ACCESS CODE: Varied Practice Model

White Paper

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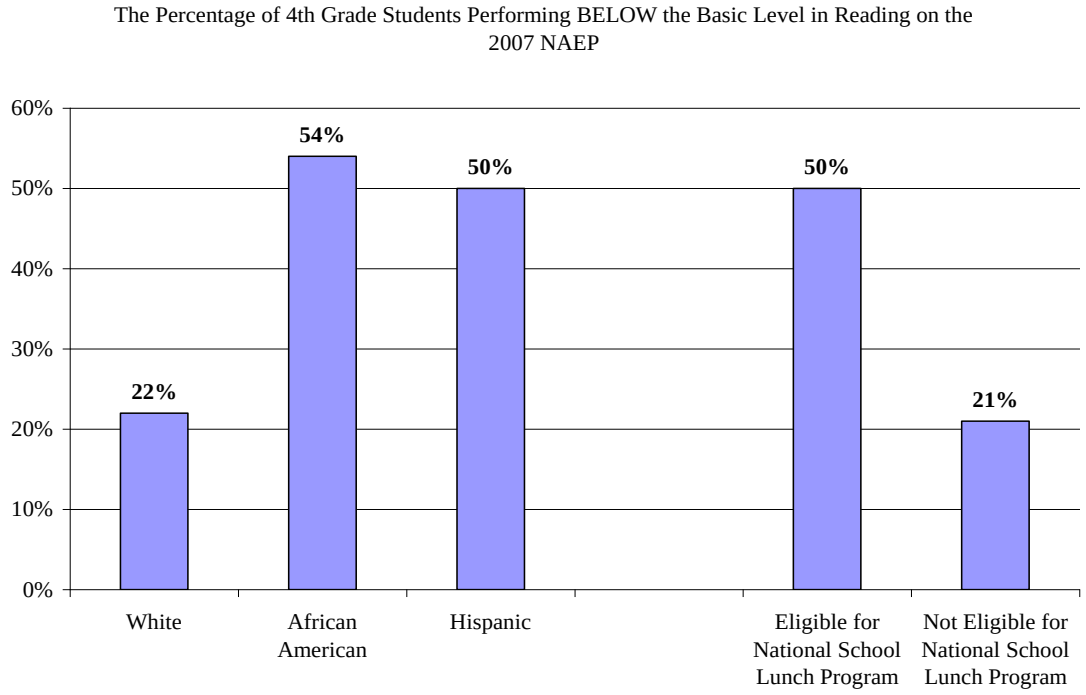
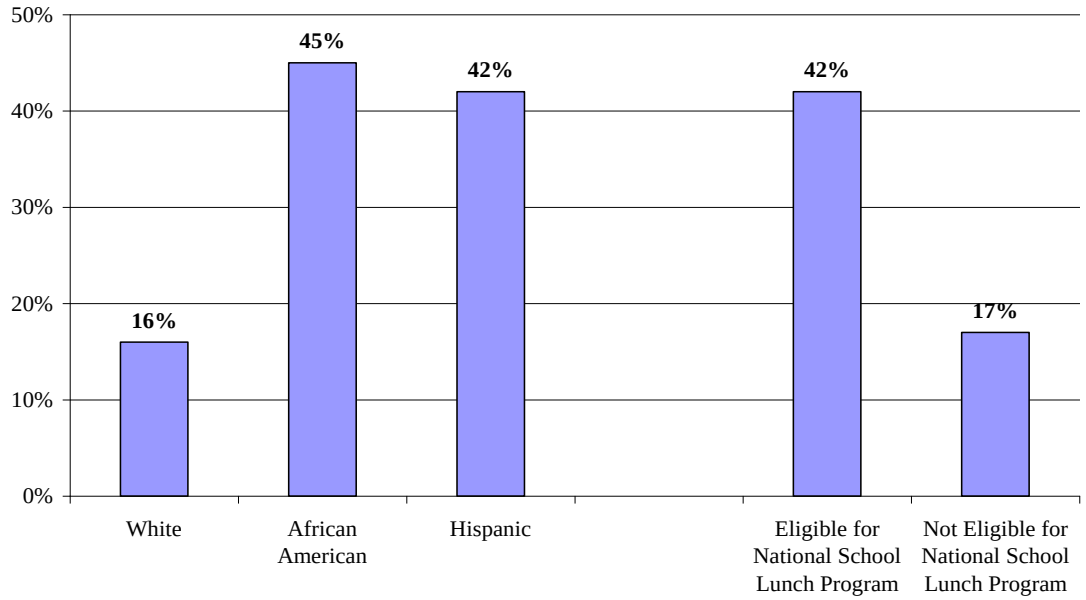
Why do we need reading intervention?

Reading is the most important foundational skill for academic success. The ability to read provides students with the ability to springboard into learning other skills and disciplines. As Slavin (2009) observed, "Those who succeed in becoming fluent, strategic, and joyful readers are not guaranteed success in school or in life, but they are well on their way. However, those who do not succeed in reading, or who become reluctant readers, face long odds in achieving success in school and life." The results of a longitudinal reading study conducted by Francis et al, 1996 supports Slavin's observation. On average, children who were poor readers in Grade 3 did not "catch up" to their peers in reading skills. 74% of children who were poor readers in Grade 3 were poor readers in Grade 9. Adams (1994) observed that illiterate adults make up a preponderance of the unemployed and prison inmates.

It is difficult, however, for many students to master this vital skill. The 2007 National Assessment of Educational Progress, administered to a nationally representative sample of more than 350,000 students at grades 4 and 8, indicated that 33% of fourth graders and 27% of 8th graders performed below the Basic level in reading comprehension. The problem is of even greater concern when one considers the difference in reading achievement for students of different ethnicities and from homes with different income levels. (Lee et al., 2007)



The Percentage of 8th Grade Students Performing BELOW the Basic Level in Reading on the 2007 NAEP



African-American and Hispanic 4th grade students are "failing" in reading at approximately 2.5 times the rate of white 4th grade students. The same is true for 4th grade students eligible for the National School Lunch program relative to students that are not eligible. The data paints a similar picture for 8th grade students.

ACCESS CODE was designed as a supplemental, computer-based reading intervention program to help these students in grades three through eight.

What should *ACCESS CODE*, a reading intervention program, address?

The National Reading Panel report (2000) identified five areas essential to effective early reading instruction: phonemic awareness, phonics, fluency, vocabulary, and comprehension.

The findings from the United States Department of Education in their 2008 Practice Guide focusing on key components of successful primary grade reading intervention programs was consistent with the findings from the National Reading Panel. (Gersten et al., 2008) The Practice Guide recommended that students identified for Tier 2 interventions receive systematic, small group instruction on foundational reading skills which included phonemic awareness, phonics, fluency, vocabulary and comprehension.

Roberts et al. (2008) proposed a modified, but comparable list of essential areas to focus on to address the needs of older, struggling readers: word study (decoding multisyllabic words, morphemic analysis), fluency, vocabulary, comprehension and motivation.

As Foorman and Santi (2009) observed, and as evidenced in the consistency of the researchers' findings above, a consensus has emerged on the components of effective reading instruction for core and intervention reading programs. These components are phonemic awareness, phonics, fluency, vocabulary, and comprehension.

Why focus on phonics in *ACCESS CODE*?

ACCESS CODE focuses on phonics instruction because it is one of the essential components of effective reading programs for elementary as well as struggling adolescent readers and because it is a critical precursor in the development of reading comprehension.

Pressley (2006) observed that one of the most salient problems for many poor readers is that they do not decode well. Poor readers struggle with the letter-sound mappings of the English language. As a result of this problem, poor readers tend to rely on semantic-contextual clues in an attempt to decode text. (Pressley, 2006) This process often leads to the inaccurate decoding of words and places a burden on the reader's limited working memory. Little capacity is left for comprehending these words once they are decoded (Pressley, 2006, Foorman, 2009)

According to McGuiness (2002), reading problems in the United States are primarily a product of the English alphabetic code lacking a one-to-one sound to symbol correspondence coupled with the use of instructional programs that do not adequately address the challenges presented by this reality. Teaching students the link between the 44 English phonemes and the letter or letters that they map to, known as the alphabetic principle, is a key instructional element of her description of exemplary reading instruction programs.

McGuinness' view is shared by other researchers as well. Rayner et al (2001). observed that the two main challenges in learning to read English is that phonemes are abstract and that English does not code each vowel with a unique symbol. English has more than a dozen vowel sounds but only five standard vowel letters.

The research paints a clear picture. Many struggling readers struggle because they have deficient decoding skills.

Learning phonics is critical because researchers have found that decoding abilities and reading comprehension abilities are tightly correlated. Shankweiler et al. (1999) conducted a study on 361 children aged 7.5 to 9.5 years old in which they found that the ability to decode words had a .89 correlation with the ability to comprehend reading passages for and that ability to decode words was more highly correlated with reading comprehension success at this age than general linguistic comprehension (as measured by listening comprehension measures). Shankweiler et al. (1999) observed that as skill in decoding advances, it will account for less and less of the variance in reading ability, and as the variety of reading matter increases, differences in listening comprehension, will contribute progressively more. He argued, however, that measures of decoding would not

lose predictive value in the case of experienced readers, but simply explain less of the total variance in reading skill. Kendeou et al. (2009) reached similar conclusions.

Additionally, a randomized controlled study on older students, aged 7 to 10, demonstrated a significant improvement in reading comprehension scores as a result of 20 sessions in an intervention program focused on decoding skills for students identified as being deficient decoders (McCandliss et al., 2003)

What content is covered in *ACCESS CODE*?

As observed by several researchers, the current discussion about reading rarely focuses on whether any phonics instruction should be provided but how phonics instruction is provided. (Foorman, 2009; Stuebing et al., 2008) There is a dearth of research on the optimal way to structure the child's reading experience with regard to the order and frequency of presenting different types of words (Foorman et al., 2004), but recent research has shed some light on the most beneficial ways to structure a phonics program.

ACCESS CODE is a systematic phonics program that assumes that students have a working knowledge of basic letter-sound correspondences. Systematic phonics instruction is defined as an approach in which phonic elements such as simple grapheme–phoneme correspondences are taught sequentially advancing from simple to more complex and students work on these concepts until automaticity has been achieved (de Graaff et al., 2009). *ACCESS CODE* is organized around the role that vowels play in the structure of the syllable. Difficulties identifiying and discriminating vowels and with understanding the structure and role syllables in words are characteristics of many challenged readers. The sequence of the first 22 units of the curriculum is systematically organized around vowel concepts that advance from simple to more complex. The last two units provide experience with a mixture of vowels and silent consonants.

Research indicates that systematic phonics is more beneficial to students than non systematic approaches. A meta analysis by Ehri (2001) indicated there were better reading outcomes for children taught using systematic-phonics programs than nonsystematic or non phonics programs. Recent finding from de Graaf et al, 2009 found that on measures of phonemic awareness, spelling, and reading, the systematic-phonics group progressed more compared to both the unsystematic training group and the control group.

ACCESS CODE's well organized, systematic scope and sequence is presented below.

Unit Number	Unit Objective	Vowel or Consonant Focus	Syllable Type	Structure
1	Short Vowels Easy	a, e, o	CVC	1 to 1
2		a, i, o	CVC	1 to 1
3		a, e, i, o, u	CVCC	End Digraph
4		a, e, i, o, u	CVCC	End Digraph
5	Long Vowels	a, i, o	CVCe	Silent "e"
6		a, i, u	CVCe	Silent "e"
7		a, i, o	CCVCe	Silent "e", Beginning Blend
8	Short vs Long Vowels	i, u	CVC vs CVCe	1 to 1 vs Silent "e"
9		a, o	CVC vs CVCe	1 to 1 vs Silent "e"
10	Short Vowels Advanced	a, e, i	CCVC	Beginning Digraph
11		a, i, o	CCVC	Beginning Blend
12		a, e, i	CVCC	Ending Blend
13		a, o, u	CVCC	Ending Blend
14	Long Vowel Digraphs	ai, ea, oa, ui	CVVC	Vowel Digraph
15		ie, ai, ee	CVVC	Vowel Digraph
16	Long and Short Vowel Digraphs	oo, ou, ee	CVVC	Vowel Digraph
17	Diphthongs	oi, ou	CVVC, CCVVC, CVVCC	Vowel Digraph (1 to 1) Beginning Blends and Ending Blends
18	R-Controlled Vowels	ar, ur, er	CVC	1 to 1
19		ir, or, ar	CVCC	Ending "r" + Consonant
20		ear, oar, air	CVVC	"r" Vowel Digraph
21	Short Vowel Digraphs	au, oo, ea	CVVC, CCVVC, CVVCC	Vowel Digraph (1 to 1) Beginning Blends and Ending Blends
22		au, ea, ou	CVVC, CCVVC, CVVCC	Vowel Digraph (1 to 1) Beginning Blends and Ending Blends
23	Mixed Vowels with Silent Consonants	gh, wr, kn, mb, lk, wh	CVCCC, CCVC, CVCC, CVVCCC CCVCC,	1 to 1, Vowel Digraph, Beginning Blends, Ending Blends and Consonant Digraph
24		gh, wr, kn, mb, gn, wh	CVCCC, CCVC, CVCC, CVVCCC CCVCC,	1 to 1, Vowel Digraph, Beginning Blends, Ending Blends and Consonant Digraph

Why focus on vowels?

ACCESS CODE focuses on vowels because research has found that vowels present a particular challenge to students. In a study done on reading by McCandliss et al. 2003, it was noted that children who have decoding difficulties past the first grade "may have particular difficulty with vowels" (McCandliss et al., 2003). Fowler, Liberman, & Shankweiler also noted in 1977 that vowels carry the majority of the variable mapping difficulties in the English language, and are the cause for the majority of reading errors for normal adult readers. As Adams 1994 observed, vowels are the most frequent and phonologically uninformative.

Vowels are more difficult and even more important for struggling readers to initially focus on than consonants because they are the "foundation on which the syllable is constructed" and because in the English language there tend to be significantly more spellings for each vowel and more one-to-one spelling-sound relationships for consonants. (Fowler et al. 1977, Rayner et. al, 2001)

Why focus on syllables?

ACCESS CODE focuses on syllables, in part, because as Adams (1994) observed, skilled readers ability to recognize a long word depends on whether they can chunk it into syllables as they perceive it. As students progress through school, they are confronted with more and more complex words particularly in their content area texts (Torgesen, 2007) Ehri observed that whereas skilled readers can syllabicate words to read them, struggling readers have difficulty syllabicating. Low achieving readers have particular difficulty with medial syllables. (Bhattacharya and Ehri, 2004) Roberts (2008) also observed that struggling adolescent readers tend to have a problem identifying syllable parts. A review of research on word study, including such strategies as having students learn to identify syllable types, break larger words into their syllable parts, and read those words by blending the parts together had a moderate effect on both standardized and researcher-developed measures of word reading and reading comprehension. (Scammacca et al, 2007).

How is instruction structured in *ACCESS CODE*?

Instructional tasks in ACCESS CODE have been designed to reflect research findings which indicate the critical role of varied practice as a means of enhancing the development and retention of skills in a variety of domains. This approach in ACCESS CODE is called the Varied Practice Model (VPM).

What is varied practice?

Varied practice is practice in which the content and/or context of the practice is varied during practice trials. It stands in sharp contrast to block practice which is practice that focuses on the same skill and or context during each practice trial. For example, in ACCESS CODE, students practice identifying phoneme-grapheme pairs in a variety of contexts in each unit including single syllable words, multi-syllable words and phrases within one unit.

Some researchers have seen varied practice as a means of promoting deeper understanding of the categories of "problems" or situations students encounter in a given domain. For example, researchers hypothesize that varied practice with math problems promotes students' appreciation of the different solution procedures that need to be applied to different types of problems. The mixed presentation of math problems, for example, facilitates students' understanding of categories of problems and their associated procedures. Researchers have hypothesized that this mixed presentation encourages a deeper representation of the skills being practiced which facilitates greater

retention and greater success at transferring skills to solving new problems.

What evidence is there that varying the context and content of practice improves long term retention?

Evidence for the successful impact of varied practice on long term skill acquisition is found in a variety of domains.

Shea and Morgan (1979), for example, conducted an experiment to investigate the effects of varied practice as compared with blocked practice on the acquisition and retention of three similar motor skills. The blocked group practiced one motor skill for 18 trials. When the 18 trials were completed, this group practiced the second of three motor skills for another 18 practice trials. This pattern continued for the third motor skill. The varied group was presented the three motor skills to practice randomly. In the first 18 practice trials, the varied group practiced each motor skill 6 times. This pattern was repeated for the next two sets of 18 practice trials. The practice trials for this group were arranged so that no more than 2 trials on the same skill would occur consecutively. Results showed that retention was greater for subjects in the varied practice group. Transfer was also greater for the varied practice group on two new motor skills tasks. This effect was most pronounced when transfer was measured for the transfer task of greatest complexity.

Rohrer and Taylor (2007) analyzed the impact of varying the content in math practice problems on student achievement. They compared two groups of students: Mixers and Blockers. Students in the Mixers group were presented with instruction on calculating the volume of 4 different types of solids. They then received 16 mixed practiced problems asking them to find the volume of the types of solids they were presented during instruction. Blockers, on the other hand, received instruction on one type of solid and then received 4 practice problems asking them to find the volume of that one type of solid. One week later similar practice sessions were repeated for each group. One week following this final practice session students were tested on 8 novel problems. While Blockers outperformed Mixers on practice, Mixers significantly outperformed Blockers on the follow up test.

Kornell and Bjork (2008) asked college students to study paintings by different artists. Artist's paintings were presented consecutively (massed) or interleaved with other artists' paintings (spaced). In Experiment 1A, half of the artists' paintings were presented massed and half of the artists' painting were presented spaced. In Experiment 1B, students were placed in the massed or spaced condition and paintings were presented accordingly. After the learning phase, participants were tested on new paintings by the same 12 artists and asked to select, from a list of all the artists' names, the artist who had painted each new painting. Students in the spaced condition outperformed students in the massed condition in their ability to classify the new paintings. In a follow-up experiment, Experiment 2, students were presented with similar paintings as in Experiment 1 A, but were simply asked when presented with paintings in the test phase if the artist was familiar or unfamiliar. Once again student performance in the spaced condition was superior to performance in the massed condition.

Nitsch (1977) as cited in Schmidt and Bjork (1992) had subjects learn novel concept-words (e.g., to "crinch" was to offend someone) by providing several uses of the word that were in either a constant context (all in one setting) or a variable context (in numerous settings). Nitsch found that constant contexts were more effective than variable contexts for enabling subjects to identify the concept in the same context as it was presented earlier. However, when the subjects were asked to recognize novel examples of the concept, variable practice was more effective than constant practice.

Some research has shown the impact of variable practice on language acquisition as well. Rost and McMurray (2009) conducted a series of experiments in which they evaluated the impact of varied practice on 14-month-olds ability to distinguish between words that differed by a single phoneme. In one experiment, they found that children at this age could not make this single phoneme distinction when the phoneme was spoken by one person 7 times during the training session. However, in a follow-up experiment, the researchers found that presenting the 14-month-olds with a series of 7 different speakers presenting the phoneme one time each led to the children being able to make the distinction between the two phonemes.

Researchers have also created computer models to simulate detailed aspects of how children learn to read (Rayner et al, 2001). One type of computer model of reading, known as a connectionist model, has been shown to be consistent with some aspects of how children learn to read. One set of experiments found that one connectionist model while making errors that diverged from the type of errors made by children was a good match for children's ability to read non-words. (Powell et al, 2006)

In a series of experiments with these computer models, researchers discovered that if a computer model was trained on one set of patterns, followed by training the model on a second set of patterns, the computer model unlearned the first set of patterns. Researchers found providing occasional trials to refresh learning on the first set of patterns while training the second set eliminated the interference effect. Interleaving or varying the training sequence for the computer models was found to be more effective than block training. (Harm and Seidenberg, 2004)

How does variability in practice promote learning?

The variability of content and context in these experiments may have pushed subjects to both consciously and subconsciously wrestle with the similarities and differences of the tasks they were asked to consider in each experiment. Taylor and Rohrer observed (2009) that the best explanation of why varied practice has a bigger impact than block practice on retention tests is that varied practice improves discriminability among problems. Since varied practice requires participants to repeatedly switch between different kinds of tasks, they must learn how to pair each kind of task with its appropriate procedure.

In reflecting on why variability facilitated 14-month-olds ability to make distinctions between phonemes, Rost and McMurrary (2009) argued that exposure to multiple

exemplars may have allowed children to better understand the similarities and differences between the spoken phonemes in the experiment. The variability allowed them to attend to relevant differences that indicated a different phoneme and to ignore irrelevant differences that indicated the same phoneme.

Both Taylor and Rohrer (2009)and Rost and McMurrary (2009) relate the impact of varied practice to improved category learning. They argue that varied practice facilitates comparisons and contrasts between category exemplars which strengthen the understanding of within category features and the distinction between categories. In Taylor and Rohrer (2009), variability facilitated comparisons between categories of math problems and helped subjects better understand how to approach each category of problem differently. In Rost and McMurrary (2009), variability facilitated infants' comparisons between phonemic categories.

These researchers' observations about the impact of comparisons achieved through varied practice on student retention is consistent with the extensive research that has been conducted on the impact of comparisons on improving category learning (Kurtz and Boukrina, 2004; Hammer, Hertz, Hochstein, Weinshall, 2009; Hammer, Diesendruck, Weinshall and Hochstein 2009).

What is the link to learning to read?

Sperling, Lu and Manis (2004) have argued that learning to read involves a similar type of categorical learning. These researchers maintain that beginning readers must learn how to identify essential aspects of phonemes and how they relate to orthographic patterns. They must notice that the phoneme /s/ in SING and in THIS are connected and although having a slightly different pronunciations are a part of the same grapheme-phoneme category.

Some researchers maintain that students may develop this understanding of grapheme-phoneme pairs in English through explicit learning and through implicit learning. In explicit learning, students are explicitly taught the grapheme-phoneme correspondences – what they are and when to apply them. In implicit learning, students pick up these correspondences from their print experiences. For example, children may acquire the association between the orthographic representation of the letter -*t* and the /t/ sound through various positional contexts of the right boundary of the visual-orthographic representation of words such as *get, cat, went,* and *got.* (Fletcher-Flinn and Thompson, 2000; Wang, Liu, and Perfetti, 2004)

Implicit learning or statistical learning involves relatively automatic learning mechanisms that are used to extract regularities and patterns distributed across a set of exemplars and typically without conscious awareness of what regularities are being learned. (Conway et al, 2007)

Adults and infants can perform complex statistical computations to detect the boundaries of words in connected speech. In particular, they have been shown to use statistics to

discover nonsense words in continuous streams of artificial speech. (Bonatti et al, 2009) Statistical learning is believed to be important for word segmentation, word learning, the learning of phonotactic and orthographic regularities, aspects of speech and the acquisition of syntax. (Conway et al, 2009)

While statistical learning may take place automatically without conscious awareness, studies on people have indicated that it is possible to structure and order the patterns with which people are presented to facilitate the inferences they draw and expedite the learning process.

Kachergis et al (2009) set up a study to understand the parameters that would impact college students' statistical learning. The researchers presented college students with four objects concurrently on a computer screen while four pseudo words were spoken sequentially. The researchers wanted to determine what conditions would improve the students' ability to infer the correct association between the object and the spoken word. They varied the frequency in which pairs appeared and they also varied the context in which object-word pairs appeared.

The researchers found that while statistical learning is a natural, automatic process it can be improved by varying the inputs to which students are exposed. Kachergis et al. (2009) discovered that increasing the contextual diversity in which word pairs appeared, when the frequency of the pairs was held constant, increased students ability to learn the picture – word correspondences more quickly. Kachergis' findings demonstrate the significance of varied practice with respect to context on improving the outcomes of statistical learning.

This research suggests that learning to read, as an example of category learning or as an example of statistical learning , is likely to benefit from varied practice that promotes comparison between different phoneme-grapheme categories.

The instructional tasks in ACCESS CODE have been designed to have students practice on a varied set of content in varied contexts to develop students' understanding of key phoneme-grapheme relationships. The activities promote comparisons between different and similar phoneme-grapheme pairs to support long term retention and to promote transfer to novel contexts. The following section depicts how varied practice is manifest in the program.

What does Varied Practice look like in ACCESS CODE?

Practice in each unit of ACCESS CODE is varied in several ways:

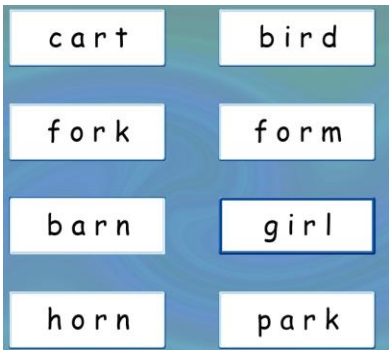
- **Content Variation -** The content of each unit focuses on a several related but different grapheme-phoneme pairs. Practice tasks help students to observe the similarities and differences between categories of related phoneme-grapheme pairs.
- **Context Variation** - The content in each unit is presented in several different contexts. In Level 2 tasks, for example, students manipulate initial and final grapheme while examining the impact on the targeted phoneme-grapheme

relationships in the unit. These practice tasks help students identify contexts that do and do not change the targeted phoneme-grapheme relationships. Throughout a given unit as well, students examine phoneme-grapheme pairs in the context of single syllable words, multi-syllabic words and in phrases.

What is an example of Varied Practice that involves content variation?

Each unit focuses on several related but distinct phoneme-grapheme pairs. In Unit 19, for example, the focus is on the r-controlled vowels: ar, ir, and or. The graphemes are different in their unique pronunciations but are similarly constructed with an r. The tasks in the unit are intended to help students understand both the similarity and distinction between these grapheme-phoneme categories.

In the Level 1, Unit 19 Find the Word task, for example, students are presented with the 8 focus words of the unit. Students listen to a word and are asked to select it from this list.



The task is intended to get students' to observe

- the similar pronunciation of words like bird and girl.
- the different pronunciations of words like cart, fork and girl.
- the way all the pronunciations of the words are similarly affected by the letter r.

Students who are struggling readers are unlikely to have a clear understanding of the ways in which these r-controlled graphemes and their associated phonemes are both similar and different. Some students tend to perceive a single phoneme-grapheme relationship, believing that r-controlled vowels are uniformly pronounced /er/. Students' grapheme-phoneme categories for any given r-controlled vowel in this unit are ambiguous. The goal of these tasks in the unit is to help students develop a more finely tuned understanding of these categories.

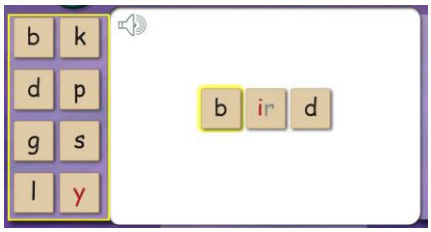
This initial presentation of the content, as described in the above task, is similar in each unit of ACCESS CODE. The unit begins with a targeted examination of 7 or 8 words in the Level 1 Rule Introduction task which reflects the phoneme-grapheme pairs that are the focus for that unit. These words reappear throughout each task at each of the five levels in each unit of the program. These words are repeated to facilitate the student comparisons of similar and dissimilar phoneme-grapheme pairs and subsequently

improve students' ability to draw the correct inferences about these relationships in new word, syllable and sentence contexts. Research by Kurtz and Boukrina, 2004 demonstrated that repeated comparisons focused on a small set of pairs improved students' transfer accuracy in a category learning experiment.

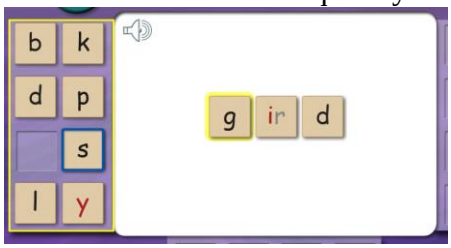
What is an example of Varied Practice that involves context variation?

In Level 2, Unit 19, Change the Word: Initial and Change the Word: Final tasks, students get an opportunity to observe and compare how initial and final grapheme changes impact the pronunciation of r-controlled vowel based words. The changes in context helped students to understand the types of phonemes changes that are produced with certain types of grapheme changes.

For example, the student is presented with the word "bird" in the Unit 19, Level 2, Change the Word: Initial task and asked to create the word gird from bird:



By seeing and hearing the word bird and then subsequently the word gird



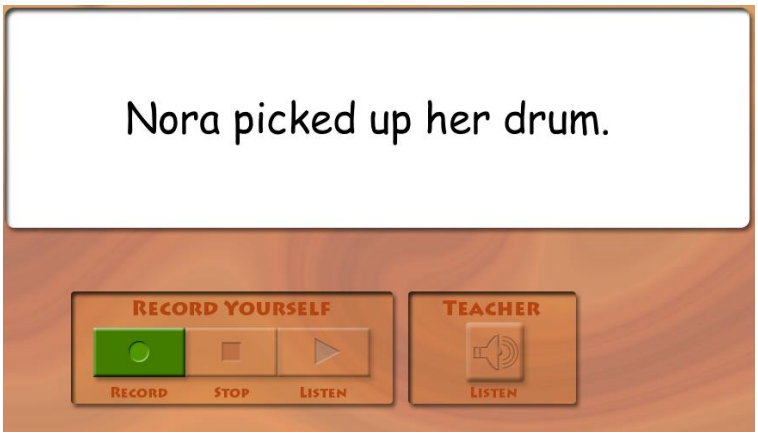
the student has an opportunity to contrast the different contexts in which the r-controlled vowel, ir, is presented. Both bird and gird represent different contexts for /ir/. However, these contexts do not change the pronunciation of /ir/. This is an important inference for students to make and it is facilitated by students' experimenting with and observing how changing contexts do and do not change certain phonemes.

While the design of this task in ACCESS CODE stems from recognition of the importance of varied practice on developing long term retention of grapheme-phoneme pairs, research on similar tasks has arisen from different theoretical perspectives and demonstrated the soundness of this instructional approach used in ACCESS CODE. The idea of identifying specific sections of the word and manipulating that particular section to show a reader the subtle impact of a single change on the appearance and pronunciation of a word is supported by theoretical proposals made by Perfetti as reported in McCandliss et al, 2003. In the Restricted-Interactive Model, "the key

development in learning to read is the acquisition of word representations whose constituent letters and phonemes become increasingly specified in all word positions." McCandliss et al, 2003 conducted a randomized controlled study of twenty-three 7 to 10 year old children to discern the impact of an instructional program using single grapheme manipulation on reading achievement. The treatment group had greater gains in measure of word recognition and reading comprehension than the control group. The researchers observed that by manipulating a single letter, it draws students' attention to graphemic units within printed words and the corresponding graphemic units within spoken words. Another benefit of the single manipulation tasks is that it provides students with the opportunity to pay attention to all the grapheme positions within a word and decode each position, especially the positions that students habitually neglect—the medial and final positions (McCandliss et al, 2003). Described in terms of the Varied Practice model, one might conclude that these students, by virtue of being exposed to a variety of contexts in which the graphemes appeared, developed a deeper understanding of the grapheme-phoneme relationships being presented. Students were better able to understand when certain contexts did and did not change the pronunciation of the grapheme.

Students also have an opportunity to work with phoneme-grapheme pairs in a variety of contexts throughout the levels of a given unit in the program. The levels in ACCESS CODE are designed to provide students with an opportunity to apply their decoding skills in phrases and sentences and with more complex, multisyllabic words. As Moats (2004) observed "Partial approaches, for example, phonics instruction without direct and immediate application to reading and writing, have little justification within a neuroscientific approach."

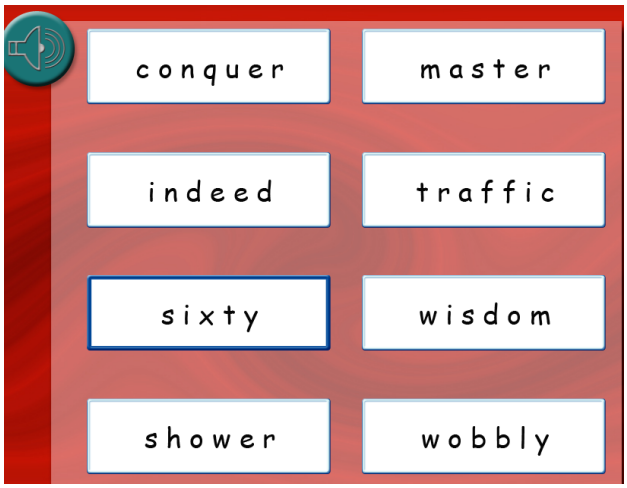
In Unit 6, Level 4 of ACCESS CODE, for example, students have the opportunity to read sentences with words that contain the short vowels a, i, o which where the focus of the unit. They can record their reading of the sentence and compare their recording to a model.



Moats further observed that teaching sound symbol correspondences were not enough to

"to educate a well-functioning orthographic processor." Lessons, she argued, needed to focus on syllabication as well to facilitate pronunciation of new words encountered in text, a view consistent with Torgesen's (2007).

In Unit 6, Level 5 of ACCESS CODE, for example, students are asked to identify the multisyllabic word that corresponds to the spoken word containing the short vowel a, i, or o.



ACCESS CODE also provides supplementary reading material for students to apply their developing word recognition skills in more complex, realistic contexts.

What are the benefits of implementing the program in a computer environment?

As a web-based program, *ACCESS CODE* provides each child an adaptive, individualized experience. By working individually students have an opportunity to benefit from the structure of the scope and sequence, but also have the opportunity to move at their own pace as well as make some decisions as to the tasks on which they want to focus.

One of the key findings from the research on the development of students' early reading skill is that there is an interaction effect between students' initial skill level and the impact of teacher guided versus student guided activities. Connor et al. 2007 found that children with weaker initial letter-word skills demonstrated greater skill growth by the end of second grade when they were in classrooms with greater amounts of teacher managed code-focused instruction in both first and second grade. However, for children with stronger initial skill levels, less first-grade teacher managed code-focused instruction was related to stronger letter-word reading skill growth.

Providing students with a self-paced, but structured learning environment such as *ACCESS CODE* that keeps tracks of students' strengths and areas of improvement in phonics is essential for addressing the particular needs of a variety of learners. Students come to *ACCESS CODE* with stronger initial skills will easily pass through the tasks in

the program with which they are skilled and they have the opportunity to spend more time on tasks of their own choosing. Similarly, students that need more teacher direction have the benefits of a well-structured scope and sequence in *ACCESS CODE,* corrective computer feedback and teachers that are provided with timely information regarding their particular strengths and weaknesses allowing teachers to better guide and assist them in their development of grapheme- phoneme correspondences.

Conclusion

ACCESS CODE focuses on phonics, a critical element of effective reading instruction. Research has demonstrated that close link between decoding proficiency and reading comprehension for young and learning disabled readers and it has proven to be an essential precursor to the development of reading comprehension in older students.

ACCESS CODE's approach to phonics instruction rests on a strong research base. The units focus on developing students' understanding of the vowels grapheme-phoneme correspondences since research has demonstrated that vowels are the most difficult for students to decode. The program employs a Varied Practice Model which research in a variety of domains has demonstrated is a powerful technique for improving long term skill retention and for facilitating transfer.

ACCESS CODE is a well-researched and carefully developed phonics program for students that can serve as the corner stone for a balanced instructional approach to reading.

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