THE READING LEAGUE Vermont
Sharing knowledge, inspiring change.

TEACHING READING IN BRIEF

READING AND THE BRAIN: MAPPING PHONEMES TO GRAPHEMES

VOL. 2, NO. 1

Each series will be curated by a Vermont expert on the subject, with editing support from Dorinne Dorfman, Ed. S., Ed. D., and The Reading League Vermont. If you are interested in writing an article, please contact Dr. Dorfman at dorinnedorfman@gmail.com.

The three-part series features:

1. **Phonemic awareness** in September 2024 - January 2025, with lead editor Cara Arduengo, MS, CCC-SLP, M. Ed.
2. **Phoneme-grapheme mapping** in February - April 2025, with lead editor Kathryn Grace, M. Ed, CAGS
3. **Orthography and morphology** in April - June 2025, with lead editor Peggy Price, M. Ed., Fellow/OGA

During the 2025-26 school year, we will continue with the themes of **fluency, vocabulary, and comprehension.**
We look forward to sharing the teaching expertise of your colleagues across Vermont and moving toward the goal of reading equity!

Curious Question: How many ways is the phoneme /sh/ spelled in the English language?

A Note from the Editors on the Second Series

In this second series of *Teaching Reading in Brief*, *Volume 2*, we share evidence-aligned teaching practices in the foundations of reading. The next five articles are devoted to Phoneme Grapheme Mapping™ – the process of connecting letter sounds (phonemes) to letters (graphemes). Phoneme-grapheme mapping facilitates the cognitive process of orthographic mapping, in which graphemes are bonded to phonemes in memory. When orthographically mapped, words are recognized on sight, automatically and effortlessly linked by pronunciation, spelling, and meaning (Ehri, 2014).

Research has shown that adding letters as quickly as possible during phonemic awareness activities (segmenting, blending, and manipulating sounds) propels reading development (International Dyslexia Association, 2022). An advantage of introducing Phoneme Grapheme Mapping™ very early in the instructional sequence is that students learn to write graphemes in sound-spelling boxes, and thus improve their handwriting, letter knowledge, segmenting, blending, reading, and spelling, all in one activity. During instruction, teachers demonstrate the alphabetic principle as students write on sound-spelling boxes, by which they can:

THE READING LEAGUE Vermont
Sharing knowledge, inspiring change.

TEACHING READING IN BRIEF

READING AND THE BRAIN: MAPPING PHONEMES TO GRAPHEMES

VOL. 2, NO. 1

- represent graphemes within a word, such as in c|a|tch and b|r|i|dge;
- understand that a single phoneme may be represented by 1 to 4 letters (***f, th, igh, eigh***); and
- depict the relationships between graphemes within a word (b|ă|th vs. b|ā|the).

In Volume 2, articles will include the following topics:

1. A summary of the research and conceptual framework of phoneme-grapheme and orthographic mapping, plus instructional methods for mapping one-syllable words
2. Methods for more complex mapping with 5 syllable types: closed, open, silent e, r-controlled syllables, and consonant-le
3. Methods for mapping phonemes to graphemes with vowel teams and understanding Anglo-Saxon, Greek, Latin, and French morphology
4. Methods for mapping phonemes to graphemes in sound-spelling boxes with inflectional suffixes (***-ing, -ed, -s/es, -er, -est, -en***)
5. Methods for mapping syllable stress in multisyllabic words, particularly in homographs (***object, object***) and morphological changes (***capable, capacity***).

The article sequence begins with kindergarten-level skills and continues up through secondary grades. Struggling readers in all grade levels can benefit from receiving instruction in phoneme-grapheme mapping. Indeed, poor readers and spellers often demonstrate uncertain, missing, and/or incorrect connections between phonemes and graphemes on assessments. Teachers in all subject areas will reach more students by integrating phoneme-grapheme mapping in academic vocabulary instruction, emphasizing word origins (such as pronouncing and spelling Greek graphemes ***ch, ph, ps, rh***), prefixes and suffixes (such as ***pre- vs. per- and -ous, -tion, -olog***y, etc.), and syllable types for word pronunciation. We hope you enjoy traveling on this learning journey with us!

– Kathryn Grace and Dorinne Dorfman, Editors

THE READING LEAGUE Vermont
Sharing knowledge, inspiring change.

TEACHING READING IN BRIEF

READING AND THE BRAIN:
MAPPING PHONEMES TO GRAPHEMES
VOL. 2, NO. 1

References

- Grace, K. (2022). *Phonics and spelling through Phoneme Grapheme Mapping™*. Really Great Reading.
- Ehri, L. C. (2014). Orthographic mapping in the acquisition of sight word reading, spelling memory, and vocabulary learning. *Scientific Studies of Reading*, *18*(1), 5-21. https://doi.org/10.1080/10888438.2013.819356
- International Dyslexia Association. (2022). Building phoneme awareness: Know what matters. https://dyslexiaida.org/building-phoneme-awareness-know-what-matters/

Understanding and Teaching Phoneme Grapheme Mapping™

Kathryn E. S. Grace, M.Ed., CAGS
and Dorinne Dorfman, Ed. S., Ed. D.

Note: Over thirty years ago, Kathryn Grace first coined the term Phoneme Grapheme Mapping™ after creating the methodology to use with her struggling third graders.

It has since become ubiquitous in evidence-based instruction by this and other terms, such as word mapping and phoneme-grapheme matching. In recognition of Grace's contributions to the field after her graduate studies with Drs. Lousia Moats and Reid Lyon at Saint Michael's College in the 1980s, we will refer to instructional practices to facilitate students' orthographic mapping as Phoneme Grapheme Mapping™.

In this article, we answer the following questions:

- What does research tell us about mapping phoneme-grapheme relationships?
- What is Phoneme Grapheme Mapping™, and why should we teach it?
- When should I begin to teach Phoneme Grapheme Mapping™?
- How should we teach Phoneme Grapheme Mapping™?
- Which spelling concepts must a teacher understand to begin instruction and assessment in Phoneme Grapheme Mapping™?

TEACHING READING IN BRIEF

READING AND THE BRAIN: MAPPING PHONEMES TO GRAPHEMES, VOL. 2, NO. 1

What does research tell us about mapping phoneme-grapheme relationships?

Studies in neuroscience have revealed the complex brain circuitry and information processing involved in reading. Researchers have developed a strong understanding of how readers use their brains to read, and how the patterns of activation differ between skilled and poor readers, particularly students with unremediated dyslexia. Researchers have also demonstrated that students' patterns of brain activation can change as a result of reading intervention (Kearns et al., 2018).

Shaywitz (2020) explains how different parts of the brain respond to language stimuli and work together to facilitate quick, fluent reading. Two key brain pathways are activated. The first pathway slowly analyzes words letter by letter, sound by sound, and links these together. This pathway is used for unfamiliar, decodable words or for beginning readers who still decode every word they encounter. The second pathway becomes engaged when readers instantly recognize familiar words. Shaywitz noted, "The more skilled the reader, the more she activates this region. It responds very rapidly – in less than 150 milliseconds (less than a heartbeat) to seeing a word" (p. 76).

Orthographic mapping is a cognitive process in which graphemes (letter and letter combinations) are bonded to phonemes (sounds).

Words orthographically mapped are quickly retrieved from long-term memory, connected by pronunciation, spelling, and meaning automatically and effortlessly, and thus recognized on sight (Ehri, 2014).

The concept of sight words is often misunderstood as either high-frequency words (***farm, play***), phonetically irregular words (***the, was***), or familiar words in memory. People do not memorize words by shape or "sight," though this may be the impression left when words are instantly recognized and need no decoding or sounding out (Moats, 2020). Reading researchers most often use the term to refer to written words firmly embedded in the memory system and recognized *on sight*. "It does not matter if the words are high frequency, low frequency, phonetically regular or irregular" (Kilpatrick, 2015). Orthographic mapping *does not* involve memorizing the shape of a word, guessing based on the first and last letters, or remembering pictures from a story. These methods actually bypass the process of orthographic mapping and interfere with developing effective orthographic fluency.

> If a child memorizes ten words, the child can only read ten words, but if a child learns the sounds of ten letters, the child will be able to read 350 three-sound words, 4,320 four-sound words, and 21,650 five-sound words (Kozloff, 2002).

Orthographic mapping is not a skill, teaching technique, or classroom activity. However, phonemic awareness and phonics skills can be taught, which support the brain's orthographic mapping of words (Kilpatrick, 2019). Ehri (2014) stated that students must become highly proficient in phonological and phonemic awareness, have automatic letter-sound knowledge, immediately blend those sounds, and access meaning to become skilled readers. With effective instruction and repeated practice, most words can become orthographically mapped and thus automatic by sight.

What is Phoneme Grapheme Mapping™ and why should we teach it?

Systematic phonics programs for instruction are essential to help students make orthographic connections between what they hear and what they see and write (Ehri, 2020). Phoneme Grapheme Mapping™ and its reciprocal process of grapheme-phoneme mapping are effective methods for facilitating these important connections. Ultimately this enables a child to read and spell individual words accurately and quickly so they can easily retrieve them in isolation and within connected text. Following a word study program's scope and sequence, such as that found in *Phonics and Spelling Through Phoneme Grapheme Mapping™* (Grace, 2022).

Following a sequential and systematic scope and sequence of the phonemes and graphemes in the English language ensures alignment to the requirements for phonemic awareness and phonics instruction as required in Vermont's 2024 literacy law, Act 139.

Phoneme Grapheme Mapping™ emphasizes the connection between phonological processing (sound) and orthographic processing (writing). It builds phonemic awareness, strengthens letter-sound knowledge, and leads to a better understanding of the alphabetic principle. It also facilitates orthographic mapping. (Grace, 2023). The multimodal components of Phoneme Grapheme Mapping™ help bridge the brain's phonological and orthographic processors to strengthen learning and recall.

A key principle in Phoneme Grapheme Mapping™ is that the number of sounds in a word is not always equal to the number of letters needed to spell it. This principle is demonstrated by showing students how to map the intricate relationships between sounds and print. If students receive explicit instruction and practice, Phoneme Grapheme Mapping™ can improve their independent reading and writing skills. Concrete manipulatives, such as colored chips or two-color counters, linked to graphic mapping strategies help students build a bridge between their understanding of the sounds they hear and the graphemes they are learning to write independently (Grace, 2022).

Demonstrating these skills with the graphemes is the goal for reading and writing instruction.

Every word we read or hear requires knowing how phonemes and their corresponding graphemes are sequenced, written, and turned into meaning. (Moats, 2005). This process relies on the following:

- **Alphabetic principle:** The knowledge that the oral and written language is based on the letters of the alphabet and there is not always a one-to-one correspondence between what is heard and written. (For example, /ī/ can be represented by ***igh***.) *See Figure 2 for additional examples.*

- **Phonemic awareness:** An awareness that the English language is made up of discrete sounds. (The word ***night*** is comprised of /n/ /ī / /t/.)

- **Letter - Sound Knowledge:** Each sound corresponds to a letter or letter pattern that is written in a specific sequence (/n/ /ī / /t/) = ***night***)

- **Syllables:** Units of pronunciation organized around a vowel

English has six syllable types: closed (***met***), open (***me***), silent e (***mete***), r-controlled (***march***), consonant-le (***meddle***), and vowel team (***meat***).

- Morphology: Words may be broken down into morphemes, the smallest units of meaning (unmetered = un + meter + ed).

English spelling is more challenging than in more transparent languages, such as Finnish and Hebrew. For most of the twentieth century, English spelling instruction was determined by the belief that English spelling was highly irregular. Typically spelling instruction was based on rote memorization of assigned words and emphasized visual memorization of the most common irregular sound/symbol relationships (Putnam, 2017). Decades of research support the view that spelling is a complex cognitive process intrinsically related to oral language, reading, and writing (Ehri, 2006; Snow, Griffin, & Burns, 2005; Treiman, 2006.) Additionally, the work of Hanna et al. (1966) on the predictability of the English language showed that English spelling was grounded in a predictable, logical, and rule-based language system. The table on the next page shows the predictability of English spelling.

Table 1 Spelling Pattern Predictability

Characteristic	Description	Example	Portion of English Words
Predictable and consistent	• By sound-symbol correspondences alone	• pan, must, that	Approximately 50% of words in our language.
Predictable and frequent—one error per word if only phoneme/grapheme mapping is used	Determined by • Position of a phoneme in a word (initial, medial, or final) • Syllable stress • Phonemic environment (e.g., soft *c* and *g*)	• rain *vs.* ray baby *vs.* bake • con *TENT vs.* *CON* tent • cent *vs.* cost gym *vs.* cage back *vs.* bank wrench *vs.* watch	An additional 36% of the words in English are then "regular."
Predictable but infrequent	• Word relatives/word families	• kind, mind, blind • old, fold, mold	
Morphologically complex	• Compound words • Affix-root structure • Latin/Greek derivation • Rule-based generalizations • Foreign language spelling patterns	• caretaker, playfellow • undoing, refilled • circle, circus, circular • stuff, fill, pass, liked, happily, running • chaise, buffet, beautiful	Another 10% of so-called "irregular" words are explained.
Odd, truly unpredictable spellings	• Leftovers from our Anglo/Saxon heritage	• of, aunt, does	Approximately 4% of words in our language.

Figure 1. Spelling Pattern Predictability (Grace, 2022)

By mapping sounds to print, students acquire a metacognitive approach to decoding and encoding (spelling) and can self-monitor when engaging in these complex tasks.

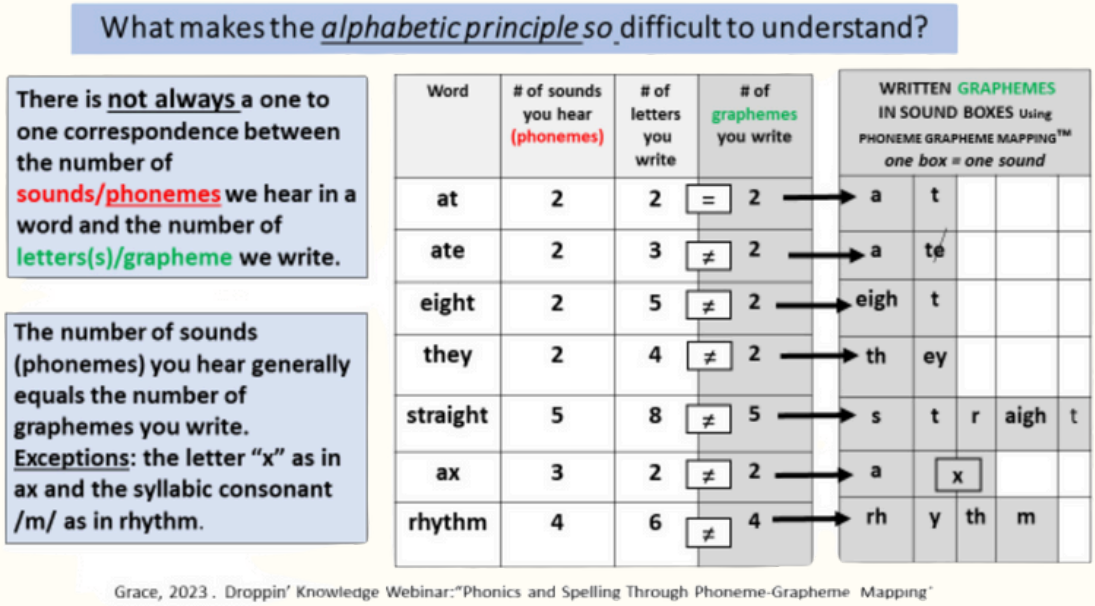


Figure 2: Droppin' Knowledge (Grace, 2023)

When should I teach Phoneme Grapheme Mapping™?

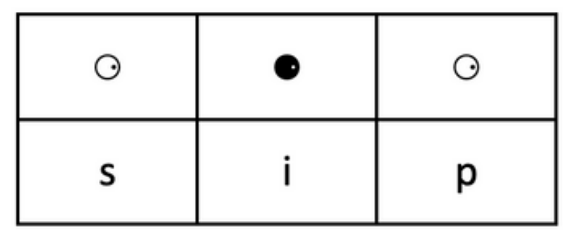
Birsh and Carreker (2018) expand the definition of phonemic awareness to not only the "awareness of the smallest units of sound in the speech stream…" but add "the ability to isolate and manipulate the individual sounds in words" (p. 835). To form connections and retain words in memory, readers must possess phonemic awareness, particularly segmentation and blending.

Students struggling with phonemic awareness after repeated instruction and practice can nevertheless move on to Phoneme Grapheme Mapping™, though these students will need embedded phonemic instruction, especially for phonemes with similar articulation features, such as /ch/ and /sh/, /f/ and /th/, and /ĕ/ and /ĭ/, or other sounds students confuse. Beginning with common words that students likely mapped from exposure (e.g. ***cat***, ***dog***) is only helpful if each phoneme is regular in speech and print. Thus, words like ***the***, ***was***, or ***of*** would not be suitable for beginning readers.

Students who have received systematic phonemic awareness instruction and are beginning to make associations between phonemes and graphemes are ready for Phoneme Grapheme Mapping™.

This first requires oral blending. For example, when the teacher segments "/l/ ē/ /f/," students can blend the sounds together and say ***leaf***. Teaching blending initially takes place at the syllable level (pic/nic = ***picnic***), then at the onset-rime level (/b/ /at/), and finally at the complete phoneme segmentation level (/m/ ā /d/ = ***made***). The goal of phoneme segmentation is to facilitate phoneme blending for reading words. If possible, connect sounds to letters from the start. This instruction helps students link the sound that they hear with the letter representation for that sound. Over time, more and more phoneme-grapheme correspondences are taught, progressing from the most common graphemes to the least common.

Prekindergarten and kindergarten teachers should instruct phonemic awareness and add corresponding letters as early as possible. Using colored chips or two-color counters, teachers instruct students to segment phonemes in a word by placing chips in Sound/Spelling Boxes – a grid that provides spaces for students to place each chip (Grace, 2023).



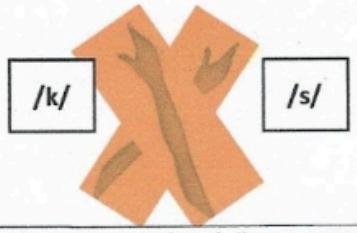
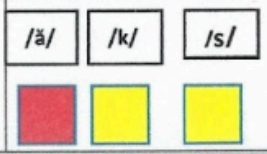
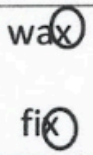
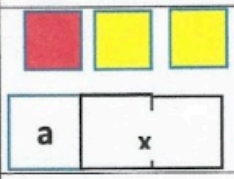
Once students develop one-to-one correspondence between the tile and the sound the tile represents, they can use a separate but consistent color (e.g.. red) to represent a vowel sound and a different, consistent color (e.g., yellow) for consonants. When using phoneme counters for this purpose, it is recommended to consistently use these colors, easily flipping from one side to the other.

How do we teach Phoneme Grapheme Mapping™?

Phoneme Grapheme Mapping™ works best in small groups in the classroom or other interventions, yet can be successfully taught in whole-class settings when given time for direct instruction, student practice, and immediate teacher feedback. Plan for three days of instruction per week with Phoneme Grapheme Mapping™. Based on our experience, we recommend teachers devote 25 to 30 minutes for the introductory day, and 10 to 15 minutes on two additional days that week.

See Figure 3 below for a step-by-step instructional process.

PHONEME-GRAPHEME MAPPING™ Step-by-Step Process

Day One – Teach Concept and Segment Sounds		
Teacher Directions	Notes	Sample
PREPARE: Compile Lesson Wordlist. Students need sound tiles.		
TEACH: Teach the new sound, spelling concept and pattern. 	Cross your arms while you make each sound in "x". This provides a visual cue of the "x" as the two crossed arms look like an "x" with each arm signifying one of the two sounds. /k/ and /s/.	Today, we are going to learn about the letter "x". It is the only letter in our language that represents two sounds. "Say ax. Now say "ax" without the /a/. What do you hear? /k/ /s/. How many sounds is that? (2).
SEGMENT: Instruct students to use colored tiles to segment dictated words. Tell students the tiles represent sounds NOT letters.	Have them use a red tile to represent each vowel sound.	
CHECK: Check each word immediately by having students touch each block one at a time and say its corresponding sound. Remember one tile represents one sound NOT one letter.	Circulate among the group to insure students are segmenting correctly and prompt corrections as needed.	
Day Two – Read Words. Find, Circle and Say Target Sound.		
PREPARE: Day One Wordlists for Students. (5-10 words)		ax, fax, wax, ox, box, fox, fix
READ: Instruct students to independently read the list silently then lead the group to read the words chorally.		
FIND AND CIRCLE THE SOUND for each word: a. Instruct students to find, point to, and say the target sound. "Say the sound." b. Then, instruct students to circle and say the letter(s) for the target grapheme. "Say the letter(s) that represent that sound.	Instruct younger students to say the sounds when circling the letters.	
Day Three – PHONEME GRAPHEME MAPPING™		
PREPARE: PHONEME GRAPHEME MAPPING™ grids, sound tiles and copies of the Day One wordlist.		
TEACH/DEMONSTRATE specific mapping approach.	Demonstrate specific mapping approach. Since "x" makes two sounds, it is put in the middle of two sound boxes.	
SEGMENT: Dictate word. Student says each sound and positions one tile in each grid square for each sound.	Advance students may dot each square.	
SAY PHONEME (SOUND) AND GRAPHEME (LETTER/LETTER GROUP)		
a. Point to the first tile. Say, "What do you hear?" Students say the sound. b. Ask, "What do you write?" Students say the grapheme, move the tile up from the sound box and write the grapheme in the square on the grid. Repeat steps *a* and *b* for each sound-spelling until the whole word has been written in the sound boxes on the paper.	Some lessons instruct students to apply specific color coding for vowels and to note syllable divisions with colors and/or dotted lines.	
When the word is completely written, the student should have the exact spelling of the word on the paper with the letters distributed across the boxes based on their phoneme/grapheme correspondence: One sound, one grapheme per square. REMEMBER: One sound or single phoneme can be represented by more than one letter/grapheme unit. Ie. long a is represented by the grapheme "ai " in the word exclaim.		
REVIEW: Instruct students to restate in their own words the sound/spelling relationship of the lesson.	Have students think of other words with "x".	lax, lox, max, sax, tax, mix, six

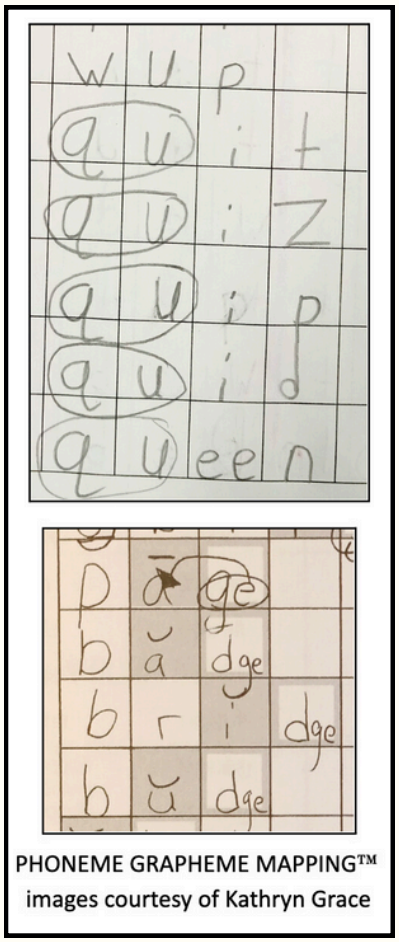
Taken from *Phonics and Spelling Through Phoneme-Grapheme Mapping* by Kathryn E.S. Grace. C. 2006, 2022

Figure 3. Adapted from *Phonics and Spelling Through Phoneme Grapheme Mapping*™ (Grace, 2022)

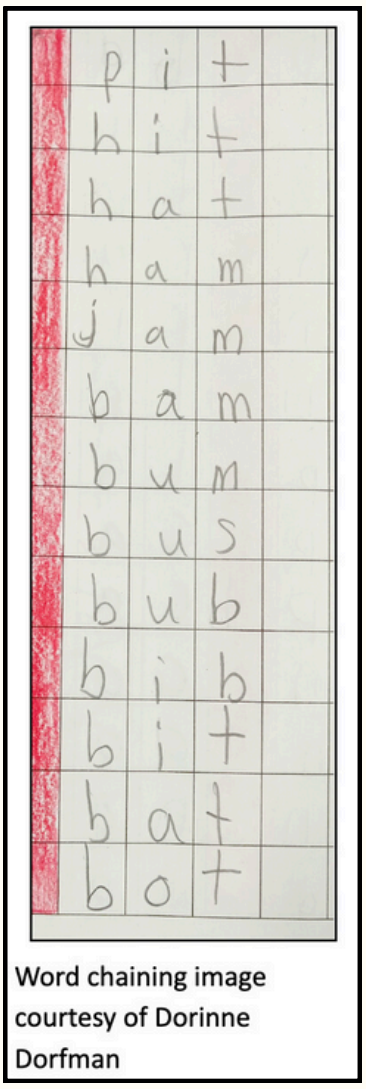
In all three steps, the teacher checks students' accuracy for the following:

1. Did the students articulate the correct phoneme while pointing to the block or letter selected?
2. Did the students select the correct colored block to represent those phonemes (yellow or red)?
3. Did the students point to the sound block and rearticulate the correct sound while sliding the block onto the Phoneme Grapheme Mapping™grid?
4. Did the students write the correct grapheme in its corresponding block on the grid?
5. Did the number of sound blocks the students selected match the corresponding number filled on the grid?
6. Did the student correctly spell across the sound boxes in the grid?

Word Chaining is an activity that can help students focus on the individual sounds in words to improve their phonemic awareness, decoding, and encoding skills, as well as strengthen their orthographic memory. Word chains can be used throughout the grades to improve orthographic automaticity (Harrison, 2022). After completing a word chain, the teacher asks students to take turns reading the words back and writing them on the board so students can correct their work. See Figure 4 for examples of word chains for K-3 students or older students struggling with short vowel sounds.



PHONEME GRAPHEME MAPPING™ images courtesy of Kathryn Grace



Word chaining image courtesy of Dorinne Dorfman

Figure 4. Student word chaining practice with Phoneme Grapheme Mapping™in sound-spelling boxes with CVC words, consonant blends, digraphs, and trigraphs

After completing a scope and sequence for the 26 letters of the alphabet, teachers move on to digraphs (2 letters = 1 sound) and eventually trigraphs (3 letters = 1 sound). While not all spelling and writing activities require students to use sound-spelling boxes, this template is especially useful for introducing new graphemes and clearly distinguishing each phoneme in a word. The routine of using sound-spelling boxes when learning new concepts can reduce cognitive load. As they learn new graphemes, they further their understanding of English orthography. Sound-spelling boxes are used to attain mastery at the word level. In other activities such as sentence writing, students can use ruled paper with dotted lines, double-line paper, or wide-ruled composition paper depending on the lesson focus and their handwriting skills. When writing, they may feel less distracted by other factors, such as paragraph indentation, punctuation, or other materials, because they know the routine and can devote their attention to learning the new grapheme while practicing learned graphemes.

What do students' errors reveal about their understanding?

Writing displays students' phonemic awareness. In Phoneme Grapheme Mapping™ activities, teachers can spot student errors and determine where the breakdown occurs. For example, the short vowel sounds /ĕ/ and /ĭ/ are very close, and students may confuse words such as ***pen*** and ***pin*** (Moats, 2020b), not only in writing but in pronunciation.

This confusion can continue through middle and high school, such as the 7th grader who expressed surprise to discover the spelling of ***since***, which he was certain was ***sense***. Articulating the word ***been***, the standard English pronunciation is "bin," though many Vermonters say, "ben." Recognizing that their pronunciation of some words may differ from others' is a component of phonemic awareness and essential in learning English spelling. Classroom teachers, literacy specialists, special educators, and other teachers of reading support their students when they recognize the impact of bidialectical experience [facility in using two dialects of the same language] on comprehending and producing language in speaking and writing. Washington and Seidenberg (2021) explain, "The challenge is to balance the need to respect children's language and culture, while helping them gain additional facility with the classroom language variety because it serves other functions (as in learning to read)."

When using the Phoneme Grapheme Mapping™ methodology, a child's understanding of phonemic awareness quickly comes to light. Phonemes articulated similarly may be confused by a student, such as the affricates /ch/ and /j/. Students may write ***gin*** instead of ***chin*** or ***cheep*** instead of ***jeep***.

The teacher can bring attention to voiced and unvoiced consonants and target words with these phonemes with repeated instruction. When leading a word chain, the teacher can direct students to touch their throat when repeating the words in order to detect the correct sound. For example: ***jam, Jim, chimp, chump, champ, chap, chip, chin, gin, gem, gel.***

While this exercise may seem somewhat tedious, in fact the routine is quick. Most students catch on quickly and learn to distinguish between similar consonant sounds. A teacher can consult with a school's speech-language pathologist to address students who continue to struggle, and who often have articulation difficulties as well.

Some students still struggling with the alphabetic principle may write letters that do not correspond with the phonemes. Some students may confuse letter names with sounds, such as ***y*** for /w/ (***yet*** for ***wet***) or may confuse voiced and unvoiced letters with similar placement, writing ***f*** for /v/ (***haf*** instead of ***have***). If this continues after whole-class instruction, these students will need intensive, repeated instruction in letter-sound correspondence to attain mastery. Indeed, even middle and high school students who have not received explicit instruction in phoneme-grapheme correspondence may not know all their letter sounds.

Using an inventory such as the LETRS Advanced Phonics and Word-Reading Survey or the CORE Phonics Survey, starting with letter names and sounds, teachers can learn if gaps remain. Often these struggling readers have difficulty in naming the sounds of ***y, z, qu, ch, wh***, and ***ng*** and thus struggle with words containing those graphemes.

A key concept in English is left-to-right tracking of words in sentences and graphemes in words. Skilled teachers recognize that grapheme order is essential in teaching Phoneme Grapheme Mapping™, distinguishing between words such as ***tab*** and ***bat*** or ***pan*** and ***nap***. Struggling readers who have received three-cueing instruction and habitually guessed words despite their grapheme order will need more instruction and repeated practice in left-right grapheme tracking.

A teacher can maintain records of student mastery of Phoneme Grapheme Mapping™ skills by creating a simple table on paper or a computer spreadsheet. In the first column are the students' names. In the first row are the graphemes to teach, ordered by the scope and sequence.

By observing students' writing during Phoneme Grapheme Mapping™ exercises, a teacher can quickly see which students have mapped the correspondence and which students need additional targeted instruction, which may be as little as a few minutes a day in grades K-2, when children's brains are most receptive to mastering these skills.

Students may make orthographic errors, such as reversing letters ***b*** and ***d*** and ***p*** and ***q*** when reading and spelling, which can persist for years for some students. Prior to and during Phoneme Grapheme Mapping™ exercises, the teacher can teach students to write the letter correctly or self-correct in several ways:

- Provide a model for students to create their own uppercase and lowercase B/b and D/d chart. The teacher says, "The little ***b*** is inside the big ***B***. The little ***d*** is outside the big ***D***" (Grace, personal communication, 2024) (see Figure 5a).
- Demonstrate for students to make a "bed" with their fists and thumbs facing each other (see Figure 5b). At the head is ***b*** and at the feet is ***d***.
- Teach the mnemonic, "***C*** the ***d***," in which students write the letter ***c*** before completing the straight line that completes the letter ***d***.

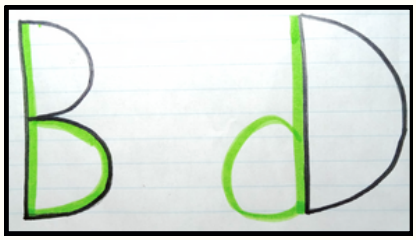


Figure 5a. Image courtesy of Dorinne Dorfman

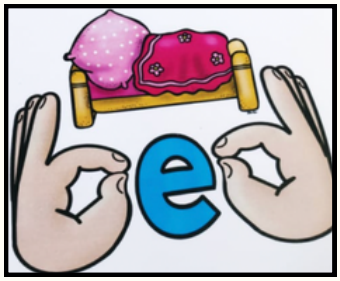


Figure 5b. The Measured Mom (2024)

Reflections

Phoneme Grapheme Mapping™ is a sequential, systematic approach created to help students more deeply understand the alphabetic principle and that the number of phonemes heard in a word may be different from the number of letter(s) seen or written in that same word. It strengthens phonemic awareness while simultaneously building an association of sounds to the spellings of words. Its multimodal elements help bridge the brain's phonological and orthographic processors to strengthen learning and recall through orthographic mapping in the brain.

A few years back in my classroom, one student challenged another's discovery of a spelling exception. A second student named Kyle proudly responded, "Let's take it to the spelling courtroom. Letters can lie, but sounds speak the truth." Then he quickly added, "You can put that in your book, Mrs. Grace, if you use my name." To all the Kyles in our classrooms, thank you for sharing your word study awareness with us each and every day.

Answer to this issue's Curious Question:

Five. The most common is the Anglo-Saxon spelling of ***sh*** (***shell***), though the French spelling ***ch*** (***chef***) is widespread. Additionally, the Latin spellings ***ti*** (***nation***), ***ci*** (***musician***), and ***si*** (***profession***) include thousands of words.

Meet the Writers

Kathryn Grace, M. Ed, CAGS, served as a classroom teacher, special educator, literacy coach, learning specialist, and language arts coordinator for over 40 years in Vermont's public schools. Ms. Grace was a professional developer for the Stern Center for Language and Learning and an adjunct professor at Trinity College. She is the proprietor of Learning Roots, an educational consulting, tutoring, and student advocacy business, and continues to offer literacy workshops and educational materials. First published in 1991, Really Great Reading will soon release the 4th edition of Ms. Grace's Phonics and Spelling through Phoneme-Grapheme Mapping. The recipient of numerous awards in education and active in the local community, she has lived in Waterbury for 46 years.

Dorinne Dorfman, Ed.S., Ed.D., OG/A
Dorinne Dorfman has served as a teacher and principal for nearly 30 years in Vermont schools. After completing her undergraduate studies at Goddard College, she earned her Master's and Doctorate in Educational Leadership at the University of Vermont. As a postdoctoral Fulbright Scholar, she taught at the Technical University of Berlin and conducted research on democratic education in Germany. Since completing an Education Specialist Degree in Reading and Literacy Instruction at Bay Path University, Dr. Dorfman teaches evidence-based literacy at Barre Town Middle School.

References

Birsh, J. R., & Carreker, S. (2018). *Multisensory teaching of basic language skills*. Brookes.

Ehri, L.C. (2006). Alphabetics instruction helps children learn to read. In R.M. Joshi & PG. Aaron (Eds.), *Handbook of orthography and literacy (pp. 649-678)*. Lawrence Erlbaum.

Ehri, L. C. (2014). Orthographic mapping in the acquisition of sight word reading, spelling memory, and vocabulary learning. *Scientific Studies of Reading*, *18*(1), 5-21. https://doi.org/10.1080/10888438.2013.819356

Ehri, L. C. (2020). The science of learning to read words: A case for systematic phonics instruction. Special issue: The science of reading: Supports, critiques, and questions. *Reading Research Quarterly*, *55*(S1), S45-S60.

Grace, K. (2023). The role of orthographic mapping in learning to read and spell. Blog post: https://phoneme-graphememapping.com/the-role-of-orthographic-mapping-in-learning-to-read-and-spell

Grace, K. (2022). *Phonics and spelling through Phoneme Grapheme Mapping™*. Really Great Reading.

Grace, K. (2023). Droppin' knowledge: An overview of Phoneme Grapheme Mapping™. Webinar.

Hanna, P.R., Hanna, J.S., Hodges, R.E., & Ruforf, H. (1966). Phoneme-grapheme correspondences as cues to spelling improvement. U.S. Office of Education Cooperative Research.

Harrison, C. (2022). Why word chaining should be a part of every literacy lesson. The Dyslexia Classroom. Website. https://www.thedyslexiaclassroom.com/blog/why-word-chaining-should-be-a-part-of-every-literacy-lesson#:~:text=Word%20chaining%20and%20the%20building,essential%20for%20reading%20and%20writing.

Kearns, D., Hancock, R., Hoeft, F., Pugh, K., & Frost, S. (2018). The neurobiology of dyslexia. *Teaching Exceptional Children*, *51*(3), 175-188. https://haskinslabs.org/sites/default/files/files/Kearns%2C%20Hoeft%2C%20Hancock%2C%20Pugh%2C%20Frost%20(2019)%20Neurobiology%20of%20dyslexia.pdf

Kilpatrick, D. A. (2015). *Essentials of assessing, preventing, and overcoming reading difficulties*. Wiley.

Kozloff, M. (2002). A whole language catalogue of the grotesque. Website. http://people.uncw.edu/kozloffm/wlquotes.html

The Measured Mom. (2024). 8 ways to stop b and d letter reversals. Website. https://www.themeasuredmom.com/8-ways-to-help-learners-with-b-and-d-letter-reversals

Moats, L. C. (2005). How spelling supports reading: And why it is more regular and predictable than you think. *American Educator*, *12*(22), 42–43. https://www.aft.org/sites/default/files/Moats.pdf

Moats, L. C. (2020). Teaching reading is rocket science. American Federation of Teachers. https://www.aft.org/sites/default/files/moats.pdf

Putman, R. (2017). Using research to make informed decisions about the spelling curriculum. *Texas Journal of Literacy Education*, *5*(1) 24-32.

Shaywitz, S. E. (2020). *Overcoming dyslexia, 2nd Edition*. Knopf.

Snow, C. E., Griffin, P., and Burns, M. S. (Eds.) (2005). *Knowledge to support the teaching of reading: Preparing teachers for a changing world*. Jossey-Bass.

Treiman, R. (2006). Knowledge about letters as a foundation for reading and spelling. In. R.M. Joshi & P.G. Aaron (Eds.), *Handbook of orthography and literacy* (pp. 581-600). Lawrence Erlbaum.

Washington, J. A. & Seidenberg, M.S. (2021). Teaching reading to African American children. American Federation of Teachers. https://www.aft.org/ae/summer2021/washington_seidenberg#:~:text=12,child%20already%20knows%20in%20AAE.