EXPLODE THE CODE®
Nancy Hall and Rena Price

By Beth Davis

Explode The Code® is a research-based, teacher-tested program that builds essential foundational literacy skills for students at a variety of levels. Based on the Orton-Gillingham hallmarks of instruction, *Explode The Code* offers direct instruction, multisensory teaching, and careful pacing. The Common Core State Standards Initiative pays particular attention to these foundational skills, calling them "…necessary and important components of an effective, comprehensive reading program designed to develop proficient readers with the capacity to comprehend texts across a range of types and disciplines" (CCSS, p. 15).

The *Explode The Code* program for beginning readers includes three books that teach the sounds for the consonants and how to write them (*Get Ready for The Code*, *Get Set for The Code*, and *Go for The Code*), eight books that teach students to recognize and combine phonetic sounds in order to read (*Explode The Code* Books 1–8), and six books that provide further practice for students who need it (*Explode The Code* Books 1½–6½). Picture-Letter Cards and Code Cards accompany the books. The four books of *Beyond The Code* extend the series with comprehension and reasoning activities. They have longer stories that follow the same phonetic pattern as the first four books of *Explode The Code*.

The *Explode The Code Wall Chart* and *Explode The Code Wall Chart Activity Book* help students remember the key words for each letter sound and offer over thirty games to reinforce letter sounds.

The Explode The Code Placement Tests help teachers place students in the appropriate *Explode The Code* student book. Five Teacher's Guides accompany the student books. *Explode The Code Teacher's Guide for English Language Learners* helps teachers meet the needs of these students.

Explode The Code is also available in an online format. For more information on *Explode The Code Online*, see page 9.

Systematic, Direct Teaching of Phonics

Jeanne Chall's *Learning to Read: The Great Debate*, an extensive review of classroom, laboratory, and clinical research, revealed the efficacy of direct, explicit, systematic teaching of decoding skills. Chall concluded that code emphasis programs produced better results "not only in terms of the mechanical aspects of literacy alone, as was once supposed, but also in terms of the ultimate goals of reading instruction—comprehension and possibly even speed of reading" (Chall, 1967, p. 307).

Even as new understandings about learning and teaching have evolved in the years since 1967, these findings have been repeatedly reconfirmed (Chall, 1983; Adams, 1990; Bond and Dykstra, 1997; National Reading Panel, 2000). In studies published since 1970, comparing phonics instruction with other kinds of instruction, the National Reading

> Based on the Orton-Gillingham hallmarks of instruction, *Explode The Code* offers direct instruction, multisensory teaching, and careful pacing.
>
> Chall concluded that code emphasis programs produced better results "not only in terms of the mechanical aspects of literacy alone, as was once supposed, but also in terms of the ultimate goals of reading instruction—comprehension and possibly even speed of reading"

Panel (2000) found that for children from kindergarten through sixth grade, systematic phonics instruction enhanced children's ability to read, spell, and comprehend text, particularly in the younger grades. These results were especially evident for the word-reading skills of struggling readers and children from lower socioeconomic groups and for the spelling skills of good readers. Studies have continued to support systematic literacy instruction (Morris, et al., 2003; Leppanen, et al., 2004).

Chall and Popp (p. 2, 1996) write of "two kinds of meaning—meaning of the medium (the print) and the meaning of the message (the ideas)." Knowledge of phonics gives students the ability to decode print, which in turn reveals the message ideas. The more words early readers can recognize, the more accessible meaning becomes. Children who have difficulty identifying words lack the fluency needed to concentrate on meaning (Rasinsky, 2000). Conversely, children who are given direct, systematic instruction in decoding skills have the tools for developing fluent, meaningful reading. Furthermore, they have the tools to produce print and consequently express their thoughts in writing, which in turn reinforces their word identification skills (Ehri, 1998).

Explode The Code offers a complete systematic phonics program for the elementary grades. Phonetic elements and patterns, carefully sequenced to consider both frequency of use and difficulty, are practiced in a series of instructive workbooks. Teacher's Guides with answer keys accompany all of the books.

The first three books, *Get Ready for The Code*, *Get Set for The Code*, and *Go for The Code*, focus on visual identification of consonants, their written lowercase letter forms, and their sound-symbol relationships. An engaging, colorful Wall Chart with felt objects that serve as key words for the 26 letters of the alphabet may be used to introduce children to the names and sounds of the lowercase letters and/or to reinforce lessons

in these books. An activity book with instructions for 35 games comes with the wall chart. Key word picture and letter cards are also available.

The remaining eight books progress through the vowel sounds and patterns, consonant clusters and digraphs, syllables, and suffixes. Post-tests are found at the end of each workbook. If a need for extra practice is indicated, additional workbooks for reinforcement (Books 1½, 2½, 3½, 4½, 5½, and 6½) accompany Books 1–6.

When systematic, direct teaching of phonics occurs through the use of *Explode The Code*, these criteria for successful reading and writing are present:

- The alphabetic principle is firmly established.
- Phonological awareness skills are fostered along with the phonics teaching.
- Understanding of how sound/symbol correspondences permit words/text to be decoded and encoded is fully developed and practiced to achieve fluency and automaticity.
- Students of varying language and skill needs are accommodated in vocabulary and concept building through exposure to different approaches to teaching phonics and through flexible grouping and use of the materials.

The above criteria are among those featured in the Common Core Reading Standards, Foundational Skills: "Demonstrate understanding of...features of print;...spoken words, syllables, and sounds;...grade-level phonics and word analysis skills in decoding words; read with sufficient accuracy and fluency to support comprehension." *Explode The Code* provides instruction in all these components of early reading (CCSS, p. 15-17).

The Alphabetic Principle

Adams (1990) and Stahl (1998) discuss the importance of the alphabetic principle, which is the relationship of the 26 letters in the English alphabet to sounds in spoken words. This concept is a difficult one because English

Conversely, children who are given direct, systematic instruction in decoding skills have the tools for developing fluent, meaningful reading. Furthermore, they have the tools to produce print and consequently express their thoughts in writing, which in turn reinforces their word identification skills (Ehri, 1998).

words use over 40 sounds with only 26 letters. In addition, the alphabetic principle relates not only to the individual letters, but also to combinations of letters known as consonant clusters, consonant and vowel digraphs, diphthongs, and phonograms.

Furthermore, both the graphemes used to represent sounds and the sounds a grapheme represents may vary. The long *e* sound is spelled differently in *he*, *seed*, *peal*, *cookie*, *cede*, and *deceit*. The sound of the letter *c* differs in the words *cake* and *city*. Helping children to grasp the alphabetic principle is a challenging task for their teachers.

To help children understand that connection, it is most practical to teach the consonants first. Most consonants have a one-to-one correspondence between letter and sound. In addition, the names of most consonants are similar to the sounds they represent in words. Initially, it is knowing the names of the letters that appears to predispose children to success with word recognition and which has been a predictor of beginning reading ability (Chall, 1967, 1983). Adams (p.63, 1990) speculates that one reason letter name knowledge predicts word recognition success is because the letter name often relates to its sound and "mediates… [children's] ability to remember the sounds."

Short vowels also tend to have a one-to-one correspondence between letter and sound within words, whereas long vowels usually are represented by more complicated patterns. Teaching the consonants and short vowels first, as in *Explode The Code*, reflects beginning readers' knowledge of the alphabetic principle. Later, with more reading experience, children can better deal with the exceptions and variation in the alphabetic principle.

Ehri (1991, 1998) describes the four stages— prealphabetic, partial alphabetic, full alphabetic, and consolidated alphabetic—children go through in learning to recognize words as they acquire command of the alphabetic principal.

In the first, or prealphabetic, stage children use some kind of visual or logographic cue to identify a word, such as the color and octagonal shape of the stop sign to identify the word stop.

As they begin to identify beginning and/or final letters and sounds, they enter the partial alphabetic, or phonetic cue, stage. At this stage, a child may recognize the word *black* using the beginning and ending letters as cues; however, the word might easily be mistaken for *book*, *back*, or *break*.

In order to decode new, unfamiliar words and/or similarly spelled words, children need familiarity with vowels as well as consonants, enabling them to "fully analyze" the word, an indication that they are at the full alphabetic stage.

When children can recognize familiar chunks of words, reading new words by relating to the onsets, rimes, and/or affixes, they are at the consolidated alphabetic stage. At this stage the ability to relate to patterns enables them to read polysyllabic words with relative ease (Ehri, 1991, 1998; Gaskins et. al., 1996/7).

The *Explode The Code Wall Chart* and Get Ready primer books introduce and reinforce the sound-symbol relationships of the alphabetic code through the consonants. Children are taught to visually identify and discriminate one consonant at a time, to associate the sound it stands for both in isolation and at the beginnings of words, and to trace, copy, and print the lowercase letter in isolation and in relation to the initial sounds of words (pictures). In tracing, copying, and printing the letters, children gain automatic recognition of the letters. Through varied activities in the student books and the accompanying Teacher's Guides, the skills are repeatedly practiced for each letter. The letters that are introduced first are those whose names most closely resemble the sounds they represent in words. Picture-letter cards that accompany the Get Ready books and the activity book for the wall chart may be used for drills or games to reinforce the sound-symbol relationships of the initial consonants.

In order to decode new, unfamiliar words and/or similarly spelled words, children need familiarity with vowels as well as consonants, enabling them to "fully analyze" the word, an indication that they are at the full alphabetic stage.

Explode The Code offers a complete systematic phonics program for the elementary grades.

Explode The Code Books 1–8 continue student exposure to the alphabetic code with the introduction of short vowels and CVC words, helping students to discover how the letter sounds map onto the written letters to produce spoken words that can be read and spelled. As students proceed through the phonetic elements noted earlier, they develop the skills that move them through the full alphabetic stage to the consolidated alphabetic, or fluent reading, stage. Written text that helps them apply the alphabetic code combines isolated words with more and more sentence, paragraph, and short story text.

Phonological/Phonemic Awareness

A second component of an effective phonics program calls for attention to skills that promote phonological awareness (NRP, 2000; Stahl, 1998; Yopp, 1992; Stanovich, 1991; Adams, 1990; Juel, 1988)—the ability to identify and manipulate spoken language features, such as rhymes, words, syllables, onsets and rimes, and phonemes, which may be taken apart, put together, deleted, and substituted to form new words. Phonemic awareness, a subset of phonological awareness, focuses specifically on the sequences of phonemes or sounds comprising spoken words and the ability to identify and manipulate these features. Children often need training in differentiating sounds within words. Sounds, contextually influenced, run into one another, often blurring their distinct phonological features. Whereas phonics is concerned with sound-symbol correspondences (the relationship between phonemes and graphemes in print), phonemic awareness is concerned only with the spoken word.

Phonemic awareness has been shown to be a strong predictor of success in learning to read (McCulley, et al., 2013; O'Connor, 2011; NRP, 2000; Juel, 1991; Adams, 1990; Chall, 1967). Muter and Snowling (1998) found that phonemic awareness was a significant predictor of reading accuracy in the first year of school as well as at age nine. Stanovich, citing studies that have shown better reading success in children trained in phonological awareness, finds it plays a causal role "because phonological awareness is a foundational ability underlying the learning of spelling-sound correspondences" (p. 284, 1993/4). Although children can be taught to associate specific letters and sounds, if they lack an inherent understanding of oral language structure where sounds blend into one another, they may experience difficulty learning to read and spell words (Gaskins, 1996/7). The National Reading Panel (2000) found phonemic awareness training particularly benefited at-risk children in terms of transfer to both reading and spelling.

Yopp (1992) identifies six kinds of aural manipulation skills that facilitate the abilities needed for reading and writing. Children who can perform these tasks at an aural level will be much more receptive to phonics instruction where children combine print with sound. The six aural tasks that may apply to words, syllables, and onset and rime as well as phonemes include:

Matching (Identity)—recognizing elements in words or word parts

Isolation—hearing beginning, middle, and ending sounds/word parts

Substitution—changing the word by replacing a beginning or other sound/word part with a different sound/word part

Segmenting—separating individual phonemes/word parts within words

Blending—putting together phonemes/word parts to form new words

Deleting—saying the word/word part without a specified sound/word part

Although teaching phonemic awareness involves the tasks described above as applied to spoken language, these skills may also be acquired using letters. When this occurs, the instruction qualifies as both phonics instruction and phonemic awareness instruction. Building phonemic awareness facilitates children's ability to benefit from phonics instruction, and some kinds of

phonics instruction may in turn enhance the acquisition of phonemic awareness. The National Reading Panel (2000) found that training was most effective in building phonemic awareness skills when children were taught to manipulate sounds with letters.

Explode The Code develops phonological and phonemic awareness skills throughout the series. The *Get Ready* books and the Wall Chart games help children to match and isolate beginning and ending sounds with letters. Books 1–8 match written and spoken words and have children segment, blend, substitute, and delete words and word parts. Exercises in every lesson segment ask children to look at a picture such as a fish, circle the three graphemes that correspond to the sounds heard in the word, and then write the word. As the children fully analyze the words, they enhance their spelling and word recognition abilities (Ehri, 1998; Gaskins,1996/7).

The *Explode The Code* Teacher's Guides provide a number of oral activities to help students recognize and manipulate individual phonemes in spoken words. Because "phoneme segmentation of English words is particularly difficult for those with little prior experience listening to English speech sounds" (The Education Alliance at Brown University), *Explode The Code Teacher's Guide for English Language Learners* provides strategies for children to distinguish and pronounce English language phonemes. These skills are reinforced as children begin to recognize and use these new sounds in English conversation.

Sound-Symbol Relationships

Freebody and Byrne (1988) concurred with the correlation between reading ability and phonemic awareness, yet found it is not enough for the development of proficient decoding skills necessary for achievement in reading, especially beyond grade 2. Research on eye movements as reported by Pressley (2002) shows fluent readers process every letter, and because they recognize familiar letter combinations/chunks, they can

read nonsense words with speed as well. It is important for many children to have instruction and reinforcement with the full array of sound-symbol relationships encountered at the full alphabetic and consolidated alphabetic stages.

Phonics falls into various types, as defined below:

Synthetic Phonics—Individual sound/symbol correspondences are taught and blended to read words. (The word *cat* is sounded /k/ /a/ /t/ and blended to form the word.)

Analytic Phonics—To avoid distortions, sounds are not pronounced in isolation. Instead, letter sounds in known words are analyzed. After the words *cat*, *cake*, and *cup* are recognized/known, the letter *c* is taught as the sound we hear at the beginning of these words.

Analogy Phonics—Students learn to read new words by relating to known words, usually in terms of rimes (phonograms) and onsets. The word *slight* is read by relating the *-ight* to the known word *night* and the onset *sl* to the known word *slip*.

The findings of the NRP (2000) endorsed systematic phonics instruction but found that there was no statistical gain in choosing one type of phonics instruction over another. Children have different learning styles and may respond differently to the contrasting ways in which phonics instruction may be presented. The CCSS likewise concur that instruction should be differentiated.

Explode The Code lessons on each of the phonics elements span a number of pages to teach and reinforce. Within this span, various approaches are utilized; individual sounds are blended; elements are practiced within whole words; and word chunks are related. This results in a thorough treatment of the skills needed for decoding new words, accessible to children with differing learning styles. In the *Explode The Code* Teacher's Guides, new phonics skills are taught by calling attention to sounds in familiar words. Next, students are taught the letter or letters that

represent that sound. Students then practice the skill, working with other words that include that phonic element.

However, phonics without meaning is useless to an English Language Learner. "For ELLs, as with all students, it is important to pronounce and distinguish auditorily, as well as to place into a meaningful context. It is therefore necessary for ELLs to have knowledge of the English vocabulary words within which they are to understand phonemes" (Antunez, 2002). During explicit phonics instruction, the Teacher's Guide for English Language Learners provides strategies for children to discover and acquire new English vocabulary as they develop phonemic awareness, pronunciation, decoding, and encoding skills. In one strategy, the teacher introduces a new word orally. Students segment the word and provide the sounds for the teacher to write the corresponding letters. Students read the word aloud. The teacher asks what the word means, then draws a picture of the word to communicate the meaning. Then, as students connect meaning to the word, they read the word several times.

Automaticity

The ultimate goal of skilled reading is comprehension of the written text. To achieve understanding, the skilled reader's decoding skills are automatic, occurring instantly and without effort. Teaching children the alphabetic code is a means of enabling them to recognize words to comprehend the message. At first, decoding takes up a great deal of one's short-term memory, leaving not much room for comprehension. As word recognition becomes more automatic, however, space is freed up. Pressley (2000) speaks of short-term memory as a limited resource with decoding operations and comprehension processing competing for a small area of capacity. Poor readers whose decoding skills are labored also show low comprehension. The goal, therefore, is to give children the tools to build automaticity. As children move into the consolidated alphabetic

stage, where they are decoding via sight words and word chunks that require little attention, capacity is freed to focus on comprehension (Rasinsky, 2000; Ehrlich et al, 1993).

Explode The Code builds automaticity through multiple exposures to the words that illustrate the many decoding elements. In each lesson group, opportunities are provided for students to read the words in isolation and in varying amounts of text that range from sentences to paragraphs to very short stories. In addition, children write the words, again in a variety of formats, sometimes after segmenting and identifying the sequence of sounds or chunks within the words. Words may be written in isolation, to complete sentences/paragraphs, or in answers to questions.

The *Explode The Code* Teacher's Guides present children with additional opportunities to develop skills in reading words, sentences, and passages accurately and quickly. In addition, the Teacher's Guide for English Language Learners provides high utility word (HUW) tables for children to read repeatedly and eventually recognize words automatically. This repeated exposure improves automaticity of sight words and other very common words during reading. It also encourages ELLs to begin using these words in their English speech and writing.

Adams (p. 410, 1990) writes, "It is their overlearned knowledge about the sequences of letters comprising frequent words and spelling patterns that enables skillful readers to process the letters of a text so quickly and easily." As words are initially processed, readers make connections between graphemes and phonemes, which form access routes to memory. Continuous encounters reinforce the access to memory and meaning until simply seeing the word accesses pronunciation and meaning (Ehri, 1991).

Stanovich and West (1988) also discuss the melding of accurate decoding skills with the visual or orthographic form of the word, which when repeated produces automaticity. Adams (pp. 206, 207) speaks of the importance of connecting

The ultimate goal of skilled reading is comprehension of the written text. To achieve understanding, the skilled reader's decoding skills are automatic, occurring instantly and without effort.

Explode The Code **builds automaticity through multiple exposures to the words that illustrate the many decoding elements.**

printed word forms with their sounds, contexts, functions, and meanings so that these associations are established and strengthened each time the printed words are encountered. When decoding skills are automatic and words are identified, meaning is triggered as well. Meaning depends on accurate, efficient decoding skills.

Concept and Vocabulary Building through Context

As with its treatment of letter/sound development, *Explode The Code* utilizes context in a sequential manner that builds in difficulty level. In the beginning, context appears at the word level, relating word to picture. It builds to the sentence level, to short paragraphs, and finally, to denser text. All of the text for a lesson uses words that pertain to the element or elements taught in the lesson. Students have the opportunity to apply what they have learned to meaningful text, which can facilitate the ease with which these words will be recognized in the future.

In its pictures and illustrations of the targeted elements and words, *Explode The Code* builds vocabulary concepts. Words like *bass*, *hut*, *gull*, *snare*, *shed*, *jolted*, *bolted*, and *quiver* from Books 1, 3, and 5 are examples of words to which children may attach little meaning. The pictures and the contextual text, in a concrete manner, help to build meaning. If, when children attempt to decode words, the words are not part of their listening/speaking vocabularies, they will have no means of confirming the accuracy of their attempts. Vocabulary knowledge and concepts are crucial not only for comprehension but for word recognition as well. *Explode The Code* offers vocabulary enhancement opportunities for all levels of students. *Bass*, *shed*, *bolted*, and *quiver* have alternate meanings that may be explored with students who are able to benefit from expanded instruction.

In addition, the *Explode The Code* Teacher's Guides provide definitions of phonics words from the lesson. The comprehension-building activities in the guides expand students' understanding of words and concepts by having them answer questions, work with synonyms and antonyms,

use words in oral sentences, explain the meaning of words in context, and draw pictures.

Because "it is easier for students to comprehend their reading when they can personally relate to the reading materials" (The Education Alliance), the Teacher's Guide for English Language Learners builds students' background knowledge through interactive vocabulary development during phonics lessons. But ELLs must often put forth much greater effort to achieve meaning. Therefore, the Teacher's Guide for English Language Learners also provides explicit comprehension strategies through which children progress from visualization of words to visualization of sentences and stories. These strategies can and should be extended throughout reading in all genres and subject areas.

Books 7 and 8 focus on vocabulary building through an emphasis on syllables and morphemes. As students learn to recognize polysyllabic words, the likelihood of these words not being a part of their listening/speaking vocabulary increases. Consequently, it is essential that word meaning be stressed. Most exercises in these books ask for definitions, using a variety of techniques including crossword puzzles, syllable scrambles, and interesting short vignettes followed by questions. Instructions on several pages ask children to verify words and word meanings with the dictionary.

Flexibility

Finally, good phonics instruction does not conform to the theory that one size fits all. Children come to school with very different skill levels of phonemic awareness, phonics knowledge, or word recognition ability. Moreover, as children progress through the grades, they acquire these skills at differing rates. An effective phonics program accommodates these issues.

Explode The Code offers the classroom teacher a program with the level of flexibility that is needed to meet the varying demands of most classrooms. The *Explode The Code Placement Tests* assess specific reading and spelling skills taught in the series. Results can determine entry

Explode The Code **offers the classroom teacher a program with the level of flexibility that is needed to meet the varying demands of most classrooms.**

level, placement within the series, or specific skills intervention. Pre- and post-tests in the student books can also help teachers determine appropriate placement levels for the students in the program. If a need for further practice on a particular skill is indicated, an extra practice book is available for levels 1–6. Referring to the Foundational Skills, the CCSS state, "...good readers will need much less practice with these concepts than struggling readers will. The point is to teach students what they need to learn and not what they already know..." (CCSS, p. 15).

Explode The Code allows the teacher flexibility in presenting and practicing concepts. The books may be used for whole class teaching, with small groups, or individually. Whole lessons may be used or selected pages within each lesson may be taught and assigned. Children may work individually or as partners. Different levels of the series may be used within one classroom. Systematic, explicit teaching does not mean that everyone moves ahead in lockstep. Rather it means assessing a child's skills as well as acknowledging his or her pace in proceeding with a sequence of concept development. The *Explode The Code* Teacher's Guides expand on the skills presented in the student books, providing teachers with numerous options for instruction and reinforcement. *Explode The Code Teacher's Guide for English Language Learners* provides teachers with classroom-tested techniques and strategies for teaching English Language Learners.

Research findings cited above recommend systematic direct teaching of phonics as one part of the total reading program. Cunningham (2000) and Pressley (2002) are among those who advocate a balanced literacy program. In Cunningham's four blocks program, word study constitutes one block. *Explode The Code* works most effectively when it is used along with a curriculum filled with connected reading and writing experiences where students may apply the skills they are learning.

Villaume and Brabham (2003) comment on the success with which seasoned teachers create flexible, multidimensional reading programs. They propose that their ability to do so may stem from the foundation of systematic instruction that structured commercial phonics programs provide. *Explode The Code* offers this foundation and provides a crucial part of the scaffolding needed for the successful teaching of reading and writing.

Nancy Hall, an experienced teacher, tutor, and educational consultant, has degrees from Middlebury College and Lesley College as well as Language Therapist Certification from Children's Hospital, Boston, Massachusetts. Her work has focused on both teaching and assessment, with a specialty in reading, writing, and spelling. She operates an independent testing service to evaluate private and public school students experiencing learning problems.

Beth Davis received her B.A. in history from Smith College and her M.Ed. in Reading from Boston College. She has been teaching Elementary Reading at Brandeis University for almost 30 years to both Brandeis and Wellesley College students. She began her career as an elementary classroom teacher in Hamden, Connecticut, and subsequently taught elementary reading courses concurrently at Boston College and Brandeis University. She has been an evaluator for Title 1 programs in Massachusetts, has instructed tutors for School Volunteers for Boston, has given numerous workshops to school systems in the greater Boston area, and has been a presenter at the Massachusetts Reading Association. She also coaches volunteer tutoring teams for the Jewish Coalition for Literacy in Boston. Ms. Davis is the author of several literature packets for students and teachers (Novel Ideas, Sundance Publishing). She co-authored *The Remedial Reading Handbook* (Prentice-Hall, 1985) and *Elementary Reading: Strategies that Work* (Allyn & Bacon, 1995).

Referring to the Foundational Skills, the CCSS state, "… good readers will need much less practice with these concepts than struggling readers will. The point is to teach students what they need to learn and not what they already know…" (CCSS, p. 15).

EXPLODE THE CODE ONLINE
Nancy Hall and CurriculaWorks

By Edina Torlaković

Computer-Assisted Instruction

The Association for Education Communications and Technology (1977) defines Computer Assisted Instruction (CAI) as a method in which a computer is used as an instructional tool to teach, guide, and evaluate a student until the student reaches a desired level of proficiency. There has been a significant increase in the use of CAI in classrooms across the country over the past decade.

A significant body of research suggests that technology integration into the curriculum enhances learning (Change, 2002; Cotton 2001), mostly due to increased student motivation. Both Cotton (2001) and Roblyer et al. (1989) maintain that CAI advances students' positive attitudes toward learning. In his meta-analysis of 500 studies, Kulik (1994) reported that CAI increases the positive attitudes of students toward learning, which consequently increases achievement. Torlaković (2001) suggests that this type of instruction considerably improves students' confidence, which may positively influence learning. Torlaković suggests that there are other benefits to CAI, including frequency of exposure and practice, student control of learning, immediate feedback, and absence of negative psychological effects that can result from face-to-face corrective feedback. In their meta-analyses, Tilman (2006) and Kadiyala and Crynes (1998) suggest that there are great benefits to using CAI with disadvantaged students and that students of lower socioeconomic status benefit even more from CAI than their peers in more advantaged environments.

CAI in Literacy and Intervention

CAI in reading has been evaluated by many researchers and determined to be a practical method of teaching critical reading skills. (National Reading Panel, 2000) Many studies suggest that there is a positive relationship between the use of CAI and reading ability. In a meta-analysis of 17 studies that took place from 1982-1997 and recorded the effect of CAI on the reading achievement of K-12 students, Soe, Koki, and Change (2000) concluded that CAI has an overall positive impact on reading success.

While CAI in reading has been proven to have significant benefits for all age groups (Roblyer, et al., 1989) it appears that CAI is most successful with students of elementary school age (Cotton, 2001). And, there is consensus in the literature that students with disabilities and students at risk for reading failure, in particular, benefit from CAI (Kim & Kamil, 2001). Many researchers support the use of CAI in the area of reading instruction for students with learning disabilities (Hall, Hughes, & Filbert, 2000, van Daal & van der Leij, 1992) and for students who struggle with the development of reading skills (Byrd, 2001; Hook, Macaruso, & Jones, 2001). MacArthur, Ferretti, Okolo, & Cavlier (2001), in their review of fifteen years of research on the influence of CAI in literacy, found that all studies support the use of CAI in the area of reading instruction for students with mild to moderate disabilities. They also found that the studies they reviewed support the use of this type of instruction to improve decoding skills and phonological awareness.

Warren and Rosebery (1988) point out that the computer's potential as a tool for reading instruction depends on the quality of program design and the appropriateness of the context in which it is used. As with any contemporary pedagogy, well-designed CAI in reading needs to be research-based, with a strong psychological and pedagogical foundation. Burns, VanDerHeyden, & Boice (2008) maintain that effective reading intervention must provide students with the following five components: 1) correctly targeted instruction, with individualized interventions matched to each student's current

A significant body of research suggests that technology integration into the curriculum enhances learning.

Explode The Code Online is an effective Computer Assisted Instruction (CAI) system for reading interventions in phonemic awareness and phonics. It offers research-based, instruction in an interactive format.

level; 2) explicit instruction, where skills are broken down into a manageable set of carefully sequenced steps; 3) tasks that present an appropriate level of challenge; 4) opportunities to respond; and 5) immediate feedback regarding the accuracy of responses.

Explode The Code Online

Explode The Code, the print program, offers time-tested synthetic (sound-by-sound), systematic, and explicit instruction in phonemic awareness, phonics, and decoding for grade levels K – 4 (Books 1 – 8). *Explode The Code Online* presents the same content as *Explode The Code* print; for more details on *Explode The Code* print content and the research behind it, please see the beginning of this document.

Explode The Code Online is an effective CAI system for reading interventions in phonemic awareness and phonics. It offers research-based instruction in an interactive format.

The five components of a well-designed CAI in reading intervention mentioned above, along with two additional criteria—an adequate research base and lmotivation through intrinsic and extrinsic rewards— are discussed below in relation to *Explode The Code Online*.

Explode The Code Online Is Research-Based

Efficacy studies report that students who used *Explode The Code Online* every day for 20 minutes for at least 10 weeks **gained reading proficiency at a rate of at least three times that of** students from the same schools who did not use the program. Anecdotally, teachers and administrators in schools using *Explode The Code Online* attest that reluctant readers were transformed into students who actually enjoyed reading. Sound instruction, a motivating format, and the opportunity for students to feel successful were all identified as contributing factors in this transformation. (For further information, see the *Explode The Code Online* overview video at eps.schoolspecialty.com/Video.

Explode The Code Online Instruction Is Correctly Targeted

In *Explode The Code Online*, effective instruction is matched to the student's current learning stage and proficiency level. First, teachers are given two options for placing students in the appropriate starting level of the program. Teachers may utilize the Assessment Zones that offer automatic placement. Assessment Zones are cumulative review lessons throughout *Explode The Code Online* that also serve as placement lessons. When a student successfully completes an Assessment Zone, the student is immediately jumped to the next Assessment Zone. This process continues until the student completes the curriculum with proficiency or fails an Assessment Zone. When a student fails to pass an Assessment Zone he or she is then placed into the first unit associated with the Assessment Zone. Teachers also have the option of manually placing students within the scope and sequence, using formal and informal assessments first to select the level that best fits each student's ability.

Once instruction is underway, an embedded diagnostic tool continuously analyzes accuracy and speed as students interact with each unit, and the curriculum is adjusted accordingly. If a student is struggling with a specific skill, the program moves the student back in the instructional sequence; if a student performs well, he or she is moved ahead and allowed to skip concepts mastered. Because time is spent on targeted areas of student deficit, instructional time is optimized.

Explode The Code Online Offers Explicit Instruction

Explode The Code has a well recognized and approved scope and sequence of skills. *Explode The Code Online* has the same scope and sequence, with its instruction broken down into highly manageable steps.

All skill explanations and sound and word identifications are recorded using clear, concise,

and specific language. Learning is scaffolded in a consistent, predictable way. First, a Helper character gives step-by-step instructions for completing the activity. Next, the Helper demonstrates the task. Finally, students are asked to perform the task independently.

Explode The Code Online Provides Appropriate Challenge

Gresham (2001) argues that instruction must be at the right level of challenge. Match between student skill and instructional material is an important functional variable for student learning. In other words, if instruction is too easy, students won't learn. However, if it is too hard, students will give up. Therefore it is necessary to have a match between skill and task demand, or instructional level.

Explode The Code Online provides students with appropriate challenge and instructional match. In addition to the adaptive technology that ensures instruction is always individualized. *Explode The Code Online* offers robust reporting features such as detailed reports, in the form of charts, tables, graphs, and summaries, that are available for individual students or for the entire class. Teachers and administrators can access these reports anytime on the Student Summary Report page. Report data shows where students were successful and where they struggled, as well as how they measure up against their peers in the classroom, school, or state, so that the curriculum-delivery settings on the program can be adjusted, if necessary.

Explode The Code Online Provides Students with Many Opportunities to Respond

Research demonstrates that providing students with multiple opportunities to interact with a skill and demonstrate skill mastery leads to improved retention of the newly learned items (Burns, 2004). Inadequate exposure to and experiences with new skills will lead to memorization of question-answer combinations and not necessarily skill acquisition.

In each unit of *Explode The Code Online*, students are given no fewer than eight opportunities to interact with each target skill to acquire proficiency. A variety of task types are provided to deepen understanding and provide engagement. Depending on the activity, students choose letters to spell pictures' names, match words or sentences with pictures, find pictures that begin with the sound of a letter shown on the screen, choose the best words from a word bank to complete sentences, or answer yes/no questions. Growing difficulty or challenge is also part of the opportunities to respond. Not only are task types varied, but they build in difficulty as students practice a concept.

The multisensory nature of the instruction and activities also adds more depth and differentiation, especially for those students with language-based learning difficulties.

Explode The Code Online Provides Students with Immediate Feedback

As they work on their own, students receive feedback from the program about their answers. Feedback is the information regarding the accuracy and correctness of the response. It is widely believed that feedback should match the stage of learning; the earlier the student is in the development of skills (i.e., acquisition phase), the more immediate and explicit the feedback should be.

One effective feedback strategy is overcorrection (Singh, 1987), where students are told about errors and asked to provide correct responses. This strategy is used successfully in *Explode The Code Online*. For each item, students receive a verbal acknowledgement of a right or wrong answer. For wrong answers, they are asked to try again, and at least two chances are given to be successful. As Torlaković (2001) points out, the benefits of CAI include the ability to deliver immediate feedback and absence of negative psychological effects that can result from face-to-face corrective feedback (teacher-provided).

Explode The Code Online Motivates for Success

An important component of effective feedback is that it be positive and supportive. *Explode The Code Online* uses an engaging reward system to motivate students and get them excited about learning. After completing each unit in *Explode The Code Online*, the student receives a badge on a chalkboard. Either a bumblebee, ladybug, butterfly, or airplane is awarded. Each badge corresponds to a specific range of speed and accuracy. Teachers report that students quickly become excited about earning the badges, which accumulate as students progress through the program, keeping them motivated.

It is clear that engagement with an appropriate task breeds more engagement as success breeds more success. *Explode The Code Online* ensures success through its high level of engaging interactivity, appropriate skill leveling and challenge, and a program of rewards. Besides the badges students receive for performing good work, they may also choose reward links to online games and puzzles after a certain number of curriculum units have been completed or a certain amount of time has been spent.

Summary

Explode The Code Online has all the elements of an excellent computer-assisted academic intervention in reading. It is research-based, correctly targeted for each student, providing the student with individualized, explicit, and appropriate yet challenging instruction. It gives a student many different opportunities to respond so that learning is varied and engaging. *Explode The Code Online* also provides students with immediate corrective feedback and opportunities to celebrate their progress with the inner confidence of successful program participation and the fun and games that can reward the completion of a job well done.

Explode The Code Online has been found to be especially effective with English Language Learners and students with disabilities because of its rich visual and auditory components.

The curriculum provides instruction with auditory reinforcement to help students hear specific sound-text correspondence and develop their oral language proficiency, a factor associated with improved reading comprehension and writing skills for English learners. The curriculum also provides targeted literacy instruction that most benefits students with disabilities, including, word-level and text-level skill development, clear instructional objectives, highly motivational structures, direct instruction in phonics as well as phonological awareness with auditory aids, word identification activities, repetitive practice and embedded assessment. (August & Shanahan, 2006; Goldenberg, 2006).

Edina Torlaković is a cognitive scientist who specializes in computer assisted language learning, second language acquisition, and computer modeling of second language acquisition. Edina is a PhD candidate with a decade of experience in studying, developing and evaluating computer assisted language learning systems. She has been published in the Computer Assisted Language Learning Journal and has served as a reviewer for the Canadian Journal of Applied Linguistics and Annual Cognitive Science Conferences.

CurriculaWorks is an online engine provider that creates advanced online learning software. Their curriculum delivery and assessment engine features efficient web access, high-resolution data collection, and sophisticated reporting.

Learn more about CurriculaWorks at curriculaworks.com.

For more information about this and other research-based materials from EPS Literacy and Intervention, visit epsbooks.com or call 800.225.5750.

> An important component of effective feedback is that it be positive and supportive. *Explode The Code Online* uses an engaging reward system to motivate students and get them excited about learning.

References

Adams, M. J. (1990). *Beginning to Read: Thinking and Learning about Print*. Cambridge, MA: MIT Press.

Anderson, R. C., Hiebert, E. F., Scott, J. A., & Wilkinson, I. A. G. (1985). *Becoming a Nation of Readers*. Champaign, IL: National Academy of Education and Center for the Study of Reading.

Antunez, Beth. (Spring 2002). "Implementing Reading First with English Language Learners," *Directions in Language and Education*, 15, 1-12.

Association for Educational Communications and Technology. (1977). *Educational technology: Definition and glossary of terms* (Vol 1). Washington, D.C.: Association for Educational Communication and Technology.

August, D. & Shanahan, T. (Eds.). (2006). Executive Summary: *Developing Literacy in Second Language Learners: Report of the National Literacy Panel on Language-Minority Children and Youth*. Mahway, NJ: Erlbaum.

Bond, G.L., & Dykstra, R. (1997). The Cooperative Research Program in first-grade reading instruction. *Reading Research Quarterly*, 3, 348-427. Originally published in 1967.

Burns, M. K., VanDerHeyden, A. M., Boice, C. H. (2008). Best practices in delivering intensive academic interventions. In A. Thomas & J. Grimes (Eds.). *Best Practices in School Psychology, 5th Edition*, Volume 4 (pp. 1151-1162). Bethesda, MD: National Association of School Psychologists.

Byrd, M. (2001). Technology helps Increase reading scores. *Media & Methods*, 37(3).

Chall, J. S. (1967, 1983). *Learning to Read: The Great Debate*. New York: McGraw Hill.

Chall, J. S. & Pope, H. M. (1996) *Teaching and Assessing Phonics: Why, What, When, How: A Guide for Teachers*. Cambridge, MA: Educators Publishing Service.

Chang, C.Y. (2002). Does computer-assisted instruction + problem solving = Improved science outcome? A pioneer study. *Journal of Education Research*, 95(3), 143-151.

Clay, M. M. (1991) *Becoming Literate: The Construction of Inner Control*. Aukland, New Zealand: Heinemann Education.

Common Core State Standards Initiative. (2010) Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects. Washington, DC, National Governors Association Center for Best Practices and the Council of Chief State School Officers.

Cotton, K. (2001). Computer-assisted instruction. Northwest Regional Educational Library: School Improvement Research Series, 10.

Cunningham, P. M., Moore, S. A., Cunningham, J. W. & Moore, D. W. (2000) *Reading and Writing in Elementary Classrooms: Strategies and Observations*. New York: Addison Wesley Longman.

Education Alliance at Brown University. "Teaching Diverse Learners: Understanding the Challenges." Brown University. http://alliance.brown.edu/tdl/elemlit/challenges-prt.shtml.

Ehri, L. (1991). *Development of the Ability to Read Words*. In R. Barr, M. Kamil, P. Mosenthal, & P. Pearson (Eds.), *Handbook of Reading Research*, 2, New York: Longman, 318-417.

_____. (1998). *Grapheme-phoneme Knowledge is Essential for Learning to Read Words in English*. In J. L. Metsala & L. C. Ehri (Eds.), Word Recognition in Beginning Literacy. Mahwah, NJ: Erlbaum, 3-40.

Ehrlich, M., Kurtz-Costes, B., & Loridant, C. (1993). "Cognitive and Motivational Determinants of Reading Comprehension in Good and Poor Readers." *Journal of Reading Behavior*, 23, 365-381.

Freebody, P.& Byrne, B. (1988) "Word-reading Strategies in Elementary School Children: Relations to Comprehension, Reading Time, and Phonemic Awareness," *Reading Research Quarterly*, 23, 441-453.

Gaskins, I. W., Ehri, L. C., Cress, C., O'Hara, C., & Donnely, K. (1996/7). "Procedures For Word Learning: Making Discoveries about Words." *The Reading Teacher*, 50, 312-327.

Goldenberg, C. (2006). "Improving Achievement for English Learners: Conclusions from 2 Research Reviews" retrieved January 24, 2007 from http://www.colorincolorado.org/articles/cgoldenberg_apr06.php

Gresham, F. (2001). Responsiveness to intervention: An alternative to the identification of learning disabilities. *Paper presented at the 2001 Learning Disabilities Summit: Building a Foundation for the Future*.

Griffith, P. L. & Olson, M. W. (1992). "Phonemic awareness helps beginning readers break the code." *The Reading Teacher*, 45, 516-523.

Hall, T. E., Hughes, C.A., & Filbert, M. (2000). Computer assisted instruction in reading for students with learning disabilities: A research synthesis. *Education & Treatment of Children*, 23(2), 173-194.

Hook, P.E., Macaruso, P., & Jones, S. (2001). Efficacy of fast forward training on facilitation acquisition of reading skills by children with reading difficulties - a longitudinal study. *Annals of Dyslexia*, 51, 75-96.

Juel, C. (1988). "Learning to read and write: A longitudinal study of 54 children from first through fourth grades." *Journal of Educational Psychology*, 80, 417-447.

References

_____. (1991). *Beginning Reading*. In R. Barr, M. Kamil, P. Mosenthal, & P. Pearson (Eds.), *Handbook of Reading Research*, 2, New York: Longman, 759-788.

Kadiyala, M. & Crynes, B.L. "Where's the proof? A review of literature on effectiveness of information technology in education," fie, vol. 1, pp.33-37, *28th Annual Frontiers in Education* - Vol 1 (FIE'98), 1998

Kim, H. S., & Kamil, M. L. (2002). Successful Uses of Computer Technology for Reading Instruction. In M. L. Kamil, H. Walberg, H., & J. Manning, (Eds.) *Successful Reading Instruction*. Greenwich, CT: Information Age (pp.11-32).

Kulik, J. (1994). Meta-analytic studies of finding on computer-based instruction. In Baker, E.L. and O'Neil, H.F. Jr. (Eds.), *Technology Assessment in Education and Training*. Hillsdale, NJ: Lawrence Erbaum.

Leppanen, U., Niemi, P., Aunola, K., & Nurmi, J. (2004). Development of reading skills among preschool and primary school pupils. *Reading Research Quarterly*, 39, 72-93.

MacArthur, C.A., Ferretti, R.P., Okolo, C.M., & Cavlier, A. R. (2001). Technology applications for student with literacy problems: A critical review. *The Elementary School Journal*, 1001, 273-301.

McCulley, L. V., Katz, S., & Vaughn, S. (2013). Reading instruction and students with learning disabilities. In J. P. Bakken, F. E. Obiakor, A. F.Rotatori (Eds). *Learning disabilities: Practice concerns and students with LD* (pp. 19-44). Bingley, United Kingdom: Emerald Group.

Morris, D., Bloodgood, J. W., Lomax, R. G., & Perney, J. (2003). Developmental steps in learning to read: A longitudinal study in kindergarten and first grade. *Reading Research Quarterly*, 38, 302-328.

Muter, V. & Snowling, M. (1998). "Concurrent and longitudinal predictors of reading: The role of metalinguistic and short-term memory skills." *Reading Research Quarterly*, 33, 320-335.

National Reading Panel (2000). *Teaching children to read: An evidence based assessment of the scientific research literature on reading and its implication for reading instruction−Reports of the subgroups*. Washington, D.C.: National Institute of Child Health and Development.

O'Connor, R.E. (2011). Phoneme awareness and the alphabetic principle. In R. E. O'Connor, & P. F. Vadasy (Eds.). *Handbook of reading interventions* (pp. 9-26). New York: Guilford Press.

Pressley, M. (2002) *Reading Instruction that Works: The Case for Balanced Teaching*. New York: The Guilford Press.

Rasinsky, T. V., (2000). "Does Speed Matter in Reading." *The Reading Teacher*, 54, 146-151.

Roblyer, M. D., Castine, W. H., & King, F. J. (1989). *The impact of microcomputer based instruction on teaching and learning: A review of recent research*. ERIC digest. Syracuse, NY: ERIC Clearinghouse on Information Resources. (ERIC Identifier ED315063).

Simmons, D. C. & Kameenui, E. J. (Eds.) (1998). *What Reading Research Tells Us about Children with Diverse Learning Needs: Bases and Basics*. Mahwah, NJ: Lawrence Erlbaum Associates.

Singh, N. N. (April 1990). Effects of two error-correction procedures on oral reading errors. *Behavior Modification*, 14(2), 188-199.

Soe, K., Koki, S., & Chang, J.M. (2000). *Effect of computer-assisted instruction (CAI) on reading achievement: A meta-analysis*. Retrieved March 15, 2010 from Pacific Resources for Education and Learning Web site: http://www.prel.org/products/Products/ effect-cai.htm

Stahl, S. A., Duffy-Hester, A. M., Stahl, K. A. D. (1998). "Theory and research into practice: Everything you want to know about phonics (but were afraid to ask)." *Reading Research Quarterly*, 33, 338-355.

Stanovich, K. E. (1993/4). "Romance and Reality." *The Reading Teacher*, 47, 280-291.

Stanovich, K. E. & West, R. F. (1989) "Exposure to Print and Orthographic Processing," *Reading Research Quarterly*, 24, 402-433.

Tilman, P.S. (2006). "Computer-Assisted Instruction (CAI) and Reading Acquisition: A Synthesis of the Literature" retrieved from the web on March 5, 2010 http://teach.valdosta.edu/are/ TillmanPLRFinal.pdf

Torlaković , E., (2001). "Application of a CALL system in the acquisition of adverbs in English". Master's thesis, Carleton University.

Van Daal, V.H., & van der Leij, A. (1992). Computer-based reading and spelling practice for children with learning disabilities. *Journal of Learning Disabilities*, 25 (3), 186-195.

Villaume, S. K. & Brabham, E. G. (2003) "Phonics Instruction: Beyond the Debate," *The Reading Teacher*, 56, 478-482.

Warren, Beth, and Rosebery Ann S. Theory and Practice: Uses of the Computer in Reading Remedial and Special Education 1988 9, 29-38.

Yopp, H. K. "Developing Phonemic Awareness in Young Children." *The Reading Teacher*, 45, 696-703.