves fastest what she or he knows best in oral and written language. Each of these component skills will be discussed further with concrete examples in later sections.

To summarize the first two goals, the RAVE-O program is designed as a comprehensive approach toward fluency that addresses multiple levels of reading-related skills. The underlying sublexical skills, particularly for orthographic letter pattern recognition, are addressed along with lexical-level retrieval and vocabulary skills. The facilitation of speed and accuracy at these lower levels is believed to enhance the speed and accuracy of word attack, word identification, and comprehension, especially for the population of impaired readers whose heterogeneity can be based on a variety of underlying sources.

Goal 3

The third goal is the most difficult to articulate and implement, but essential to overall success—that is, an evolving self-recognition by the children of their growing command over the language, through incremental success in daily practice and an accumulation of metacognitive tools (strategies) aimed directly at decoding and retrieving words. In other words, our third goal has both a cognitive and an emotional component that work together to change children's attitudes toward language and their perception of themselves as language learners (Donnelly, Joffe, & Wolf, 1998).

Negative attitudes like denial, inflexibility, and fear of failure, we believe, are the product, not the precursor, of reading problems in most young impaired readers. Many of the poor

readers we have taught believe that they cannot gain control of the reading puzzle—that there is some magic to learning to read that they will never know. They do not readily make the connection between the strategies they are taught and the ability to decode. In the RAVE-O program, we call the metacognitive strategies that are taught "magic tricks," thus tacitly confronting this often implicit belief in poor readers that reading is beyond their ken. By calling children "word magicians" or "speed wizards," we place them more in control of their own "bag of tricks."

The RAVE-O materials are designed to combat students' expectations of failure by establishing a platform of success in early reading skills. Each material can be used in a variety of activity formats, so that componential skills can be systematically developed by the teacher and presented in small-step challenges that are within the reach of individual students. Students' initial successes and their observations of their own growing competence encourage greater risk-taking and rekindle their beliefs in their own capacities to learn. Practice is key in this process, some of which is provided by computerized word and letter recognition games called Speed Wizards (described in the next section).

The combined emotional and motivational components that contribute to a changed attitude toward learning to read are integral to the RAVE-O structure. For example, the RAVE-O program's intensive small-group, pull-out approach allows teachers to build an environment that fosters this growth. The trusted community of the small classroom becomes the place to try new skills and discover new strengths. Both the teacher and the students work together to build a RAVE-O classroom, where children become able to express the frustration in not being able to learn something easily as well as the positive feelings accompanying success. One way the children learn this is through play—in this case, through the game-like formats that characterize much of the RAVE-O curriculum.

Indeed, at the surface level the RAVE-O program may appear to be a collection of whimsical activities that actively attempt to engage the child's and the teacher's imagination. First, this engagement is critical. Second, whimsy and fun not only disguise much-needed practice and multiple exposures, but they are also conceptualized as antidotes to self-perceived weaknesses and the consequent tendency to give up in many children with learning disabilities. Below the surface format, however, teachers use these game-like activities to provide a foundation of highly practiced skills and strategies in three areas:

1. phonological and orthographic pattern analyses of the internal structure of words into common sublexical units,
2. the retrieval of words through word finding strategies or the finding of alternative vocabulary choices, and
3. the semantic analysis of words into known roots and associations.

The unique features of this program lie in the explicitly connected, daily practice of these three areas through fun activities.

Put another way, while playing games, the children are practicing the many necessary componential skills for decoding and reading comprehension. The teacher gradually helps them make the megacognitive connections between the skills they are practicing and their applications in other areas of their lives. The children are encouraged each day to report on where they saw a word, discovered a new meaning for a word, or used a magic trick to unlock an unknown word. The cumulative effects of these skills and strategies encourage the children to persevere during the exact moments of former weakness, and not give up. Eventually, the children begin reporting with pride how they have used these skills during other parts of the school day or at home.

To summarize Goal 3, we aim to change children's attitudes toward language, oral and written, and toward themselves as learners. The cognitive and emotional elements of this goal are inextricably bound in the curriculum's format, the pull-out environment, and the incremental units of learning that encourage both succeeding and persevering.

Summary of Goals

Underlying the convergence of this program's three goals is a framework based on a connectionist view of the reading process (Adams, 1990; Foorman, 1994): Phonology, orthography, and semantic processes are seen as integrally connected aspects of reading development. In a similar vein, we believe that different problems in reading acquisition can be based on various contributions by these three aspects of reading. The remainder of this article elaborates on the specific ways in which the above goals are implemented in the program, with special emphasis on orthographic and semantic skills. There will be no individual section on phonology, because the major work in this area falls within the province of the separate phonological analysis and blending program that is used (see Lovett et al., 1994, for description of the program used with RAVE-O in the National Institute for Child Health and Human Development (NICHD) intervention program by Morris, Lovett, & Wolf, 1996). Nevertheless, consistent with a connectionist view of reading, all work in orthography is conceptualized as using, reinforcing, and extending those skills taught in the phonological base.

The Development of Automaticity

The systematic development of fast, accurate letter pattern recognition is the central goal of this part of the program and is the basis of many RAVE-O activities. Based on the work of Seiden-

berg and McClelland (1989), Ehri (1997), and memory research on "chunking," RAVE-O was designed to address the components of letter pattern recognition with a range of activities.

The treatment package includes one half-hour of a phonological program and one half-hour of RAVE-O. As presently structured, the package is designed for second and third graders and includes 70 1-hour classes that usually extend from October to March in an average school year (future planned iterations include a full-year program). The focus moves from the phonological program's introduction of single phonemes to RAVE-O's introduction of predictable letter patterns using those phonemes; for example, onset-rimes, consonant blends and digraphs, and common affixes are gradually introduced. Children in the same session, therefore, are taught in the phonological program to analyze a selected group of phonemes and in RAVE-O to use these same phonemes to perceive sublexical chunks that speed up word recognition. In this way, RAVE-O both reinforces and expands word attack skills.

Several concrete examples illustrate this interconnected application of phonological and orthographic skills. A child is introduced to the vowel sound *a* and the consonant sound *m* in the PHAB program. In RAVE-O, the child learns several core words with the *am* rime (e.g., *jam* and *ram*). After the multiple meanings of the core words are discussed, the words are taught on *rime cards* with separable *starter (onset) cards* that are color coded (see orthographic pattern cards in chart on Table 1). Students learn to segment and recompose a set of approximately five core words each week and also to identify other words with the same rime patterns. They begin to recognize the segments (chunks) in words and to become more flexible in their ability to recognize multiple other examples of taught letter patterns.

Orthographic pattern cards (that is, the rime, starter, and ender cards) offer a high level of teacher control, so that the

TABLE 1
Relationships Between RAVE-O Materials Used in Activities and Reading Outcome in Componential Skills

RAVE-O Material/Activity	Description	Componential skill						
		Word identification	Word attack	Comprehension	Visual recognition	Auditory recognition	Semantic development	Lexical retrieval
Whole word cards	Index cards on which core words are printed							
Activity A	Used as visual cue in introducing words of the week; posted with image cards for the week	●			●		●	
Activity B	Used in orthographic sorting games		●		●	●		
Orthographic pattern cards	Playing cards printed with high-frequency rime patterns, onsets, and suffixes							
Activity A	Used to introduce sub- lexical units of words; practice "packing" and "unpacking" them		●		●	●		
Activity B	Used to generalize knowledge of core word rime patterns and onsets in matches with other known sublexical units	●	●		●	●		
Image cards	Pictorial representa- tions of at least two definitions of each core word							
Activity A	Used to introduce se- mantic background for each core word			●			●	
Activity B	Used in matching and memory games with orthographic pattern cards	●		●	●		●	●
Word Web	Wall chart of semantic associations to the multiple definitions for one word; structured questions guide brain- storm development of chart			●			●	●
Sound sliders	Set of folder with start- ers listed on its edge and card printed with rime patterns; card is inserted into folder and moved vertically to match sublexical units; shield limits no. of patterns attended to at one moment	●	●		●	●		

(table continues)

(Table 1 continued)

RAVE-O Material/Activity	Description	Componential skill						
		Word identification	Word attack	Comprehension	Visual recognition	Auditory recognition	Semantic development	Lexical retrieval
Spelling pattern dice	Dice printed with single onsets, blends, or rime patterns are combined to build words	●	●		●			
Minute stories	Illustrated controlled text stories read in only a minute or two; introduce contact and comprehension skills	●		●	●		●	
Writing worksheets	Short exercises integrating word family recognition and comprehension	●	●	●	●	●		●
Activity A	List building of rime family groups	●	●		●	●		
Semantic word games	Used to provide salient semantic and word family clues							
Mystery Word	In pairs, students give partner definition, association, or rime family clues in order to guess as many words as possible during time period		●	●		●	●	●
Tickets	Two-minute orthographic or semantic activities at end of day that require quick response and bring closure to class	●	●	●	●	●	●	●

Note. Although most activities address several interrelated goals in reading development, the goals targeted most directly by particular activities are marked. Note that each material can be used to address particular componential goals through the design of its use in the activity.

teacher can individualize the materials to match the student's level of achievement. By manipulating the total number of cards and patterns, the teacher creates activities that can challenge children and can ensure success.

As accuracy for core words is mastered, two fluency-related activities occur. First, rime pattern knowledge is generalized by additional starter cards to make new words (e.g., *ham*, *ram*). The goal of this activity is for the child to begin to realize that she or he has power over letters to "make words." The ability to create new words, in turn, facilitates the student's ability to

distinguish one word from another, thus building both word identification and word attack skills.

Second, to facilitate the underlying components of orthographic pattern recognition, an evolving, computerized set of games called Speed Wizards was designed in conjunction with Gordon Goodman at the Rochester Institute of Technology. The computerized game format permits the increased facilitation of

1. visual perception of teacher-selected, common orthographic patterns;

2. visual discrimination of similar sublexical patterns (e.g., *am* vs. *an*); and

3. visual-auditory matching (through games that have the student match the word on the screen to an auditory presented word).

Thus, the computerized Speed Wizards games have been designed to provide simultaneous attention to the sublexical-level skills discussed by Seidenberg and McClelland (1989) and to word-level skills.

Speed Wizards provides controlled, timed practice of the most common

rime patterns at four levels of difficulty. Practice can be constrained to only one or two rimes (e.g., *am* or *an* plus *an* rime words) or can include an entire vowel family of rime patterns. The auditory stimulus reinforces phoneme discrimination. There are five general game formats—one for each vowel. Each format extends from consonant–vowel–consonant (CVC) to compound and multisyllabic words that employ the embedded root rimes. Very important, children work to increase their individual speeds of word recognition. At any point, the teacher can have the child work on a particularly difficult speed for a given rime pattern or on a strategy for dealing with longer, multisyllabic words with a specific rime.

Multiple other activities (see Table 1) reinforce these same orthographic skills and strategies. Our guiding principle here is that a range of imaginative activities that teach the same skills in different formats is our best tool for helping children tolerate drill and routine. Based on work by Reitsma (1983) and Levy and Bourassa (1998), we seek to provide children with RD maximum exposure to common orthographic patterns, but in constantly varying ways.

Many of these activities are already long familiar to teachers but are used here in new ways with focused goals. For example, the orthographic cards can also be used in adaptations of well-known card games, such as Go Fish, Rummy, or Memory, to add a nuance of fun and a decrease in structure. Orthographic cards can also be incorporated into writing activities. Timed sorting or recomposing activities can add the speed dimension to push the development of automaticity.

Sound sliders are another game-like component that provide a next level of scaffolded practice of orthographic patterns. After the week's rime patterns are learned, sliders are often introduced. Sliders are easily made from a manila file folder and consist of a list of known patterns with a "sliding" initial phoneme. This tool allows students to match different possible starters with, for example, the *am*-family rime.

The activity combines visual, auditory, and semantic knowledge bases, as students generate lists of both real words and nonwords. Adding a timed component increases the development of rapid automatic responses to orthographic patterns.

Dice games are an activity that can reduce teacher scaffolding. *Spelling pattern dice* are composed of rime patterns for a single vowel or for two vowels. Starter dice have single consonants or consonant blends. Students can be guided in more controlled activities to use the dice as blocks to make words. Paired with a writing activity, it brings mastery over the system of words to a somewhat higher level. As students advance in the program, they enjoy the less scaffolded activity of dice games in which they roll a selection of dice and then compose as many words as possible. Variations of solitaire versus partner play and timed versus untimed conditions incorporate dimensions of automaticity and play.

The Development of Fluency

Semantic Facilitation

Although the activities discussed in the previous section concentrate on the orthographic basis of words, they are never used in isolation from semantic activities designed to strengthen students' vocabulary knowledge base. RAVE-O is grounded in the belief that word recognition is facilitated by semantic knowledge (Beck et al., 1982; Beck et al., 1987; Kameenui et al., 1987; Segal & Wolf, 1992; Wolf & Segal, 1992, 1999) and that these components are interactively connected. In the initial introduction of words, therefore, RAVE-O puts strong emphasis on the semantic component. This is based on pilot research begun 10 years ago on the relationship between vocabulary and retrieval in adolescent readers with severe reading disabilities (see Wolf & Segal, 1992, 1999). Accentuating the fun that words can provide is one part of the third, overarching goal—to win students' affection for language itself.

As discussed, *core words* are central to the program and are selected on the basis of both their sublexical patterns and their multiple meanings. Core words are first introduced every week through a discussion of the children's prior knowledge of the words' various meanings. Idiomatic usage and even jokes are used to concretize this aspect of linguistic flexibility. Most core words have three or more common meanings. For example, the word *jam* has four relatively well-known meanings. *Image cards* accompany the children's discussion and have pictorial representations of each of the word's meanings, selected from popular children's literature or drawn by an artist. Beyond their introductory function, the image cards can be used in adaptations of Memory and various sorting games to consolidate the breadth and depth of meanings possible from any group of words.

There are several important reasons for RAVE-O's emphasis on multiple meanings. First, many children with reading impairments begin with or develop a particular inflexibility toward words. Children who become progressively disenfranchised from their language are more likely to cling rigidly to what they know. Moreover, some children with dyslexia have significant word finding problems or dysnomia. The image cards provide a visual mnemonic for these children (see reviews of word finding difficulties in children with dyslexia in Wolf, 1982; Wolf & Goodglass, 1986; Wolf & Obregon, 1992; Wolf & Segal, 1992).

Another reason involves the allocation of time during reading. Dysfluent readers literally don't have time to process alternative meanings to words when they read and, thus, miss out on more and more of the richness of language. (This is analogous to Stanovich's [1986] discussion of Matthew effects for poor readers.) RAVE-O stresses the richness of written language from the start to combat this potential consequence of dysfluency and to help build a better basis for comprehension. Furthermore, we wish to give all children an early set toward the

multiple-layered structure of written language and the many connections among words.

Word webs (weekly changing wall charts) offer a different method for increasing children's understanding of semantic connections. Each week, students create a word web for one core word by brainstorming their associations for the word's multiple definitions. The resulting graphic web of meaning dramatizes the many facets that words can have. As the year progresses, webs change subtly to be able to teach such concepts as hierarchical relationships within semantic associates. The overall goal of web work is to increase the children's appreciation of a word's depth of meaning and its great breadth and connectedness to other words. Children begin to realize that, if you know one word very well, you know a hundred more. Such knowledge contributes directly to comprehension and indirectly to providing alternative words during word retrieval lapses, as discussed later.

Minute stories are very short "short stories" that were written for the RAVE-O curriculum. The stories use only the cumulative words in the program and emphasize the particular week's core words with their multiple meanings. Minute stories meld orthographic and semantic representations of words and incorporate direct work on comprehension and fluency in connected text. Through the controlled vocabulary in the stories, students have an opportunity to apply the week's particular orthographic and semantic strategies and to build fluency in a contextual reading activity. The stories are short enough to be attended to without interruption and interesting enough to be reread to build fluency and automatic recognition. Repeated reading practice, a main component in other fluency programs (Samuels, 1985; Samuels et al., 1992; Stahl et al., 1997; Young et al., 1996), is easily incorporated through these stories. Students' ability to demonstrate mastery in these stories is a significant accomplishment. For many of the children, these stories represent their first book.

Companion writing activities accompany minute stories and push students to another level of recognition of orthographic patterns in their own spelling. Work focuses on vocabulary use, reading comprehension, and self-expression and is incorporated by the teacher according to student capability.

Lexical Retrieval Strategies

Several references have been made in this article to the difficulties that some children with reading impairments have in word retrieval. Indeed, some of the original work on naming speed emerged from a more general study of lexical processes and the word retrieval difficulties experienced by many dyslexic readers (see Bashir & Scavuzzo, 1992; Wolf, 1982). As noted in several recent studies, word retrieval problems in children with language impairments (Lahey & Edwards, 1996) and reading impairments (Wolf & Obregón, 1992; Wolf & Bowers, in this issue) can be based on a variety of underlying sources, ranging from simple lack of vocabulary knowledge to issues in phonological or lexical access and retrieval processes. The precursor to the present program, RAVE (Wolf & Segal, 1992, 1999), sought to address the range of possible sources of retrieval problems through a combination of semantic development activities and explicit strategies for lexical storage and retrieval.

The lexical retrieval activities in the present RAVE-O program are based on theoretical principles and findings from the original RAVE vocabulary retrieval program. The two central axes are (a) the employment of different modalities in the introduction and practice of core words to enhance storage and (b) a metacognitive approach to the retrieval of words that are difficult to "find." First, with regard to storage, as discussed in the last section, image cards that depict the multiple meanings of the core words provide a visual mnemonic. Other modalities are also invoked. For example, some core words like *jam* are literally *eaten* from a jar by the children in the introductory

discussion or *heard* on a tape. Second, core words are sometimes presented for brief exposures as concrete objects and then covered with a cloth. Attempts to recall the covered objects help both storage and retrieval. The color-coded orthographic pattern cards for teaching core words are often given a kinesthetic dimension through letters made of sand. Vivid associations are elicited through word web activities and often pictorially presented on evolving wall charts. The cumulative, multi-modality effect of these storage activities is aimed to aid long-term memory and easier, faster retrieval.

A more metacognitive approach to retrieval is exemplified in the *Sam Spade strategies* for finding elusive but known words. Developed earlier in the precursor RAVE program, Sam Spade is a *word detective* who gives the children a set of four questions, each of which begins with an *s* to help find clues for the words they cannot retrieve. The image of the detective and his ability to use clues to find words "on the tip of the tongue" has proven to be a powerful one for adolescents (Segal & Wolf, 1993; Wolf & Segal, 1992) and younger children. The questions are

- Starts with? That is, what sound does the missing word start with?
- Sounds like? That is, what known word does it sound like? Do you know the rime inside it?
- Similar to? What word has a similar meaning? Do you know any associated word from a word web that can lead you to it?
- Short word? That is, is the word a short, simple word or a long word with two or more syllables?

The children play different deduction games based on the four strategies with the teacher and among themselves to locate "missing words." The Sam Spade strategies help provide a series of clues to the missing word. When playing these games, by the second or third clue children often deduce the missing word or find an acceptable alternative. Either result helps them

feel more in charge and more capable of using language to help themselves.

Over the course of the program, the children internalize these Sam Spade strategies and use them not only for oral word finding difficulties but also when they encounter unknown written words. These strategies integrate orthographic (rime pattern clues), phonological (phoneme onsets), and semantic information that is useful in both oral and written contexts. Moreover, these tools give the children the psychological confidence to try, to persevere, and to find alternatives when confronted with gaps in their knowledge of words. As such, the Sam Spade strategies contribute to several goals of the RAVE-O program: increased fluency in underlying retrieval skills, a sense of greater flexibility toward words, and growing linguistic prowess.

Summary

The RAVE-O program is a comprehensive approach to reading fluency that is based on a model of reading development that integrates phonological, orthographic, and semantic knowledge. The RAVE-O program is conceptualized as one half of an intervention treatment package that moves daily from a phonological analysis and blending base to emphasis on orthographic pattern recognition, semantic development, and retrieval strategies. RAVE-O has been designed to supplement, reinforce, and extend reading programs that stress phonological decoding principles in intervention reading programs in primary grades.

There is a simultaneous, dual focus on fluency in reading outcomes like word attack, word identification, and comprehension and on automaticity in the underlying phonological, orthographic, semantic, and lexical retrieval skills that collectively contribute to, or impede, overall reading fluency. Systematically introduced, game-like activities address both accuracy and speed in each reading outcome and in each underlying component skill, such

as letter and letter pattern recognition, auditory discrimination of phonemes, and semantic facilitation. Within the component skills, orthographic pattern recognition is particularly emphasized; numerous opportunities for practice are provided through imaginative activities and through a specially designed set of computer games called Speed Wizards.

The major, theoretically based objectives of this experimental program are to help children activate phonological, orthographic, and semantic information about words more automatically and to facilitate fluency in word recognition and comprehension. The major pedagogical objective is to harness the imagination of children and teachers in the service of transforming linguistically disenfranchised, impaired readers into children who can see, use, and ultimately enjoy the power of human language. Ongoing empirical studies of the RAVE-O program with different subtypes of readers will be available in the coming year.

ABOUT THE AUTHORS

Maryanne Wolf, EdD, is director of the Center for Reading and Language Research at Tufts University and a professor in the Eliot-Pearson Department of Child Development. Her work focuses on reading disabilities, reading intervention, and cognitive neuroscience. **Lynne Miller** is in the PhD program of the Eliot-Pearson Department of Child Development at Tufts University, and a research member of the Center for Reading and Language Research. Her interests include learning disabilities, risk and resiliency, and intervention. **Katherine Donnelly**, MA, is a research teacher at the Center for Reading and Language Research. Her interests include reading disabilities, reading intervention, and teacher education. Address: Maryanne Wolf, Center for Reading and Language Research, Miller Hall, Tufts University, Medford, MA 02155.

AUTHORS' NOTE

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