PHONIC FACES AS AN INTERVENTION TO IMPROVE DECODING SKILLS OF CHILDREN WITH PERSISTANTLY POOR DECODING ABILITIES

Kayla Therese Martin
Louisiana State University at Baton Rouge

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PHONIC FACES AS AN INTERVENTION TO IMPROVE DECODING SKILLS OF CHILDREN WITH PERSISTANTLY POOR DECODING ABILITIES

A Thesis

Submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College in partial fulfillment of the requirements for the degree of Master of Arts in The Department of Communication Sciences and Disorders

by

Kayla T. Martin
B.S., Southeastern Louisiana University, May 2018
May 2024
Acknowledgements

Most importantly, I want to recognize my thesis committee, Dr. Janet Norris, Dr. Paul Hoffman, and Dr. Julie Schneider for their direction, support, and guidance throughout this whole process of writing. Dr. Norris, you are a wealth of knowledge and such a compassionate teacher. You believed in me and inspired me to continue with this project until it was finished. You provided advice and support every step of the way, and I cannot thank you enough for all of the work that you have put forth to help me get to this point. To my parents, brother, and sister, thank you for your love and support, even when maybe you didn’t understand, or you didn’t always want to take the time to help me, you were still there. There were many late nights that I needed encouragement and a listening ear, or I needed advice and someone to cry to. You continued to motivate me and cheer me on. To my grandparents, I appreciate all the prayers for success and personal growth. You know of many saints and their intercessions and you provide such a wonderful example to follow. I thank you for spending so much time in adoration, interceding for me. The comic strips and articles that you sent are always a nice reminder that I am in your thoughts, even when you are not able to see me for a while. Lastly, I thank all the participants and their parents, who gave me their time and attention over the course of this intervention. I am so profoundly thankful that I got to spend time and interact with you all, and I can only hope that everyone continued to learn and grow after this experience. I hope that you learned something that you could take with you and that you face everything with a growth mindset. Don’t be afraid to reach out and ask for help when you need it. This would not have been possible without all of you. Best of wishes for the future.
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### Abbreviations

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<th>Description</th>
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<tbody>
<tr>
<td>CI</td>
<td>Confidence Interval</td>
</tr>
<tr>
<td>LC</td>
<td>Listening Comprehension</td>
</tr>
<tr>
<td>PAT-2</td>
<td>Phonological Awareness Test – 2</td>
</tr>
<tr>
<td>PF</td>
<td>Phonic Faces</td>
</tr>
<tr>
<td>PS</td>
<td>Pseudowords</td>
</tr>
<tr>
<td>RC</td>
<td>Reading Comprehension</td>
</tr>
<tr>
<td>RF</td>
<td>Reading Fluency</td>
</tr>
<tr>
<td>SEM</td>
<td>Standard Error of Measurement</td>
</tr>
<tr>
<td>TILLS</td>
<td>Test of Integrated Language and Literacy Skills</td>
</tr>
<tr>
<td>TONI</td>
<td>Test of Nonverbal Intelligence</td>
</tr>
<tr>
<td>VA</td>
<td>Vowel Accuracy</td>
</tr>
<tr>
<td>WA</td>
<td>Word Accuracy</td>
</tr>
<tr>
<td>WWC</td>
<td>What Works Clearinghouse</td>
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</table>
Abstract

Background: Orthographic rules, phonological awareness, and the ability to process morphemes and phonemes from speech and language begins with verbal speech and the child unknowingly recognizes words from his or her environment as early as the senses can process their surroundings. Some children have difficulty integrating these processes to learn how to read. As Ehri (1979) mentions the importance of establishing mental processes, such as amalgamation and phonological recoding, are essential as a basis for establishing reading fundamentals. Decoding occurs through a complex integration of phonological and orthographic knowledge (Ehri 1992). Early readers typically have well-established amalgams for spoken words in their mental structures to bond print images to word pronunciation and, hence, result in instant sight word recognition (Ehri, 1995, 2005). The purpose of this study was to determine if decoding skills would improve when visual associations were made between graphemes and phonemes to assist in word blending.

Method: A single subject multiple baseline design replicated across three participants where all three participants received specific instruction with two syllable patterns: 12 CVC lessons and 12 CVCe lessons. Additional CVVC lessons were created but used only in the Farag Hanna (2023) study of this team project. Each lesson taught one long syllable type (CVCe or CVVC) and ranged in complexity from simple three-letter to complex six-letter syllable shapes with three consonant blends or digraphs. Daily PowerPoints presented one word per slide for a maximum of 25 practice words to decode before a probe was administered.

Results: The results of this study showed that direct instruction of nonsense words could lead to gains in decoding of words in single syllables, contrasting short and long vowel sounds. Significant changes in standardized test scores showed that a visual alphabet can teach poor readers to improve decoding scores.

Discussion: Though learning was slow at times, it was clear that growth occurred after Phonic Faces were introduced, as students began to recognize and read words more quickly. Pre-test scores were low for two participants, whereas one was on the higher end, so analysis of post-testing after the intervention phase led to varying areas of decoding growth.
Literature Review

The Use of Teletherapy for Service Delivery

The interventions in this study were conducted using teletherapy. The widespread use of broadband Internet and modem platforms has made telepractice another potential service delivery model by which speech therapy services can be rendered, as approved by the American Speech-Language Hearing Association (Troia & Wallace, 2022). Research has shown evidence that teletherapy is both time effective and valid. A series of studies, each with over 200 teletherapy participants, have demonstrated no significant differences in gains for children receiving services via teletherapy compared to in-person treatment for speech and language (Coufal et al., 2018; Musaji et al., 2021; Wales et al., 2017). In this study, teletherapy made it feasible to provide experimental treatment three times weekly after school for three participants.

Prior to the start of this study, the participants could produce the sounds associated with the consonant letters of the alphabet. However, in reference to vowels, they were inconsistent at providing the short vowel sounds and identified few, if any, of the long vowel sounds. They could sound out CVC words with moderate accuracy but were unsuccessful with orthographic patterns such as silent ‘e’ or double vowel digraphs. Overall, the participants read and decoded below average for their grade-level. The purpose of this study was to determine if decoding skills would improve after the participants were presented with an alphabet that provides a visual association between speech sound production cues and the shape of the related alphabetical letter.

Alphabetic Principle and Decoding

The English alphabet consists of 26 letters that are used to represent the 44 speech sounds of English. Learning to make these associations is called the alphabetic principle. Decades of research have shown that, in order to establish knowledge of the alphabetic principle, an emerging reader must become aware of the sounds of oral language known as phonemes. This is an ability called phonemic awareness. During the process of developing phonemic awareness, the emerging reader must simultaneously discover the written symbols, or letters, that represent these sounds in written language. While the process may appear to be memorization, it is – in fact – a complex process of creating mental representations that link oral and written words. The child must construct representations of speech sounds, or phonemes, and link them to representations of letters, or graphemes (Kohrt, 1986; Lockwood, 2001). These representations must, then, be hierarchically linked to information about the word in which they are found, the lexeme, where they attain meaning. As a vocabulary word, each lexeme has a semantic, syntactic, and conceptual component and the understanding of these is required to achieve the knowledge necessary for communication. Thus, when words are read, they are processed as language and comprehension results (Ehri, 1995, 2005).

Decoding occurs through this complex integration of phonological and orthographic knowledge, a process Ehri (1992) refers to as phonological recoding. Readers who see a written word use the integrated mental representations to recode the printed word into spoken language. This initially starts as a letter-by-letter recoding, but as mental hierarchical structures form to represent written words, recoding occurs in larger chunks of letters that, when following orthographic rules such as blends, rimes, or vowel and consonant diphthongs, evolve into
complete words (Share, 2008). As this occurs, word recognition becomes faster and more fluent (Ehri, 1992).

Ehri (1979) proposes that the process of mentally creating these hierarchical integrations of oral and written language, occurs through a process called amalgamation. Early readers typically have well-established amalgams for spoken words in their mental structures. As they learn to read, they gradually learn new amalgams to decode graphemes more quickly. The amalgamation process bonds print images to word pronunciation and eventually results in instant sight word recognition (Ehri, 1995, 2005). Ehri describes that this unfolding process can be observed in the phases of reading development. The process begins with a pre-reading phase wherein children attend with particular vigilance to features of a word so that they can assign meaning to the word. At this stage, children recognize logos, brand names, and other familiar words common in their surroundings, as well as a few words that are easy to remember because of recognizable qualities. For example, the word ‘look’ has two o’s, which resemble eyes.

Exposure to the alphabet leads to the partial alphabetic phase, where some of the letter-sound associations are learned, and developmental spelling is exhibited. Children guess a word based largely on beginning and ending letters, with the greatest decoding difficulties exhibited on vowels. This occurs because of the complex relationship between the spelling patterns that must be used to differentiate long vowel sounds from short vowel sounds and diphthongs (Ehri, 1995, 2005).

Gradually, the child's reading and spelling reaches the full alphabet stage where basic orthographic patterns are recognized and used for both decoding and spelling. Finally, during the consolidated phase, readers have developed a wide range of knowledge organized into hierarchical structures. They can use orthographic chunks such as rimes, syllables, morphemes, and root words to rapidly analyze and produce words with a wide range of complexity (Ehri, 1995, 2005).

**Orthographic Patterns**

Orthography refers to the conventions related to the spelling system of a language. It includes patterns for letter groups and sequences, as well as capitalization, hyphenation, and all other forms of punctuation. English uses 26 letters to represent all 44 phonemes, including 14 vowel phonemes that must be spelled using only 5 vowel letters, with the occasional use of ‘y’ or ‘w.’ Vowel combinations like digraphs, diphthongs, or double vowels are used within syllable patterns to signal whether a vowel will be pronounced in a long or short phoneme form. The foundational establishment of these patterns contributes to automatic word recognition and fluent reading (Zarić et al., 2020). English preserves both phonemic and morphemic information in its spelling. For example, the past tense morpheme is typically spelled as ‘-ed’ regardless of whether the pronunciation sounds like /d/ as in ‘called,’ /t/ as in ‘helped,’ or /id/ as in ‘wanted.’ Likewise, when derivational morphemes are added, the root word spelling is often maintained and may result in a vowel or consonant pronunciation shift. Examples of vowel shifts include “nation” to “national,” and “child” to “children,” while consonant shifts include “medic” [k] to “medicine” [s] and “medical” [k] (Chomsky, 1970).

Researchers such as Zarić and colleagues (2020) and Apel (2009) have concluded that there exists both word-specific orthographic knowledge and general orthographic knowledge. Word-specific knowledge means that the orthographic patterns associated with a word are automatically recognized and applied. General orthographic knowledge means that subunits of words or letter groups that are common across many words are stored and can be applied to
unknown words for decoding (Wang et al., 2015). This enables the reader to rapidly derive a pronunciation for an unfamiliar word or a pseudoword. Awareness of orthography and letter patterns is critical to fluent reading. In their 2000 study ‘Why do some resist phonological intervention? A Swedish longitudinal study of poor readers in grade 4,’ Gustafson et al. showed that phonological awareness training without orthographic awareness training did not improve reading fluency in poor readers. While their phonological ability to hear the patterns improved, without training on how the sounds are represented in spelling, word recognition gains were not any better than those of the control group that had received no training.

Summary

The basic knowledge and awareness of orthographic patterns is critical for fluent word recognition of familiar words and decoding of unknown words. Subunits of words, like rimes, morphemes, or syllable types, provide tools for recognizing and spelling unknown words. Ehri (1995, 2005) referred to these as hallmarks of her consolidated phase of reading, stating that readers who have not refined their orthographic knowledge to this level will remain poor at decoding, exhibit poor ability to segment polysyllabic words, and lack reading fluency. Phonological awareness training alone has not been shown to overcome these challenges; therefore, more direct interventions for orthographic awareness have been researched.

Syllable Awareness

One critical orthographic pattern is the syllable. A syllable may exist as a single vowel sound or a vowel with surrounding consonants to form either a part of or a whole word (Oxford dictionary, n.d.). The uninterrupted sound of a syllable is produced with a singular jaw movement. Each syllable has one vowel sound; thus, the number of syllables in a word is dictated by the number of vowel sounds (Sherman, 2018).

Syllables, with the exception of morphological units, typically can be categorized as one of six high frequency orthographic patterns regularized in spelling by Webster in 1848. Other low-frequency syllable patterns are also found in English words, with many of the syllables that appear to adhere to a syllable type violating the pattern’s rule. For example, the word ‘their’ follows neither the rule for vowel digraphs nor R-controlled vowels. Table 1.1 below first appeared in the related thesis by Farag Hanna in 2023 and is used here with permission to profile the syllable types.

Table 1.1. Profile of the Six Syllable Types in American English Spelling

<table>
<thead>
<tr>
<th>Syllable Type</th>
<th>Pattern</th>
<th>Description</th>
<th>Examples</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed Syllable</td>
<td>CVC, CCVCC</td>
<td>One vowel closed in by one or more consonants; Vowel is short</td>
<td>tap, trap, tamp, tramp</td>
<td>43.3%</td>
</tr>
<tr>
<td>Open Syllable</td>
<td>V, CV, CCV</td>
<td>One vowel alone or preceded by one or more consonants; Vowel is long</td>
<td>o-pen, go, pro, ro/de/o</td>
<td>28.9%</td>
</tr>
</tbody>
</table>

(table cont’d.)
<table>
<thead>
<tr>
<th>Syllable Type</th>
<th>Pattern</th>
<th>Description</th>
<th>Examples</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silent E Syllable</td>
<td>VCe</td>
<td>A final e that remains silent but makes the vowel before the consonant long</td>
<td>ate, date,</td>
<td>6.7%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>crate, in/side</td>
<td></td>
</tr>
<tr>
<td>Digraph/ Diphthong</td>
<td>VVC,</td>
<td>Two vowels used to make one sound, often long. Diphthongs glide</td>
<td>say, seam,</td>
<td>9.5%</td>
</tr>
<tr>
<td></td>
<td>CVV,</td>
<td></td>
<td>speech, oak</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CVVC,</td>
<td></td>
<td>cow, oink</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CCCVVC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-Controlled</td>
<td>VR,</td>
<td>One or more vowels immediately followed by letter R which creates a new sound</td>
<td>or, bird,</td>
<td>10.2%</td>
</tr>
<tr>
<td></td>
<td>CVRC</td>
<td></td>
<td>air, thorn,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>farm</td>
<td></td>
</tr>
<tr>
<td>Final C+Le</td>
<td>C+Le</td>
<td>The consonant+le occurs at the end of words and is its own syllable</td>
<td>pic/kle,</td>
<td>1.4%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>i/dle an/gle,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>a/ble</td>
<td></td>
</tr>
</tbody>
</table>

Sherman (2018) indicated that these six syllable patterns occurred with sufficient frequency to warrant orthographic awareness training for both developing and struggling readers. Bhattacharya and Ehri’s 2004 study of adolescent poor readers showed that, following training, the test group had greater gains than the control group in decoding, word recognition, and spelling, supporting Sherman’s findings. Knight-McKenna (2008) showed that poor readers failed to recognize syllable patterns within multi-syllabic words, while McCandliss et al. (2003) found that poor decoders had the greatest difficulty decoding vowels in the medial position of words when tested after the first grade. Researchers seeking to improve orthographic awareness have frequently used “pseudowords” for both training and outcome measurements.

**Training Syllable Patterns Using Pseudowords**

The use of real words in training and testing orthographic patterns is problematic because the words may be known as “sight words,” therefore, affecting the number of opportunities for adequate assessment. To eliminate this problem, researchers have used “nonsense words,” or “pseudowords,” which are letter sequences that lack any real meaning though they are orthographically consistent with real words (Arndt et al., 2008). Pseudowords are created by changing one or more letters of a real word. Subjects must use the alphabetic principle and orthographic knowledge to decode these words (Pullen et al., 2005).

While it appears logical that training in syllable patterns would improve reading skills for typical as well as for struggling readers, research exploring this practice has produced mixed results. Despite the conflicting research, teaching orthographic syllable patterns remains a standard recommendation of reading panels, most notably the U.S. Department of Education, Institute of Educational Sciences, and the National Center for Education Evaluation and Regional Assistance (Foorman et al., 2016).
Research Supporting Syllable Pattern Instruction

In 2005, Pullen et al. used a single subject design to instruct nine 1st grade students who showed persistent deficits in phoneme blending, word decoding, and spelling words. Subjects were given ten lessons where they read a book and were provided assistance as needed. Twenty-five target words from the story were used to teach target patterns using manipulative letters to practice sound segmentation and blending. The stories were re-read at the end of the session to measure real word decoding. Pseudoword lists were used daily to measure decoding accuracy and rate. All readers showed improvement in decoding both real and pseudowords during intervention phases of the study.

Cardenas (2009) chose to use pseudowords for both instruction and measurement, arguing that real words allow readers to use lexical information to guess target words without fully decoding the word. The participants were 30 kindergarteners who were learning to decode CVC words, each randomly assigned to one of two classrooms. The control group received only real word instruction for three months while the pseudoword group received one month of real word instruction, followed by one month of pseudoword instruction, and a final month of real word instruction. At the end of each phase, the decoding skills of participants were assessed. Those who received the pseudoword instruction showed greater gains in decoding following the second and third months of instruction.

Seiler et al. (2019) presented 15 decoding sessions for syllable patterns using pseudowords to eight 7-9-year-old poor decoders. Computerized instruction was administered using an iPad app adjusted for word complexity based on correctness of student responses. All eight subjects made significant gains on untrained pseudoword lists and standardized measures for decoding using pseudowords. Although not significant, upward trends were present for passage reading fluency and comprehension as well.

Summary

Current models of reading indicate that learning to read is a developmental process that begins with constructing the grapheme-phoneme correspondences that underlie the alphabetic principle and continues with constructing hierarchical structures of sub-lexical representational units such as rime, orthographic patterns for vowels and vowel digraphs or diphthongs, consonant digraphs, syllable patterns, inflectional and derivational morphemes, and low frequency “irregular” patterns (Ehri, 1995, 2005). These subunits serve as the sources of already formed word elements that can be used to decode or spell unfamiliar words. Within these subunits, letter-by-letter decoding is no longer necessary because larger units needed to decode unknown words can be readily accessed and are more familiar.

Pseudowords provide insights into a child’s current orthographic structures. They have been widely used for assessment and have often been used as intervention stimuli. However, the evidence on how effective intervention at this level is for reading fluency and comprehension is mixed and needs further exploration. Incorporation of higher-level language skills will likely be necessary to have a comprehensive model of reading. This issue is beyond the scope of this study, which only addresses whether readers who are failing to develop the orthographic structures could be better assisted to learn them when presented with an alphabet that visualizes an association between speech sound production cues and the shape of the related alphabetical letter.
The Phonic Faces Alphabet

The alphabet used in this study is termed Phonic Faces (Norris, 2001). The alphabet is unique because the alphabetic letters are embedded into the mouths of faces in a manner that depicts the articulators (I.e., lips, tongue position, voicing) for 27 consonants, and sound association cues for 17 vowels (I.e., a total of 44 cards). The majority of the consonant letters provide fairly direct depictions of articulators. The letter ‘b’ looks like the bottom lip, while ‘p’ looks like the top lip; letter ‘m’ looks like the cupid’s bow of the upper lip, while ‘v’ looks like a tooth vibrating over the bottom lip. Consonant digraphs have their own faces, with the ‘c’ drawn as a mouth sneezing the ‘h’ out, the ‘s’ shushing an ‘h’ drawn on a hand in the shhh position or in a gesture to be quiet, and ‘t’ drawn as a tongue pushing the ‘h’ out of the mouth to make the /th/ sound. Figure 1.1 shows example consonant faces.

The vowel letter shapes are placed in the mouths to resemble both speech production cues and sound associations, since vowels differ only in the position of the tongue and their distinctions are not easily seen. Seventeen vowel faces depict long vowel sounds, short vowel sounds, and other diphthongs (e.g., oi, ow, oo). Their associations help establish their sounds. Thus, letter “a” is drawn as a wide-open mouth in the short vowel face (baby a) who cries “ahhh,” but flips into a smile in the happy long vowel (adult a) as in “yay.” Baby ‘i’ doesn’t like carrots and says “iiii” as in “ick,” but the adult must wear eyeglasses because she didn’t eat her carrots, which are rich in vitamin A and help the eyes. Baby ‘ow’ has a bump on his head (ow!) while baby ‘oi’ wears a piggy mask to associate the piggy sound ‘oink.’ Figure 1.2 shows example vowel faces. The related (parent and baby) vowels with their different sounds are key to showing children how the word pronunciation shifts between CVC words (e.g., bit = short baby sound) to CVCe words (e.g., bite = long adult sound). The child must discover that the distinction is in the syllable pattern and not the individual letter.
Studies With LiPS Program Showed Mixed Results

The closest approach to Phonic Faces is the Lindamood Phoneme Sequencing Program (LiPS; Lindamood & Lindamood, 1998), formerly known as Auditory Discrimination in Depth (ADD; 1969, 1975). Lips is a heavily scripted program that progresses through a series of phases. Each phase is mastered before moving on to the next. The first phase teaches children to hear sounds in isolation. This is followed by phonemic awareness activities such as phoneme blending and segmenting that are taught in sequence from easiest to most difficult. Once phonemic awareness has been mastered, phoneme-grapheme correspondences are taught. This leads to learning to decode phonemically, followed by learning orthographic patterns. Sight word learning is taught and generalized to the context of reading sentences where rate and accuracy are emphasized. Spelling is also introduced during this phase.

Figure 1.3 shows examples of the pictures used by LiPS; to show how one or more sounds are related to specific lip postures. These sounds and accompanying pictures are given mnemonic names such as “lip poppers” or “tongue tappers.” Like Phonic Faces, the goal is to make associations between speech production and sounds. Fifteen vowels are taught according to their place of production in the mouth and their corresponding letters positioned in a vowel circle to represent those positions (see Figure 1.4). The vowels are labeled as those that are smiles, open, round or sliders. The pictures, mnemonic names, and imitation of mouth positions provide a multisensory cuing system for sound learning.

Figure 1.3. Examples of LiPS consonants where pictures of lips indicate how the sound is made

Figure 1.4. The LiPS vowel circle where children learn the tongue position for 15 vowels

LiPS has been extensively researched, with over 48 studies of populations ranging from pre-K to adults. Most of the studies have been conducted in whole classrooms or in supplementary instructional programs for children in kindergarten and 1st grade. The results have been mixed and analysis conducted by the What Works Clearinghouse (WWC) have
deemed the findings of most to be unreliable because of methodological flaws. At-risk and/or poor readers have been the subjects of four studies.

Use of LiPS with At-Risk and Poor Readers

Torgesen et al. (2010) studied LiPS intervention provided to low-performing first graders across two consecutive years, totaling 112 participants. They were randomly assigned to one of three groups: a) LiPS intervention group (Lindamood & Lindamood, 1998), b) Read, Write & Type group (RWT; Herron, 1995) or c) a control group with no supplemental instruction. The two intervention groups received 50-minute sessions in small groups for one year. Both non-control groups performed significantly better than the control following one year of intervention, but there were no significant differences between them for any measure.

Sixty 7-to-9-year-old students with reading disabilities were studied by Pokorni et al. (2004), LiPS (Lindamood & Lindamood, 1998), was compared to two other programs: Earobics (Cognitive Concepts, Inc., 1998), and Fast ForWord (Scientific Learning Corporation, 1999). All three programs claim to improve phonemic awareness, language, and reading-related skills. Participants received three one-hour sessions daily for 20 days in a summer program. A multivariate analysis revealed that only phonemic awareness showed significant improvement: Earobics improved in segmenting phonemes, LiPs improved in segmenting and sound blending, and FastForward showed no significant gains. The language and reading measures showed no group differences.

Sixty 8-to-10-year-olds with severe reading disabilities received 8-9 weeks of individual tutoring in a study by Torgesen et al. (2001). Students received two 50-minute sessions daily in either the initial version of LiPS (i.e., Auditory Discrimination in Depth (ADD; 1975) or an Embedded Phonics (EP) approach developed by the researchers. The EP program taught phonemic awareness and phonics in the contexts of spelling and writing and decoding and reading, while ADD systematically taught a prescribed sequence of phonemic skills from simple to complex. To help the children learn to apply the skills, all participants then received eight weeks of generalization training once per week for 50 minutes using classroom materials. Results showed both groups had made significant gains in reading that were retained for two years without further intervention, at which time they scored average for reading accuracy and comprehension but slow for reading rate.

McIntyre et al. (2008) compared at-risk to not at-risk first graders who received LiPS training in the regular classroom for one year. All students made significant gains, with the at-risk students making greater gains and scoring above the 25th percentile (i.e., average range), indicating that they were catching up to peers.

Castiglioni-Spalten and Ehri (2003) proposed that LiPS is effective because the articulatory awareness created by the pictures of lips (or LiPS) sensitizes students to the relationship between phonemes and their related speech productions. This awareness could then be used during decoding and spelling to make associations between letters and speech sounds. They tested this by training 45 kindergarteners using either a “mouth condition” (i.e., linking LiPS mouth position pictures to their related sounds) or an “ear condition” (i.e., different colored blocks were manipulated to represent changing sound sequences). A control condition received no training. Both treatment groups made significant gains in phonemic awareness compared to controls, but only the mouth condition group improved in reading tasks even though letters were not used in the training. Boyer and Ehri (2011) conducted a similar study with pre-K children who were trained with a) LiPS mouth pictures associated with letters, b) letters only, or c) no
treatment control. Both treatment groups improved significantly more than controls in phonemic awareness and letter knowledge, and the LiPS group was superior in word reading.

The results of these studies are inconclusive but lend credibility to the hypothesis that the mouth gesture pictures provided by LiPS support discovering elements of phonemic awareness, letter learning, and decoding. Boyer and Ehri (2011) hypothesized that the pictures serve to establish neurological connections to motoric speech gestures already formed during development.

In our first study of this group project (Farag Hanna, 2023) we hypothesized that an alternative picture that embeds letters into the mouths of faces to depict the articulatory gestures will produce a representation of letter-sounds that is more transparent in establishing phonological awareness and reading skills. Rather than an arbitrary letter-shape, the Phonic Faces letters depict relevant speech production features (the letter t is drawn to represent the tongue quietly tapping by the teeth, while the d is drawn to represent the tongue drumming inside the mouth). The visual representation of speech sound production linked directly to the letter shape provides a means to recognize the letter and sound symbols in the same visual image. Earlier studies with Phonic Faces lend support to this hypothesis.

Phonic Faces alphabet books were read three times weekly for six weeks to eight 20-24-month-old toddlers while eight others played in the control condition (Terrell, 2007). Each of nine book pages contained a Phonic Face and four pictures beginning with that letter-sound. After six weeks, the groups alternated conditions. Results showed that both groups were able to identify letters and produce letter-sounds during treatment phases and maintained the gains reassessed six weeks later. This study showed that letter-sound learning could be elicited in toddlers much younger than the typical age of acquisition.

An ABAB single subject design was used with three subjects (5;0, 6;1, and 8;9) who had severe expressive language limitations due to cerebral palsy. Phonic Faces storybooks, converted to e-books, were used to teach one letter-sound relationship per session while a converted commercial book taught another. Following 8 sessions, the book conditions were reversed. Daily probes showed improvements in letter-sound associations and remembering letter names and sounds in word positions for all letters in the Phonic Faces phases but not the commercial book phases.

Head Start teachers were taught to interactively read either a Phonic Faces or a commercial emergent storybook. The interactions throughout the book reading alternately focused on vocabulary, plot, phonemic awareness or print referencing. Each book was read for five sessions per week, with a new book introduced each week. Significantly greater changes in teacher talk about meaning, letters, and letter sounds were elicited when the Phonic Faces books were read. The faces were effective in reminding teachers to talk about letters and letter sounds.

Farag Hanna (2023) used a multiple baseline single subject design to teach three 7-to-8-year-olds to decode one short vowel and one long-vowel single-syllable pattern (i.e., CVC and either CVCe or CVVC). All three participants were introduced to the CVC pattern using Phonic Faces for the first five weeks (i.e., three 40-minute sessions weekly). Throughout this phase both long-vowel patterns remained in baseline (i.e., no training) with daily probes administered. On the 16th session, intervention for the CVC pattern was discontinued and the long-vowel pattern with the most stable baseline received treatment. Training words were all real words for two full sessions, so children could use the Phonic Faces to listen for known words in their decoding attempts. However, the number of real training words decreased systematically until, by week 12, all words were pseudowords. The syllables were comprised of five training words in each of the following categories: CVC, CVCC (final blends), CCVC (initial blends), CCVCC, and other.
Daily probes were used to measure progress at the end of each session, composed entirely of pseudowords with the same pattern of blends. Every training word list and probe word list was unique to eliminate memorization.

In addition to the features of the Phonic Faces, explanatory stories were used to embed orthographic rules in with the teaching of syllable patterns. The Phonic Faces explanation of the CVC pattern is that the short baby vowel says its sound because it is between two consonant kids who take care of the baby. It cannot run away or get hurt. The CVCe pattern starts out the same, with the CVC word displayed, but then a grumpy Mr. E joins the end of the word and starts complaining, “I don’t like babies.” In response, the adult or long vowel protects the baby by taking its place and silencing Mr. E with a zipper over his mouth. In this manner, the child physically sees how the vowel shifts because of the final ‘e’ and why the ‘e’ is not pronounced when reading the word. The CVVC pattern shows two baby vowels together, but this time the consonant kids can’t stop them and they begin to run away. The adult of the first baby comes into the word to take care of both of babies, thus making its long vowel sound.

Results showed that participant 1 performed as predicted, with CVC accuracy levels increasing by the second intervention session and remaining near mastery throughout, while the long vowel patterns remained at low levels. However, when the long vowel Phonic Face was introduced, both long vowel patterns improved, even though only CVCe was treated. Discovering the long-short vowel contrast clarified the orthographic patterns for both Participant 1 and Participant 2, who also performed as predicted, with CVC reading scores increasing by the fourth intervention session and remaining at high levels, though still below mastery, until session 26. However, the CVCe long vowel pattern went up in parallel, beginning with the fifth intervention session. In this case, the child appeared to understand the silent e rule but could not decode blends. As the Phonic Faces guided the mouth movements needed for the blends, both the CVC and CVCe vowel patterns increased in accuracy with parallel ups and downs, according to probe scores. The unfamiliar CVVC pattern stayed at low baseline levels until the pattern was explicitly taught beginning in session 17, where near mastery was achieved within three sessions of learning how the adult came in to care for both babies.

Participant 3 began making changes during the baseline phase for all three patterns, and by the third intervention session both CVC and CVCe were near mastery. The CVVC pattern also increased but to a lesser degree (50% to 70% accuracy). Immediately following the introduction of the Phonic Faces explanation of the double vowel rule, the accuracy rose to mastery and remained there throughout the second phase and beyond. Of the three patterns, CVCe showed the most variability throughout and this pattern was never demonstrated using the Phonic Faces story explanation.

Thus, although the multiple baseline profiles were not ideal, the patterns are explainable when calculating/considering the learning that was occurring and suggest that the Phonic Faces were highly successful. This position is supported by the finding that all three participants made significant gains in standardized test scores measuring phoneme, grapheme, and orthographic knowledge, which in many cases increased from the poor or below average range to average or above average.
Methods

A single subject multiple baseline design replicated across three participants examined gains in phonological awareness and orthographic syllable patterns of first grade poor decoders using the Phonic Faces alphabet (Norris, 2002). It was hypothesized that the features of the alphabet that provide a visual association between speech sound production cues and the shape of the related alphabetical letter would enable students to acquire both a short and long vowel syllable pattern and to show greater awareness of phoneme sequences in words. All intervention sessions were delivered via teletherapy, held three times weekly, and included the intervention followed by a daily probe. Sessions were regularly scheduled to be conducted on Mondays, Thursdays, and Fridays. However, makeup or replacement sessions were scheduled if a session was missed. Each session was planned to last for an hour in total, including breaks and probe administrations. Some sessions lasted for less than the anticipated time, but there were occasions and events that would interfere, during which times the material may have been incorporated into another session. However, this only occurred with one participant.

Participants

There were several criteria required in order to qualify as a participant in this study.

1. All participants were required to have completed the first grade with some remaining difficulty reading one-syllable words fluently.
2. English must be the first (and was the only) language known in each case.
3. Parents recorded the child’s knowledge of a minimum of all English letter names and their accompanying sounds.

Parents were first recruited per email sent to several local schools in search of students for an afterschool program. Once parents reached out via email, they would be directed to an interview survey where they would be asked information about their child’s academic performance and general knowledge. Once entry criteria were determined to be met, based on response to interview questions, parents were educated about the opportunity to enroll in this program online. They were extended educational information about the study, including the purpose and timeframe, potential benefits and risks to intervention, criteria that must be met by participants, and researcher contact information, for them to review. Additionally, the child was educated about the study. Once informational materials were shared, parents and children were presented with their respective forms to provide consent or assent for treatment. The next step was to coordinate dates and times to meet for more formal standardized assessments on Zoom. Three students were chosen to participate in sessions with the student therapist conducting Phonic Faces teaching and intervention, as detailed in the table below.
Table 2.1. Profile of Subjects by Age, Gender, Grade, Index Scores for CVC-CVCe-CVVC Subtests of the PAT-2E, Index Scores for TILLS Reading Fluency and Comprehension Subtests, and Nonverbal Intelligence Quotient

<table>
<thead>
<tr>
<th>Subject</th>
<th>Gender</th>
<th>CA</th>
<th>Grade</th>
<th>PAT-2E (out of 10 questions)</th>
<th>TILLS Reading (SS = Standard Scores)</th>
<th>TONI-4 SS</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fluency</td>
<td>Comprehension</td>
</tr>
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<td>8;1</td>
<td>3rd</td>
<td>30% 10% 40%</td>
<td>77</td>
<td></td>
</tr>
<tr>
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<td>3rd</td>
<td>80% 30% 20%</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Student 3</td>
<td>Female</td>
<td>8;4</td>
<td>2nd</td>
<td>80% 0% 0%</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

CA = Chronological Age at intervention start date (years; months)
PAT 2E = The Phonological Awareness Test, 2nd Edition
TILLS = The Test of Integrated Language and Literacy (Standard Scores represented)
TONI-4 = Test of Nonverbal Intelligence, 4th Edition
LC = Listening Comprehension
RC = Reading Comprehension

Participant 1 was an African American female in third grade that began participation in this intervention at the age of 8;1 years. Her case history, as filled out by the parent, revealed no relevant diagnoses. However, her teacher had previously spoken to her mother about reading concerns, for which she had received outside tutoring before. As reported, the student showed around a 3/5 frustration level when reading and a 4/5 rating of acceptance of the difficult task. Her results on the PAT-2 revealed below average performance (SS of 81) in Phonemic Awareness and a Phoneme-Grapheme total that was above average (SS of 109). She knew all of the short vowels during pre-test, but was not blending all CVC words appropriately, applying them to productions about half of the time. She had had no other comorbid diagnoses. Participant 1 received an overall PAT-2 test score of 80 (SS) points, indicating that she was in the below-average range of performance. She decoded 3/10 CVC words, 1/10 CVVC words, and 4/10 CVCe words correctly on the Decoding subtests. These scores rated her performance in the below-average performance range of reading abilities. However, it was clear that she was developing an understanding of long and short vowel sound use in words with inconsistent performance on test probes. Participant 1 was eligible to participate in the study, according to her PAT-2 test scores, and she then participated in subtests from the TILLS, named next to their standard score in parenthesis. TILLS subtests administered included the Listening Comprehension (6), Reading Comprehension (5), and Reading Fluency (77). She achieved a score of 99 on the TONI-4.

Subject 2 was an African American female in third grade, who was 8;8 years old at the beginning of participation in this intervention. She had a diagnosis of dyslexia and had also been identified as having reading difficulty by her teacher, who reported to the student’s mother. The
child’s mother reported that she has difficulty with sounding out words, reading fluently, reading comprehension, spelling, and mathematics. Reading was rated as having a frustration level of 4/5 for the student, as reported by her mother. The student had no other co-occurring diagnoses. Participant 2’s results on the PAT-2 revealed a below-average standard score (SS of 82) on the Phonemic Awareness portion and a Phoneme-Grapheme total of 113 (SS, above 82% same-age peers). Student showed good likelihood for growth according to support system and dedication to her assignments. She completed subtests of the TILLS in Listening Comprehension (8), Reading Comprehension (0), and Reading Fluency (0). Once participant 2 completed the TONI-4, she earned a standard score of 102.

Subject 3 was an African American female in second grade, who’d had to repeat because she had not achieved academic requirements to move onto third grade. She was 8;4 years old at the beginning of the intervention sessions. Her mother reported that she had an IEP plan in place at school (neither of the other participants had this at school) and had received speech therapy services before, as she had previously been evaluated and received speech therapy services at school. This student had a few other existing conditions and her mother reported a delay in developmental milestones, as she did not walk until 18 months old and exhibited a language delay. Her mother reported concerns with spelling, reading fluency and comprehension, sounding out words, handwriting, mathematics, and phonemic awareness. The TILLS was used, in addition to the PAT-2 to identify language difficulty. The TILLS subtests were completed in Listening Comprehension (6), Reading Comprehension (0), and Reading Fluency (0). TONI-4 was completed with a standard score of 82.

Test Measures

The Phonological Awareness Test

The Phonological Awareness Test, 2nd edition, normative update (PAT-2:NU) (Robertson et al., 2017) was used to assess phonological awareness, letter sound knowledge, recognition of blends, diphthongs and digraphs, and the six orthographic syllable types tested using pseudowords. The PAT-2.NU has a total index reliability of .96 to .97, with subtest reliability scores ranging from .83 to .92. Test-retest and criterion validity correlations are moderate to strong.

The Test of Nonverbal Intelligence

The Test of Nonverbal Intelligence, 4th edition (TONI-4) (Brown et al., 2010) was used to establish nonverbal intelligence. Test takers point to nonmeaningful shapes that show the ability to match, form analogies, or solve visual puzzles. Results yield a nonverbal intelligence quotient.

The Test of Integrated Language and Literacy Skills

Three of fifteen subtests from The Test of Integrated Language and Literacy Skills (TILLS) (Nelson et al., 2016) were administered. These were Listening Comprehension (LC),
Reading Comprehension (RC), and Reading Fluency (RF). These subtests provide measures of semantic knowledge, oral narrative abilities as well as abilities to listen and comprehend stories told orally, reading comprehension for text with complex sentence structures, and the degree to which automatic word recognition results in fluency. When the full battery is administered, this test provides a composite profile of 15 oral and written language skill areas and identify whether a student’s performance is consistent with a true language disorder.

**LSU Child Case History Form**

An adaptation of the Child Case History Form used by the LSU speech and hearing clinic was used to elicit information about a) family structure and background, b) child developmental history, c) school information including grades repeated, a diagnosis of a disability, or special services received, and d) extended family history of developmental delays or disabilities.

**Intervention Material**

**Introduction to Phonic Faces Consonants and Vowels PowerPoint**

Phonic Faces were introduced to participants using a PowerPoint presentation. Each slide contained 3 versions of the same alphabetic letter, a) the lowercase letter printed in black, b) the lowercase letter in red placed in the mouth of a photograph of a real child, and c) the lowercase letter in red placed in the mouth of the Phonic Face character’s drawing. The PFs were introduced in contrasting pairs rather than alphabetical order to focus on the similarity of speech production cues for letter such as “p” and “b” (both made with lips but “p” pops the sound quietly with the top lip and “b” bounces the sound noisily with the lower lip). The vertical line means the lips should hold the air inside the mouth until the lip releases it. Representative slides from this PowerPoint presentation are shown in Figure 2.1.

Figure 2.1. Representative slides of Phonic Faces introduced using a PowerPoint presentation. Used with permission of Elementory.com
**Pseudoword Probes**

A total of 32 different probes, each with unique pseudowords to prevent memorization (3 words were repeated once), were created to measure changes in decoding skills across all baseline and intervention sessions. This totaled 960 unique pseudowords. Each 30-word probe consisted of 10 pseudowords in each set of CVC, CVCe, and CVVC spelling patterns. Each vowel was used 6 times per probe and the words ranged in complexity from 3 letters (e.g., CVC = zat) to 6 letters (e.g., CCVCCC = stelks) for CVC words, 4 to 6 letters for CVCe (e.g., CCCVCE = scrame), and 4 to 7 letters for CVVC (e.g., threach) words. Vowels in these sets of words varied systematically as each vowel occurred in every syllable pattern 6-7 times across the 32 probes. The long vowel probes were created using the same procedures for assuring systematic variations in vowels and syllable complexity.

Each probe was administered on its own PowerPoint for uniformity, speed, and ease of presentation on Zoom. Each word was typed with a 200-point font size. Each syllable pattern on the probe was assessed separately, with the CVC pseudowords presented first, followed by CVCe words and then CVVC words. The random number function of excel was used to randomize the order of presentation of pseudowords (simple to complex word structure) within each syllable type (e.g., CCVCC, CVC, CVCC...). Thus, difficult patterns were interspersed within easier patterns randomly within every probe. Each syllable type was tested separately and timed. Participants were cued to begin reading the words with a stop sign that changed from blue to yellow to green as the examiner said “ready-set-go” (see Figure 2.2).

![Example sequence of CVC probe pseudowords appearing in random order using a PowerPoint presentation](image)

**Words and Pseudowords Used for Instruction**

A total of 24 different instructional lessons were used to teach decoding skills during the planned 24 intervention sessions. All three participants received specific instruction with two syllable patterns: 12 CVC lessons and 12 CVCe lessons. Additional CVVC lessons were created but used only in the Farag hanna (2023) study of this team project. Each lesson taught only one syllable type (CVC or CVCe) and ranged in complexity from simple three-letter syllable shapes to those with three consonant blends or digraphs occurring at the beginning and/or end of words. The PowerPoint presented one word per slide and presented 25 words to decode. Unlike the probes, the instructional lessons followed good teaching practices, beginning with simple exemplars of the pattern (CVC) and progressing systematically through more complex syllables. To assure participants understood the purpose of the task, the first two lessons for each syllable type began with all real words (0 pseudowords [PS]) to provide meaningful feedback when the word was correctly decoded. Beginning with lesson three, two or more words in each lesson...
were pseudowords, and more were added each day until - by lesson 12 - all of the words were pseudowords, as shown in Figure 2.3.

<table>
<thead>
<tr>
<th>Patterns</th>
<th>Lessons</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>5 CVC</td>
<td>0 PS</td>
</tr>
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<td>5 CVCC</td>
<td>0 PS</td>
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<td>0 PS</td>
</tr>
<tr>
<td>5 CCVCC</td>
<td>0 PS</td>
</tr>
<tr>
<td>5 Other</td>
<td>0 PS</td>
</tr>
</tbody>
</table>

Figure 2.3. Sequence of the session number and number of specified pseudowords introduced for each syllable pattern within instructional lessons

Each slide in the PowerPoint presented the word typed in the Avant Garde 66-point font because the lowercase “çı” in that font is the form used by beginning readers. The slide appeared with the word only, but when the ‘Enter’ key is clicked, the presentation of the word in Phonic Faces letters was revealed as shown in Figure 2.4.

Figure 2.4. Example sequence of CVC real and pseudoword instructional slides using Phonic Faces to teach how to decode the word

Other animations were provided in the PowerPoints. For example, consonant digraphs were first displayed as spelled, as in f-i-s-h. When the ‘Enter’ key was clicked, the PF representation of the actual phoneme was revealed (see Figure 2.5).
Design of the Study

Eligibility for the Study

Participants were tested for eligibility via Zoom using seven measures of the Test of Phonological Awareness (PAT-2:NU; Robertson et al., 2017). The letter sounds known by the child for consonants, short vowels, and long vowels were verified using the consonant and vowel subtests. The five decoding subtests that corresponded with the syllable patterns of the study were also used for inclusion criteria, including consonant blends, consonant digraphs, CVC, CVCe, and CVVC. Participants needed to score no more than 80% for the CVC pattern and no more than 40% for others to meet criteria. If criteria was met, the remainder of the grapheme and decoding subtests were administered. In addition, the 13 Phonemic Awareness subtests were given, including phoneme segmentation and blending that have been shown to establish readiness for decoding (Boyer & Ehri, 2011).

Pre-testing and Baseline

During the first week of the study, both pre-testing and the establishment of baseline probes occurred. In addition to the PAT-2 (Robertson et al., 2017), the remaining tests were administered (i.e., Test of Integrated Language and Literacy Skills [TILLS], Test of Nonverbal Intelligence – fourth edition [TONI-4]). These tests were repeated at post-test to determine whether changes would occur in contextualized reading abilities or in visual reasoning.

In single subject designs, a key component is to show a pattern of consistently low levels of accuracy on measures that should change with training or stay at baseline levels if not trained. The baseline probes were administered at the beginning of each Zoom session, followed by the administration of a standardized test, with a second different probe given at the end of the sessions.

On the final day of this baseline phase of testing, the Phonic Faces alphabet was introduced to the participants to familiarize them with the speech production cues depicted in the faces and how these cues link letters to the speech sounds. Once recognized, these cues reduce
the memory load during decoding because the visualization enables the subject to imitate the mouth positions shown in the PFs and recall the associated sounds because of the well-established speech-to-sound links. This enabled them to produce the sound sequences without having to rely on an auditory modality to recall sounds. The ‘Intro to Phonic Faces Consonants and Vowels’ PowerPoint was used to teach the speech cues represented by the letters.

**Intervention Phases**

During weeks 2 through 5 (12 sessions), intervention for the CVC short vowel syllable pattern was conducted. Each session began with the introduction of a new CVC lesson PowerPoint, beginning with the five 3-letter words. The child was shown the printed word and asked to read or decode it. The child's response was recorded. If the child's response was correct, the phonic faces were revealed and the examiner and child “checked” with the faces to confirm that the child's response was correct, and then the next word was presented. If the response was incorrect, the examiner used teaching strategies to facilitate an accurate decoding and recorded which strategies were used. When the five 3-letter words were completed, the examiner went on to the five 4-letter words and followed a similar procedure. This procedure was repeated for the remaining three 5-word sets characterized by increasing complexity. The total number of words completed varied across days based on the 40-minute teaching session. That is, if the child only completed 8 words in 40 minutes, then only the first two patterns were taught that day. As the patterns of vowels and consonant blends became more familiar, a greater number of the 25 instructional words were attempted.

A 30-word probe was administered immediately following each training session. Ten of the words corresponded with the syllable pattern trained that day (e.g., CVC during phase 1) while the remaining 20 words assessed the untrained alternative syllable patterns (e.g., CVCe and CVVC). It was anticipated that the number of words correctly decoded in the trained pattern would increase daily, while the untrained patterns would remain at baseline levels.

The second intervention phase began at approximately week 6 and continued through week 9. During phase two of intervention, training on the CVC pattern was discontinued and the CVCe syllable pattern was taught using procedures that paralleled the training in phase one. The CVVC syllable pattern went untrained and was expected to remain at baseline levels.

All training was discontinued on week 10 when post-testing was initiated for the PAT-2, TONI and TILLS. In addition, the pseudoword probes were then administered at the beginning of the session.

**Recording Intervention Responses**

To learn more about the strategies that are effective in enabling participants to decode during training, a Daily Lesson Response Tracking form (see Figure 2.7) was implemented. Two types of data were recorded: a) whether the word was recognized by sight, decoded from the print alone, or required the use of Phonic Faces, and b) If Phonic Faces were needed, the types and number of corrective feedback strategies that we required to elicit the word. From the total number of words attempted each session, the percentage of independent correct responses, percentage correct following feedback, and the profile of strategies used could be calculated and the profiles examined for patterns of word learning.
Figure 2.6. Introductory and reminder slides to reference in each Phonic Faces intervention PowerPoint – Arranged in quadrants, the slides are: (top left) All letters/individuals to be used for word segmentation, (top right) Vocalic sounds of English with prefixes, suffixes, and morphemes, (bottom left) Consonant and digraph Phonic Faces tiles with punctuation used within words, and (bottom right) images of animations from original spelling pattern PowerPoints in Phonic Faces intervention.

<table>
<thead>
<tr>
<th>WORD RECOGNIZED</th>
<th>CORRECTIVE FEEDBACK STRATEGIES</th>
<th>SUCCESS</th>
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<tbody>
<tr>
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*No indicates interventionist provided the word

Figure 2.7. Recording response form utilized to profile daily success in recognizing or decoding words and pseudowords, and examiner strategies required to elicit a correct decoding for unrecognized words.

During the intervention sessions, the first intervention word was presented and the child was asked to read the word or pseudoword. If the word was recognized by sight, a mark was
recorded in the “Sight” column; if the child independently decoded the word in less than 30 seconds, the examiner revealed the Phonic Faces and decoded the word using the faces to verify the child’s accuracy and marked the “Decoding, Verify with PF” column. If the child did not successfully decode the word, the “No, use strategy” column was checked, and the interventionist began providing corrective feedback. One or more of the strategies were marked. Finally, in the “Success” column, the interventionist either checked “yes” if the child decoded the word with assistance, or “No” if the interventionist needed to provide the word. This procedure continued until all 25 words in the PowerPoint were decoded or until the 40-minute time limit was reached. Immediately following the treatment, the pseudoword probe was administered.

**Recording Probe Responses**

The probe was administered immediately following the 40-minute instructional session, and recorded via Zoom so scoring could be checked for time and accuracy. The interventionist introduced the probes by reading the second slide while the participant read along. “I am going to ask you to try to sound out some silly words that have no meaning. Some are very short words, and some have many letters. Try to sound out all the letters in each word as quickly and correctly as you can. Do not worry if the word is too hard. You are still learning how to sound out words and this is just practice.”

![Figure 2.8](image_url)

**Figure 2.8.** The “Ready-Set-Go” animated stop sign used to introduce and end each 10-word syllable set in a probe

Immediately before each set of 10 pseudowords (i.e., CVC, CVCe, and CVVC sets for each probe), a stoplight appears on a slide (see Figure 2.8). The first time it is introduced, the interventionist asks, “Are you ready to begin? When I show you the lights on the stoplight, I will say ‘ready, set, go’ and then show you the first word. Try to read each word quickly and correctly.” The animation successively reveals the ready, set and go lights and then presents the first probe word. The probe word set ends with another stop sign that introduces the next set when the interventionist states, “Now we will read 10 more words. Are you ready? Ready-Set-Go!” This cycle was repeated when the third stoplight appeared before the final syllable type. Ten minutes were allowed to complete the probe (i.e., approximately 18 seconds per word or four minutes per syllable set). After 15-20 seconds on a single word, unless the child was close
to decoding it correctly, the word was scored incorrect, and the next word in the set was presented.

Figure 2.9 shows the Pseudoword Daily Probe form that was used to record the accuracy of the vowel produced, the accuracy of the entire word, and the time required to complete each 10-pseudoword syllable set. Vowels received 1 point for the correct vowel, regardless of errors on consonants. Word scores were given as 1 point for a correctly decoded pseudoword or 0 points for any error on consonants or vowels within the word. Finally, the total number of seconds required to read each 10-word probe was recorded.

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Figure 2.9. The Pseudoword Probe answer form was used to keep records of Participants’ daily Word Accuracy and Vowel Accuracy scores

**Fidelity and Reliability**

Prior to the beginning of the study, training was provided on conducting the standardized tests via teletherapy, using the instructional PowerPoints and their corresponding scoring form, and conducting and scoring probes. A criterion of 90% accuracy in training implementation was used. Accuracy during actual pre-test/post-test and training sessions was checked using the Zoom video recordings that were maintained in a university secured box folder. Twenty percent of end-of-session probes were reviewed for reliability of scoring.

The research advisor observed 25% of the sessions to establish fidelity of the intervention implementation. Problems in implementation focused on judging the type and number of scaffolding strategies needed by the participants, which were addressed with verbal feedback and modeling during the session.
Plan for Analyzing Data

Probe Vowel and Pseudoword Accuracy

**Questions 1 and 2.** The first two questions addressed changes that occurred in decoding the probe pseudowords across time. The two treatment phases addressed different vowel patterns, with Phase 1 addressing the CVC short vowel pattern and Phase 2 addressing the CVCe long vowel pattern. Question 1 tracked changes in the vowel alone, while question 2 tracked changes in the vowel and surrounding consonants, including 2-3 letter blends and consonant digraphs. Comparison of the two graphs provided an indication of when the short vowels were correctly distinguished from each other, when long vowel distinctions were made, and when consonant patterns were recognized.

Changes from baseline were determined by using an adaptation of the 2 SD band method (Rubin, 2010) to indicate that a probe point differed significantly from the baseline measures. First, the mean and standard deviation of data points within the baseline phase were calculated to establish variability during that phase. A two standard deviation level above the baseline phase was set as the upper limit of non-significant change. The binomial distribution was used to calculate the probability that the scores in the intervention phase are greater than those in the baseline phase. The proportion of scores that exceeded the 2-standard deviation band during the intervention phase were compared to the 5% probability level (.05) that the higher scores occurred by chance. For example, the probability that five intervention scores above the 2-standard deviation band occurred by chance alone would coincide with a significance level of p < .035.

Figure 2.10 provides an example from Farag Hanna (2023) showing that all of the CVC probes (blue line) were above the 2-standard deviation band throughout intervention phase 1, while the long vowel patterns, with two exceptions for the CVVC pattern, did not reach those levels until phase 2 when long vowel interventions began.

![Figure 2.10. Example from Farag Hanna (2023) data showing the 2-standard deviation band method of analysis](image-url)
**Questions 3 and 4.** The pre-test-post-test changes from the PAT-2 phonological awareness and phoneme-grapheme subtest scores were analyzed using the criterion of a clinically significant change. The criterion of a clinically significant change allows for a comparison of multiple specific subtest changes from pre-test to post-test. Clinical significance, according to Jacobson et al. (2009), occurs when an individual’s score on the same standardized test or subtest improves from a “dysfunctional population” range to the “functional population” range. The extent to which the confidence that the change is valid is measured by the range of variability of an individual’s true score, or the standard error of measurement (SEM). The SEM for PAT-2 subtests is one, while the composite subtest is three. The sum of the raw score plus one SEM determines the upper range of the true raw score at the 95% confidence level.

**Question 5.** The three contextualized reading and oral language measures (i.e., Listening Comprehension, Reading Comprehension, and Reading Fluency Subtests) of the Test of Integrated Language and Literacy Skills (TILLS) (Nelson et al., 2016) were analyzed using Jacobson et al. (2009) for determining a clinically significant change. A significant change occurs when a standardized test score improves from the “dysfunctional population” range into the “functional population” range on a standardized test.
Results

A single subject, multiple baseline design replicated across three participants was utilized to measure changes in three orthographic patterns (i.e., CVC, CVCe, and CVVC syllables) across 10-11 weeks. Two of the syllable patterns were successively taught to examine the effects of phoneme-cued visual representations of letter-sound associations using the Phonic Faces alphabet (Norris, 2001), while the third untaught pattern served as a control variable. The purpose of the study was to determine the efficacy of the features of the alphabet for improving the phonemic awareness and word reading skills for 8-year-old students with persistent decoding deficits.

Five questions were addressed in this study to determine the effects of the treatment on phonemic awareness and word reading skills. Question 1 utilized daily probes comprised of pseudowords to measure treatment effects for vowel decoding accuracy for the CVC, CVCe and CVVC syllable patterns for each baseline, treatment, and post-treatment session. The probes were scored for accuracy of the vowel, regardless of errors on consonants, Question 2 tracked changes in performance for the whole word (vowel and consonant) pattern for treatment effects. The probe profiles were assessed for significance using an adaptation of Rubin’s (2010) two standard deviation band method.

The clinical significance of the treatment on phonemic awareness and reading was assessed using the Phonological Awareness Test - 2 (PAT-2, Salter & Robertson, 2007). Question 3 compared the gain scores on the Phonological Awareness subtest scores from pre-test to post-test. Clinical significance is found if the pre-test score is below average and reaches the average range at post-test (Jacobson et al., 2009). Question 4 compared the gain scores on the PAT-2 decoding subtests, specifically the CVC, CVVC and CVCe subtest and the Decoding Composite scores. The overall change was measured by comparing the total test gain score of the PAT-2 from pre-test to post-test.

The effects of contextualized reading fluency and comprehension were addressed in Question 5. This question measured gain scores in three subtests of the Test of Integrated language and Literacy Skills (TILLS) (Nelson et al., 2016) to determine if the participant’s outcome score moved significantly closer to the range representing the normal population following treatment.

Questions 1 and 2: Accuracy of Vowel and Whole Word Decoding

Two measures were used to examine patterns of learning as measured by daily pseudoword probes for the CVC, CVCe, and CVVC syllable patterns. The first examined the vowel accuracy to determine if changes were occurring that might not be apparent because of errors in consonant blends or digraphs. The second examined changes in accuracy of the entire word (i.e., vowels and consonants). The pseudowords used in probes to assess daily accuracy included two words for each short vowel and differed in syllable complexity from three graphemes (i.e., CVC) to six including consonant blends and digraphs (i.e., CCCVCC or CCVCCC).

The data are presented successively in this discussion, with each participant’s vowel accuracy profile immediately followed by the corresponding word accuracy profile (e.g., CVC vowel data followed by CVC word data for each participant and likewise for CVCe). The graphs presenting the results for all three participants used the same color-coding system. That is, the CVC probe profiles are represented by the blue lines, the CVCe profiles are coded orange, and
the CVVC profiles are grey. The dotted lines mark changing phases (i.e., baseline phase to CVC intervention, to CVCe intervention, and to the post-testing phase).

**Participant 1**

**CVC Vowel Accuracy.** Figure 3.1 shows the graphed probe scores for Vowel Accuracy (VA) for Participant 1. The results of The Phonological Awareness Test (PAT; Salter & Robertson, 2007) administered during the pre-test showed that the participant could provide the short vowel sound for all five vowels in isolation but could only accurately decode 3 of 10 CVC syllables. However, during the baseline phase the participant showed accuracy for 5 of 10 CVC probe words on day 1 and the scores increased to all 10 by day 4 (mean 7.75; sd 2.21). This yielded a minimum band score of 12.17 required to show significance. Since the maximum possible score is 10, significance could not be achieved.

Examination of the profile showed that the high level of accuracy obtained for baseline probes was more variable once the CVC intervention phase was initiated, with the first four probes (sessions 5 to 8) resulting in a score of 7 or less. The profile during the CVC intervention was consistent with learning in that the first four scores were 7 or less, increased to 9 on the fifth training session, and then remained above 7 correct for seven of the next nine sessions. However, these changes did not achieve significance; further, mastery was not achieved during this intervention phase.

An interesting pattern of variability was shown in the second intervention phase when the CVCe long vowel was introduced. The first five CVC probe scores (sessions 18 to 22) decreased steadily, suggesting confusion occurred once the CVCe vowel pattern was introduced. However, beginning in session 23, both the CVC and CVCe probes showed parallel gains that continued through session 28. This supports the hypothesis that once the long vowel pattern was learned, the participant was able to distinguish the patterns and both increased in parallel. However, significance of this finding cannot be claimed because the baseline scores were too high for significance of change to be achieved.

**CVC Word Accuracy.** The graphed probe scores for Word Accuracy (WA) are shown in Figure 3.2 for Participant 1. The blue CVC line shows that during baseline, the CVC word scores were within the range of 0-7 (out of 10), while the CVCe and CVVC patterns were produced at 4 or lower. The average CVC was calculated to be 4.50 with a standard deviation of 1.8. Using the 2 SD band method the student needed to achieve a score higher than 8.1 for five sessions during the CVC intervention. The graph shows that once the CVC intervention was introduced in session 5, Participant 1’s Word Accuracy score showed variability, ranging from 4 to 6 for eight sessions before dropping to 3 immediately before a climb to 10 before another drop. Clinical significance was not found after analyzing these trends according to the two standard deviation band method which required five probe scores over the duration of the CVC intervention phase to be higher than 8.1 (Rubin, 2010). This performance was far lower than the vowel accuracy scores, indicating difficulty decoding the consonant sequences. The untreated CVCe and CVVC patterns made some initial gains but as the accuracy of the CVC pattern increased, these patterns returned to baseline levels of 0 to 2.
**CVCe Vowel Accuracy.** Figure 3.1 showed a similar low-to-high scoring profile for the CVCe baseline with scores ranging from 2 through 6 (mean 3.125, SD 1.42). To show treatment effects, five probes during the CVC intervention phase would need to score higher than 5.97 for the results to be significant using the two standard deviation band method (Rubin, 2010). During
phase 1 when the CVC pattern was treated, the CVCe scores were all between 1 and 5 correct, suggesting no learning was occurring compared to baseline. Once intervention for CVCe was introduced, the first six lessons (sessions 18-22) showed variability within the previous range. However, a sudden increase occurred for the seventh CVCe lesson and continued to the end of the treatment phase (sessions 23 to 28), suggesting that the child discovered during that session how the silent e affected the vowel sound and could accurately apply it to decode long vowels for that and the next five probes. This finding satisfies Rubin’s criteria for a significant change. As discussed above, this interpretation is supported by the finding that the accuracy of the contrasting CVC pattern increased in parallel, indicating that once the distinction between the two vowel patterns was understood, the accuracy of both increased. Importantly, the child’s scores for the untreated CVVC pattern appeared to be unaffected. They ranged from 0 to 5 with a mean of 2.68 from session 1 through session 28. The importance of the CVVC baseline is that it indicates that the improvements in CVC and CVCe words was not caused by some variable acting outside of the experiment during this time. Any external factor causing learning during this time span would be expected to affect the CVVC performance as well.

**CVCe Word Accuracy.** The orange CVCe line of Figure 3.2 shows that during baseline, the CVCe word scores were within the range of 2-6 (out of 10). The average CVCe was calculated to be 2.25 with a standard deviation of 1.66, yielding a minimum required significance band of 5.57. Once the CVCe intervention was introduced in session 18, Participant 1’s score remained within baseline levels (5 or less) through Probe 23 when the score spiked to 7 and continued between 4 to 9 for the remainder of the sessions, satisfying the criteria for the two standard deviation band method (Rubin, 2010). These scores paralleled the CVC scores but ended higher, suggesting mastery of the consonant blends and digraphs was occurring. This was supported by scores of 8 or higher for the final two probes of the post-testing phase, when no training occurred. Importantly, the untreated CVVC pattern (i.e., control) never increased above 4 during CVCe training or post-testing, suggesting that other outside factors were not causing the changes.

**Participant 2**

**CVC Vowel Accuracy.** The results of the PAT-2 (Salter & Robertson, 2007), administered before the start of intervention, showed that this participant could provide 4 out of 5 short vowel sounds in isolation and decode 8 out of 10 CVC syllable words. For the baseline probes, the participant scored between 5 and 7 out of 10 CVC (mean 6.0, sd 0.82) probe words decoded correctly. This established baseline mean, would require a minimum score of 7.64 to show treatment efficacy. The profile shows once the CVC intervention was introduced in session 5 (probe 5), Participant 2’s vowel score immediately increased to 8 (out of 10) but continued to vary between 4 and 9 correct throughout the treatment phase.

The two standard deviation band method (Rubin, 2010) required five probes during the CVC intervention phase to score higher than 7.64 for the results to be significant. The student received a score of eight and above for 8 of the 12 intervention probes, indicating significant results for CVC Vowel Accuracy. As shown in Figure 3.2, the baseline for the CVC pattern was rising before treatment was initiated and continued to rise during treatment albeit inconsistently.
In contrast, the Vowel Accuracy for the untreated CVVC and CVCe (i.e., control patterns) remained at scores of 0-3 throughout the CVC treatment while the CVC pattern was rising.

**CVC Word Accuracy.** The blue CVC line of Figure 3.4 shows that during baseline, the CVC word scores were within the range of 0-3 (out of 10), while the CVCe and CVVC scores were 0 to 1. The average CVC was calculated to be 1.5 with a standard deviation of 1.29, yielding a minimum required significance band of 4.08. Once the CVC intervention was introduced in session 5, Participant 2’s score remained within baseline levels (3 or less) for 3 sessions and then gradually rose to a high of 6 before dropping back to baseline and then rebounding for the final four training sessions. This resulted in eight probe scores of 4 to 6 (seven at 5 or 6), satisfying the criteria for the two standard deviation band method (Rubin, 2010). These scores paralleled the CVC scores but at a lower level of accuracy, suggesting difficulty with the consonant blends and digraphs. Importantly, the untreated CVCe and CVVC pattern (i.e., control) never increased above 2 during CVC training, suggesting that other outside factors were not causing the changes.

![Figure 3.3. Participant 2 Graphe Scores of Vowel Accuracy Obtained During Baseline, CVC, CVCe Interventions, and Post-test Periods](image-url)
**CVCe Vowel Accuracy.** The baseline for CVCe probes was extended through the first 16 sessions before intervention for this spelling pattern was initiated. The baseline scores ranged between 0 and 2 vowel points (mean 0.75, sd 0.97). This baseline would dictate a significance score of 2.63 or greater. Participant 2 achieved at least 3 points in 10 out of 12 of the intervention sessions, achieving significance. Scores immediately rose from the baseline to 3 points when CVCe intervention began, with a score of 9 attained by the third session, and scores of all 10 reached four times. However, variability was shown with two scores below three also occurring, resulting in an overall mean of 6.75 and sd of 3.42. Importantly, scores achieved for the CVVC probes did not improve (i.e., control condition), remaining in the low range of 0 to 3 points throughout the entire course of sessions and supporting the claim that factors outside of the intervention did not cause the change.

Note that during its intervention phase, the CVCe vowel pattern showed little variability and reached a level of mastery. Once the intervention for the long vowel CVCe spelling pattern was introduced by contrasting the adult Phonic Faces vowels with the baby short Phonic Faces vowels, the accuracy of the long vowel spelling pattern taught improved in parallel with the short vowel, CVC pattern. The mean score for the CVC vowel during its treatment phase was 7.5 correct, but this mean rose to 8.83 during the CVCe phase and 9.5 during the untreated post-test phase. In parallel, the CVCe pattern mean scores rose significantly from 0.5 during the CVC instruction phase to 6.75 during the CVCe instruction phase. This finding suggests that the contrasting Phonic Faces vowels solidified a sense of clarity that the participant experienced from the beginning of the CVC instruction phase that resulted in ultimate mastery of the long vowel pattern (CVCe) for which the participant received instruction. The participant achieved all possible points on probes with this pattern beginning one session before and lasting through the end of post-testing.
CVCe Word Accuracy. The orange CVCe line of Figure 3.4 shows that during baseline, the CVCe word scores were all 0 except 1, while the CVVC control pattern scores were 0 to 2. The average CVCe was calculated to be 0.1875 with a standard deviation of 0.40, yielding a required significance score of 0.99. Once the CVC intervention was introduced in session 18, Participant 2’s score immediately increased to 3 and then dropped back to 0 before spiking intermittently, moving between increasing low scores of 2 to 4 and higher scores of 6-9 through the duration of instruction and post-testing. This pattern of dropping and then spiking continued for two more cycles. This resulted in 15 of the 16 probes in this cycle satisfying the criteria for the two standard deviation band method (Rubin, 2010). Mastery of the consonant blends and digraphs was suggested to be occurring, according to the trends of CVCe scores, which paralleled the CVC scores but ended higher. This was supported by scores of 8 to 9 for the final two probes during post-testing when no training occurred.

Participant 3

CVC Vowel Accuracy. Figure 3.5 shows the graphed probe scores for Participant 3 during phases of Baseline, CVC, and CVCe intervention periods. The results of the PAT-2 (Salter & Robertson, 2007), administered before the start of intervention, showed that this participant correctly decoded 8 out of 10 CVC syllable words. Conversely, when tested with daily probes, Participant 3 scored between 2 and 3 points for short vowel accuracy (mean 2.25, sd 0.5). This baseline mean would make a score of 3.25 the minimum needed to show treatment efficacy. The profile shows that once intervention was initiated, the CVC score immediately rose between 5 to 9 points for five sessions, and then varied between 5 to 10 points for the remaining intervention sessions (mean 6.5).

The two standard deviation band method (Rubin, 2010) required five probes during the CVC intervention phase to score higher than 3.25 for the results to be significant. The student received a score above the minimum for all twelve-intervention probes, indicating significant results for CVC Vowel Accuracy. In contrast, the Vowel Accuracy for the untreated CVVC and CVCe patterns remained at scores of 0-3 throughout the CVC treatment except for one spike to 5 points for CVCe while the CVC pattern was rising.

CVC Word Accuracy. The blue CVC line of Figure 3.6 shows that during baseline, the CVC word scores were within the range of 0-1 (out of 10), while the CVCe and CVVC scores were 0 to 3 and 0 to 2. The average CVC was calculated to be 0.25 with a standard deviation of 0.5, yielding a minimum required significance band of 1.25. Once the CVC intervention was introduced in session 5, Participant 3’s scores ranged from 3 to 7 throughout the intervention, with one peak after the CVC intervention session on the probe for day 10 (6th day of CVC instruction). Throughout the CVC instruction sessions (days 6-18) Participant 3 scored gradually and consistently higher than the baseline score, satisfying the requirement to score beyond the 2 band standard deviation band method (1.25; Rubin, 2010) and made a slow and shallow dip in CVC achievement once CVCe intervention was introduced (sessions 20-28) before returning to a level between 5 and 7 for the remaining four post-testing sessions. CVC word accuracy scores paralleled CVC vowel accuracy scores at a lower level, suggesting difficulty with the consonant blends and digraphs.
CVCe Vowel Accuracy. The baseline for CVCe probes was extended through the first 17 sessions before intervention for this spelling pattern was initiated. Figure 3.5 shows the baseline scores ranged between 0 and 3, with one score of 5 vowel points (mean 1.3, sd 1.45).
This baseline would dictate a significance band score of 4.2 or greater. Once the CVCe intervention began, scores stayed at baseline levels with one peak of 4 points until the ninth training session when a score of all 10 was reached. Scores then fell to 0, but rebounded with scores of 6, 9 and 10, with a training mean of 3.83 and sd 3.95, indicating considerable variability. However, 6 of the scores met the criteria, resulting in significant findings using the two standard deviation band method (Rubin, 2010). This level was maintained, with 3 of the 4 probes taken during post-testing scoring 4 to 10 points. The findings suggest that the child was beginning to master complex syllable shapes but required additional training. Generalization to the untrained CVVC pattern was beginning to appear, with scores in the 3-to-6-point range occurring four times during the CVCe training and again at post-testing. However, it should be noted that there was a small rise in CVVC vowel scores alongside the CVCe intervention phase. Participant 3 scored between 0 and 3 points throughout CVCe intervention to reach a peak of 6 on the probe during session 5. Scores continued to rise in small increments throughout the post-testing phase, as she scored between 3 and 5 correct vowel sounds in the post-testing phase. As the untreated CVVC pattern (i.e., control) increased during CVCe training, it could be suggested that the contrast between long and short vowel sounds in words was being learned. However, it is unlikely that these vowel changes were being learned from outside factors because the scores remained low throughout the pret-est and CVC instruction phases.

**CVCe Word Accuracy.** The baseline for CVCe vowel probes was extended through the first 17 sessions before intervention for this spelling pattern was initiated. The baseline scores ranged between 0 and 2 (mean 0.53, sd 0.88). This baseline yielded a minimum significance band score of 2.28 or greater. Once intervention was initiated in session 18, scores remained at levels between 0 and 4 points until the eighth CVCe session, and then rose to 9 points. Scoring criterion was reached nine times, indicating significance of intervention method. However, mastery of the CVCe pattern was not fully achieved in stabilization of scores and performance. Post-test probes with no additional training showed maintenance of learning with scores between 2 and 7 for all four probes. Further, during the CVCe intervention phase, the untrained CVVC pattern (i.e., control condition) remained in the 0-to-2-point range. For Participant 3, vowel accuracy remained higher than word accuracy for all three syllable types. This suggests that consonant blends and digraphs remained challenging to decode. For Participant 3, vowel accuracy remained higher than word accuracy for all three syllable types. This suggests that consonant blends and digraphs remained challenging to decode.

**Summary**

Significant increases in decoding pseudowords were found for all six of the CVCe measures, including the vowel only and vowel plus consonant profiles for the three subjects. Because the high baseline scores for the CVC pattern for Participant 1, significance could not be reached for vowel or word probes. However, significance was shown for the CVC word probe and both vowel and word probes for Participants 2 and 3. Mastery was not achieved for Participant 2 or Participant 3. These results support the efficacy of the intervention for teaching CVC vowel reading.
Pre-test to Post-test Gains

The third and fourth questions examined gain scores between pre-testing and post-testing for clinically significant change on the Phonological Awareness Test -2 (Salter & Robertson, 2017). Jacobson et al. (2009) suggested that moving from a “dysfunctional population” to “functional population” range would be considered a clinically significant gain. This is interpreted as a change from the below-average range or lower to an average range or higher. Question 3 addresses PAT subtests measuring phonological awareness skills. Question 4 addresses PAT subtests measuring decoding skills. The Index score has a mean of 100, with any score between 85-115 rated as “average.” The standard error of measurement (SEM) for the composite is 1 and the subtests are 3. If the gain score is more than 3 points above the pre-test score, the gain is considered to be true within a 95% confidence level.

Question 3: PAT Phonological Awareness Gain Scores

Table 3.1 profiles the Index scores and descriptive ratings for two of the phonological awareness subtests (i.e., Segmentation and Blending) and the Composite Phonological Awareness Score (i.e., Rhyming, Segmentation, Isolation, Deletion, Substitution and Blending) of the PAT-2 (Robertson et al., 2017) from pre-test to post-test for the three participants. Segmentation and Blending were profiled because they have been shown to be highly related (and possibly prerequisite) to success in decoding (Pokorni et al., 2004; Torgesen et al., 2001).

Table 3.1 profiles two of the phonological awareness subtests (i.e., Segmentation and Blending) and the Composite Phonological Awareness Score (including Rhyming, Segmentation, Isolation, Deletion, Substitution and Blending subtests) of the PAT-2 (Robertson et al., 2017) from pre-test to post-test for the three participants. Segmentation and Blending were profiled because they have been shown to be highly related (and possibly prerequisite) to success in decoding (Pokorni et al., 2004; Torgesen et al., 2001).

At pre-test, Participant 1 scored in the average range for Segmentation. Participant 1 started with the highest probe scores during the baseline period during intervention, but struggled with decoding throughout the study, scoring above 6 only once during the CVC training and three times each for the CVC and CVCe patterns during the CVCe probes. For this participant, the training did not have a significant effect on phonemic awareness skills. In fact, Participant 1 received a lower score for Segmentation at post-test, falling to the below average range.

At pre-test, Participants 2 and 3 scored below average for Segmentation. At post-test, Participants 2 and 3 increased to the average range, with gains greater than the SEM, yielding clinically significant changes for both. Both of these participants scored between 0 to 3 points on baseline probes during intervention and made steady progress during training. They made gains but neither mastered decoding the complex probe syllables. The clinically significant changes in Segmentation are consistent with the decoding gains.

At pre-test, Participant 1 again scored in the average range for Blending with a gain of less than 1 SEM at post-test. Participants 2 and 3 scored in the poor range and remained in the poor range, despite making significant gains in the ability to blend phonemes during intervention. The third measure in the PAT-2 is the Phonological Awareness Composite, which includes six different phonological awareness skills. Participants 1, 2, and 3 scored in the below average, average, and very poor ranges, respectively, and remained in these categories at post-test. Participant 3 gained 12 raw score points, or four SEM of change, indicating considerable
progress, but the score remained in the very poor range. This participant made significant gains in probe scores during intervention (baseline scores between 0 and 2), but only scored above 6 correct four times during the intervention. This suggests that phonemic awareness and decoding were both benefitting from the intervention, but a longer period of training would be needed to reach mastery.

**Question 4: PAT Decoding Gain Scores**

Table 3.1 profiles the Pre-test-Post-test Index Scores and Descriptive Rating for the CVC, CVCe and CVVC Subtests, Consonant Blends, and the Decoding Total Score of the Phonological Awareness Test (Salter & Robertson, 2017). These tests are profiled because they served as qualifying criteria for participation in the study and assessed the three patterns plus consonant blends used in the treatment or control conditions.

Table 3.1. Profiles of Four Decoding PAT-2 Subtests and Decoding Composite at Pre-test-Post-test

<table>
<thead>
<tr>
<th>Participant 1</th>
<th>CVC Subtest</th>
<th>CVCe Subtest</th>
<th>CVVC Subtest</th>
<th>Decoding Composite</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Raw</td>
<td>Index</td>
<td>Rating</td>
<td>Raw</td>
</tr>
<tr>
<td>Pre-test</td>
<td>3</td>
<td>70</td>
<td>Poor</td>
<td>4</td>
</tr>
<tr>
<td>Post-test</td>
<td>6</td>
<td>89</td>
<td>*Average</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Raw</td>
<td>Index</td>
<td>Rating</td>
<td>Raw</td>
</tr>
<tr>
<td>Pre-test</td>
<td>8</td>
<td>98</td>
<td>Average</td>
<td>2</td>
</tr>
<tr>
<td>Post-test</td>
<td>7</td>
<td>91</td>
<td>Average</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Raw</td>
<td>Index</td>
<td>Rating</td>
<td>Raw</td>
</tr>
<tr>
<td>Pre-test</td>
<td>8</td>
<td>103</td>
<td>Average</td>
<td>0</td>
</tr>
<tr>
<td>Post-test</td>
<td>7</td>
<td>91</td>
<td>Average</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Raw</td>
<td>Index</td>
<td>Rating</td>
<td>Raw</td>
</tr>
<tr>
<td>Pre-test</td>
<td>8</td>
<td>98</td>
<td>Average</td>
<td>2</td>
</tr>
<tr>
<td>Post-test</td>
<td>7</td>
<td>91</td>
<td>Average</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Raw</td>
<td>Index</td>
<td>Rating</td>
<td>Raw</td>
</tr>
<tr>
<td>Pre-test</td>
<td>8</td>
<td>103</td>
<td>Average</td>
<td>0</td>
</tr>
<tr>
<td>Post-test</td>
<td>7</td>
<td>91</td>
<td>Average</td>
<td>5</td>
</tr>
</tbody>
</table>

(table cont’d.)
At pre-test, Participant 1 scored in the poor range for the CVC pattern. When compared to intervention data, the first two probes administered prior to intervention for CVC were 0 and 2, consistent with the PAT test performance, but then climbed to 7. Despite the spike during baseline, the participant struggled with mastering the pattern, averaging 5 points throughout the intervention and follow-up phases. These gains were consistent with the post-test score of 6 for this subtest, which yielded a rating of average for the participant’s age (8;1 years) with gains greater than the SEM, or a clinically significant gain. Participant 1 also scored 6 of 10 for consonant blends, yielding clinically significant gains with improvements from the poor to average range with gains greater than the SEM.

Participants 2 and 3 scored in the average range for the CVC pattern at both pre-test and post-test with no gains. Both of these participants scored between 0 to 3 points on baseline probes during intervention and made steady progress during training, but only averaged 5 points on probes. They showed progress but neither mastered decoding the complex probe syllables. At pre-test both participants scored in the very poor range for decoding consonant blends, with Participant 2 scoring below the available norms (<1%ile) and Participant 3 at 1%, and both improving to the near average or average range at post-test.

Participant 1 scored in the average range for the CVCe pattern at both pre-test and post-test, so no clinically significant change was noted although the post-test score exceeded one SEM. This change in scores was consistent with the profile shown in the intervention probes that increased from a mean of 2.2 to 4.9 from baseline to intervention phases. Participant 2 showed a clinically significant change from below average to average, consistent with the probe score changes from baseline (mean= 0.81) to intervention (mean=7.6). Participant 3 improved from the very poor to the below average range, making a change of 1 SEM. However, the change did not reach clinical significance because the average range was not achieved. These gains also paralleled the probe score changes from baseline (mean=0.5) to intervention (mean=2.9).

Participants 1 and 2 made clinically significant changes (1 SEM) from below average at pre-test to average at post-test. Participant 3 also made 1 SEM of change but her very poor pre-test rating changed to below average, and thus did not meet the criteria of an average ranking needed for clinical significance. Both Participants 1 and 2 made clinically significant changes from below average or poor, respectively, to average for the Decoding Composite. Participant 3 increased from a poor to a below average rating, once again making notable changes but failing to reach the criterion for clinical significance.
Table 3.2. Total Test Score for the PAT-2 Including Phonological Awareness, Graphemes and Decoding Components

| PAT-2 Total Test Scores | Participant 1 | | Participant 2 | | Participant 3 | |
|-------------------------|---------------|-----------------|---------------|-----------------|-----------------|
|                         | Raw Score | SS | Rating | Raw Score | SS | Rating | Raw Score | SS | Rating | |
| Pre-test                | 152 | 74 | Poor | 162 | 82 | Below Average | 162 | 74 | Poor | |
| Post-test               | 183 | 88 | + Below Average | 196 | 88 | Below Average | 196 | 88 | +Below Average | |

*Clinically significant gain
+ Significant gain but post-test remained in below average range

Finally, the total PAT-2 scores, Including Phonological Awareness, Graphemes and Decoding Components, were compared from pre-test to post-test. Participants 1 and 3 improved from poor to a below average range, or slightly below criteria for a clinically significant gain. Participant 2 remained at below-average for pre-test and post-test. The gain scores exceeded the SEM at the 95% confidence level.

Summary

The results of the PAT-2, administered at pre-test and again 11 weeks later at post-test yielded three clinically significant changes for Participant 1 (CVC, CVVC, and Decoding Composite); three for Participant 2 (CVCe, CVVC, and Decoding Composite); and one for Participant 3 (CVCe) although CVVC and Decoding showed large changes but did not reach the average range. These significant changes corresponded with the profiles of learning that occurred during the intervention phases.

Question 5: Reading Gain Scores for the TILLS

The effects of the intervention on contextualized reading fluency and comprehension were addressed in Question 5. This question measured gain scores in three subtests of the Test of Integrated language and Literacy Skills (TILLS) (Nelson et al., 2016) to determine if the participant’s outcome score moved significantly closer to the range representing the normal population following treatment (i.e., a clinically significant change). Listening Comprehension assesses a student’s ability to listen to and comprehend a story. The Reading Comprehension subtest assesses a student’s ability to independently read and understand a story, while the Reading Fluency assesses reading rate and accuracy of word recognition without hesitation or sounding out.

The standard score of the subtests is a scaled score with a mean score of 10. Any score between 8-12 is average; scores above or below this range from very poor to very superior. The confidence interval (CI) for the true score for listening and reading comprehension is 2; for fluency, the CI is 4. The performance of the three participants is profiled in Table 3.3.
Table 3.3. Profile of the Pre-test-Post-test Scaled Scores and Descriptive Ratings for the Listening Comprehension, Reading Comprehension, and Reading Fluency Subtests of The Test of Integrated Language and Literacy Skills (TILLS)

<table>
<thead>
<tr>
<th></th>
<th>Participant 1</th>
<th></th>
<th>Participant 2</th>
<th></th>
<th>Participant 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Listening Comprehension</td>
<td>Reading Comprehension</td>
<td>Reading Fluency</td>
<td></td>
<td>Listening Comprehension</td>
</tr>
<tr>
<td></td>
<td>Raw (SS CI) Rating</td>
<td>Raw (SS CI) Rating</td>
<td>Raw (SS CI) Rating</td>
<td></td>
<td>Raw (SS CI) Rating</td>
</tr>
<tr>
<td>Pre-test</td>
<td>12 (6) Below Average</td>
<td>7 (5) Poor</td>
<td>77 (8) Average</td>
<td></td>
<td>14 (8) Average</td>
</tr>
<tr>
<td>Post-test</td>
<td>10 (5) Poor</td>
<td>12 (9) 90% *Average</td>
<td>41 (0) Very Poor</td>
<td></td>
<td>19 (12) 90% +Average</td>
</tr>
</tbody>
</table>

*Clinically significant gain
+Significant gain but post-test remained in average range

At pre-test, Participant 1 scored in the below average range for Listening Comprehension but dropped to the poor range at post-test. Participant 2 increased scores from the low to high end of the average range but these gains did not represent a clinically significant change because the pre-test score was not in the below average range. Participant 3 increased from the very poor to average range (CI 90%), representing a clinically significant change.

Participant 1 increased Reading Comprehension from a poor range at pre-test to average at post-test with a 90% CI. To complete this subtest, the participant is asked to read the first story out loud and the test is discontinued if they are determined to be an emergent reader. Thus, the test was not administered to Participants 2 and 3. This was verified by scores in the very poor range for reading fluency for all three participants at pre-test (except Participant 1) and post-test.

Summary

Results of the TILLS indicated that the improved decoding skills resulting from the intervention did not translate to grade appropriate fluency skills. This is consistent with the primary findings that, despite improvements in decoding, none of the participants achieved mastery for decoding any of the syllable types (i.e., CVC, CVCe, or CVVC). The lack of reading fluency resulted in two of the participants unable to take the reading comprehension subtest, although both showed improvements within the average range for listening comprehension.
Discussion

Previous approaches using visual enhancements of letters have resulted in positive results for learning the alphabetic principle. However, many involve pictures of words beginning with the first sound, requiring the learner to view the word independent of its meaning and segment phonemes from the word (e.g., the sound associated with “dog” is /d/ rather than “woof”). However, this level of phonemic awareness is deficient for individuals with persistent decoding deficits, including dyslexia (Handler & Fierso, 2011). Lindamood and Lindamood (1998) developed a program that associates properties of letters with photographs of lips producing the sounds to teach phonemic awareness, termed Lindamood Phoneme Sequencing Program for reading, spelling, and speech (LiPS). However, LiPS does not have any component for teaching graphemes other than presenting plain print letters during phonemic awareness training. Learners must use rote memory to link the phoneme awareness generated by the mouth position pictures to respective letters. In contrast, Phonic Faces (Norris, 2001) addresses this problem by drawing the letters into the mouths of faces producing the sounds to represent the relevant speech production cues.

Farag Hanna (2023) demonstrated the efficacy of Phonic Faces with second and third grade participants who had multiple years of exposure and instruction in decoding. In this study, rapid gains were made once the faces clarified concepts such as short and long-vowel patterns. However, questions remained about students who were just learning the patterns. This study addressed this question with three 8-year olds who were emergent readers with persistent decoding deficits.

The participants in this study were very limited readers. Their decoding skills were in the very poor range for two (below the 3rd percentile) and below average for the third (9th percentile). Participant 3 was below the 1st percentile for phonological awareness skills, as well. All scored in the very poor range for reading fluency, scoring below the 1st percentile. Two scored 0 on the reading comprehension subtest because they couldn’t read the sentences. All three could decode some simple CVC words without complex consonant structures (e.g., “cag”), with the consonant challenge verified by the finding that all scored in the poor or very poor range for decoding words with consonant blends. Only Participant 1 could give all of the long and short vowel sounds associated with letters, with Participant 3 only responding correctly to 2 vowels. Long vowel patterns were difficult for all participants who scored 0 to 4 (out of 10) for long vowel patterns CVCe and CVVC. All reported a dislike for and frustration with reading.

During the CVC intervention phase, all three subjects achieved high levels of vowel accuracy for daily probes (means 7.75; 7.5; 6.7), although there was considerable variability between days with both drops and spikes. Because of a high accuracy rate at baseline, Participant 1’s scores were not significant for either vowel or word accuracy, although a profile of learning was apparent, and Participants 2 and 3 were significant. This finding supported the observation that the Phonic Faces facilitated vowel accuracy, even for Participant 3 who only knew two short vowels at pre-test and one at baseline, but showed rapid and robust gains in vowel accuracy once the CVC intervention was initiated. When the whole words were examined (i.e., vowels and consonants) significant gains were shown by all three participants, paralleling the variable patterns of the vowel profiles but consistently at a lower level of accuracy (means 5.25; 3.8; 4.38). This finding supported the observation that the Phonic Faces also facilitated accuracy with
consonants, although the blends remained challenging and none of the participants mastered the multiple complex consonant patterns.

During the CVCe intervention phase, Participant 2 quickly learned the long vowels for this pattern, increasing scores from a mean of 0.81 at baseline to scores between 3-to-10 for 10 of 12 probes (mean 6.75). The same pattern of learning was observed for whole words with Participant 2 increasing from a baseline mean of 0.1875 to 4.42 during intervention and continuing to increase to 7 after training was withdrawn. This finding suggests Participant 2 almost immediately learned both the long and short vowel sounds and their associated silent e orthographic pattern.

Participants 1 and 3 both presented an inconsistent and delayed profile of learning for both vowel patterns and whole words. Both participants received six vowel training sessions with no change from baseline, followed by a series of scores between 6 to 10 correct (means of 8.17 and 5.83 for participants 1 and 3, respectively). This suggests that the Phonic Faces were successful within 7 sessions in teaching the CVCe long vowel sound and orthographic pattern that had eluded the students for years. Parallel profiles of change occurred for whole word learning, with six sessions of baseline level scores followed by increases of spikes and drops that resulted in significant gains (mean changes from 2.0 to 6.5 and 0.5 to 4.5, respectively). Both showed continuing increases following withdrawal treatment to means of 7.0 and 4.25, respectively. These findings suggest that the baby short vowel and adult long vowel Phonic Faces were effective for teaching the silent e long vowel pattern in short period of time.

This finding is supported by the lack of change in the CVVC long vowel pattern that was not treated and thus served as a control. This means that, for CVVC, at the end of the CVC treatment period the ‘vowel only’ score was 2.68, and it was 2.66 at the end of the CVCe treatment period for Participant 1. Similarly, this score was between 1.69 and 2.08 for Participant 2 and between 0.56 and 2.0 for Participant 3. Likewise, the changes for the three Participants for the CVVC words were 1.44 to 1.75; 0.63-0.75; and 0.13-0.83. None of these changes neared the 2 SD band needed to show a significant change. Only the orthographic patterns that we trained using Phonic Faces resulted in significant learning.

One interesting difference between this finding and the more advanced students in the Farag hanna (2023) study was the CVVC control pattern. In that study, once the participants understood the baby short vowel – adult long vowel contrast taught in the CVCe treatment, they learned to generalize the long vowel to the CVVC pattern, as well. It was proposed that they had been exposed to long and short vowels in school but did not understand the contrast. Once they could see the similarities and differences in the adult and baby Phonic Faces, they made the association with the double vowel CVVC rule to which they had been repeatedly exposed. There is some evidence that this was beginning to occur for the learners in this study, as well, particularly for the vowel scores. During the post-test session, when no training for any pattern occurred, the CVVC accuracy continued to increase.

**Questions 3 and 4**

Only two clinically significant changes were found between pre-test and post-test scores for the phonological awareness measures of the Phonological Awareness Test (PAT-2;
Robertson et al., 2017). Both occurred in segmentation abilities for Participants 2 and 3. During intervention, the entire letter sequence was presented in Phonic Faces. Each face was separated from the others with a different colored background. Thus, segmentation was present for each training trial and heightened awareness of word segments without explicit teaching.

No changes occurred for the phoneme blending subtest, which is unexpected since this skill was practiced continuously using the faces during intervention. Participant 1 began with average scores on this subtest and scored essentially the same. However, Participants 2 and 3 scored in the poor range at pre-test and scored essentially the same at post-test. This subtest is administered auditorily (e.g., What word is this: /m – ou – s/?), whereas the sequence to blend during intervention was cued visually using the Phonic Faces. The participants required six sessions to learn to successfully blend with the faces and generalize the learning to plain letters. They required considerable practice and multiple cues throughout the training sessions to learn to blend and hear words. Even with this much practice, they were unable to blend complex consonant sequences at the end of the study. Six of the ten words on this subtest required blending consonant phonemes.

Nine clinically significant changes were found between pre-test and post-test scores for the decoding measures of the Phonological Awareness Test (PAT-2; Robertson et al., 2017). Only Participant 1 scored in the clinically dysfunctional range for the CVC subtest at pre-test and improved to the average range at post-test with 6 of 10 correct. Participants 2 and 3 improved to the average range for the CVCe subtest with 5 of 10 correct. It was noted that even though the CVVC pattern wasn’t treated, it began to improve on probes immediately before and during the post-test phase, and this improvement was represented with clinically significant gains for Participants 1 and 2 with scores of 4 and 6 of 10, and near significance for Participant 3 with a score of 3. Consonant Blends improved to a clinically significant level for Participants 1 and 3 and neared significance for Participant 2. These findings show that all of the patterns taught using Phonic Faces improved to or near a clinically significant level for one or more participants, resulting in all but two of the twelve measures scoring in the average range. The average range for this age group ranges from 4 to 6 out of 10 correct for different subtests, or below mastery, consistent with the profiles of accuracy shown in the probe measures. The increases in the subtest gains resulted in clinically significant gains for Participants 1 and 2 and near significance for Participant 3 in the Decoding Composite score. Six of the clinically significant changes improved from a poor or very poor range to average following nine weeks of intervention.

The effects of the intervention on contextualized reading skills was measured using pre-test-post-test scores for the Listening Comprehension, Reading Comprehension, and Reading Fluency Subtests of The Test of Integrated Language and Literacy Skills (TILLS). Two clinically significant gains were shown. Participant 3 improved in Listening Comprehension from the very poor to average range. Only Participant 1 could read the sentences well enough to take the Reading Comprehension subtest and improved from poor to average, yielding a clinically significant change. All of the participants scored in the very poor range at post-test for Reading Fluency. These results indicated that although decoding skills improved to a clinically significant degree, the skills did not result in changes in automaticity of word recognition to a degree that enabled fluent reading and comprehension to be measured on the TILLS. Although normatively
appropriate for this age group, more information may be gleaned by supplementing the assessment with a reading inventory containing emergent and pre-primer reading passages.

**Limitations**

Limitations to this study can be taken in several different directions of thought. These various directions can be further divided into categories of intervention length, participant limitations, and retention of materials learned.

The length of intervention was 11 weeks, after which the participants showed a significant amount of growth. However, perhaps greater gains would have been attained if the intervention had lasted for longer. Unfortunately, at this point in the research of intervention, it is unclear what length of study would be optimal according to the populations being served. Differences can certainly be seen between this study and the one completed by Farag Hanna (2023) because of the level of ability and individual differences exhibited by the participants in each study. When comparing studies, one could assert that her participants were likely of a higher ability level or a decreased level of reading impairment, whom could benefit from a potentially shorter intervention time. The participants in this study could have benefitted from an even longer individual length of sessions (or perhaps interventions could be broken up to twice per day or similar varying schedule) and/or a longer duration of intervention and teaching, as their scores were only beginning to rise at the end of the intervention/beginning of baseline period. However, it is possible that gains could have been observed to a greater degree in standardized test and probe measures had the duration of intervention continued for a longer time period, as students were still inconsistently demonstrating their understanding of differences between long and short vowel patterns. A regular rhythm of teaching and learning was becoming accepted between the learner and interventionist by the time intervention was ending. The participants were still benefiting from practicing decoding patterns within and outside of sessions, even toward the end of the intervention, as a whole. Participants could have been taught to cue themselves to remember spelling patterns and syllable markers, had a longer intervention time been planned. Participants were often curious and asked for more explicit help decoding other patterns of spelling, like were detailed in the intervention (Participant 2 asked for direct instruction with CVVC pattern words, because CVVC probes were frustrating her). However, unfortunately only one short vowel and one long vowel were to be targeted during the time of this intervention. This is a limitation that could be still further explored.

It could be seen as a positive or a negative factor that intervention sessions were scheduled 3 times weekly for children that were still attending school. This was difficult for parents to attend regularly and to maintain for a period of weeks. Not only was it difficult to recruit participants for this study that appropriately fit the inclusion criteria, but once the participants began the study, it took dedication and flexibility on both the therapist’s and the parent’s part to ensure that the child was able to attend and connect with the therapist for successful intervention to take place. Thankfully, the parents were able to adapt schedules with regular communication about any potential changes or make-ups that needed to take place during the weeks. Significant gains were made and recorded after this period was complete. It could be seen that students were making gains in decoding after they were able to differentiate the long...
and short vowel sounds. The more practice that the participants got, the more positively the students responded to the intervention sessions.

It should be noted that a difference in baseline scores for a participant, such as Participant 1, could show a greater extent of growth from beginning to end of this intervention. Participant 1’s learning patterns were recorded to be growing but clinical significance in the CVC instruction pattern were not significant due to the high scores achieved at the end of baseline testing. It can be seen as a benefit that all participants were so similar in age and demographic. However, on another side of the argument, less variability in response was seen among these participants. Generally, there was a great deal of variation in long vowel/word pattern scores from day to day, which could have become more steady had learning been observed and intervention taught for a longer period of time.

Another unexpected limitation to this study was the selection of participants. The study was anticipated to have 3 to 4 participants, all of whom struggled with reading fluency after first grade, who were able to attend intervention sessions outside of school hours with the student therapist. This factor could have been a deterrent for many parents. However, the researcher could potentially find more holistic ways to implement this kind of intervention into a larger program for a greater number of interventionists under the primary researcher’s supervision. A more appropriate demographic for the wider variety of the general population, as seen throughout schools and communities, could be applied to a greater extent in an intervention on a larger scale than this particular study.

Going forward, it could be advantageous to determine which children are more likely to prefer a visual style of learning. Children that are particularly resistant to reading interventions and assistance with tutoring to improve grades and understanding – these were the students targeted for greatest benefit resulting from this intervention. The researcher could recruit students for this intervention with a different selection of subtests from the TILLS, depending on ability level of the participants. This may be a process that could start earlier in the participants’ academic career, potentially as early as first grade, with time to begin introduction of learning materials over the summer or at the beginning of the school year. However, recruitment of students that were struggling with reading at school and spreading word to parents about their resources proved to be a limitation of this study. The availability of teaching materials online is an invaluable resource, which was used to carry out sessions to students who lived in areas large distances from the university clinic, where they would have had to come for intervention had they planned to receive the same services in person. Participants were often seen outside of clinic hours and arrangements had to be made for parents to assist their children onto Zoom for the intervention at the appropriate time.

A method that we did not use or a suggestion for further expansion of hypotheses in future studies includes potential delayed post-testing to determine if gains made during the intervention were retained after intervention had concluded and how long those results could be maintained. It would be beneficial to determine if participants were able to improve scores on academic subjects, after an intervention such as this one was completed with those students. It could be determined if there was a time during which instruction could be waned to prolong positive effects of intervention. This could also help to determine with what frequency students would need to practice the lessons that they had learned in order to maximize retention and growth.
Conclusion

This intervention yielded results that showed substantial growth in various areas of decoding. Each participant grew in segmentation and a variety of other test scores, according to test scores on the PAT-2, and each was able to reach a higher overall PAT-2 score to reach a different percentile rank. Generally, the students in this study benefitted from reinforcement of short vowel patterns before direct instruction in a long vowel pattern. Participants all showed gains in the understanding and contrast of short and long vowel sound use in English words. There are some different factors at work in representation of poor readers, as particular scores were made to be a tentative determinant of eligibility on the PAT-2.

Suggestions for expansion of this intervention study for future research could include 1. earlier and greater extent of recruitment of participants for the study and/or 2. increasing length of intervention, as needed, for lower performing students (based off of standard scores). Other suggestions could include 3. begin the intervention during an earlier point in the school year or student’s grade level (even introduce and begin practice over the summer), 4. greater variety of input from each student’s teachers or information about the curriculum at school, and 5. delayed post-testing to determine retention of decoding patterns taught.

Additional intervention studies with Phonic Faces could see a longer intervention time period with the potential for more growth in students with diagnoses of dyslexia or other persistent reading difficulties, as evidenced through parent interview. There could be an additional teaching session for teaching of consonant digraphs to participants that do not recognize these blends yet when reading. There are individualized differences that could promote efficacy of intervention with these students. However, in a general sense, even having a way for the students to manipulate cards online could help to engage increasingly into the lesson itself. Carryover is something that could be promoted, additionally, through delayed post-testing beyond the end of the intervention period to determine if gains were retained.
Appendix. Institutional Review Board Approval

Janet A Norris
LSUAM | Col of HSS | Communication Sciences and Disorders | CC00127

Alex Cohen
Chairman, Institutional Review Board

DATE: 25-Sep-2022
RE: IRBAM-22-0852
TITLE: The Use of Phonic Faces to Improve Decoding in Children with Reading Delays

SUBMISSION TYPE: Initial Application
Review Type: Expedited Review
Risk Factor: Minimal
Review Date: 25-Sep-2022
Status: Approved
Approval Date: 25-Sep-2022
Approval Expiration Date: 24-Sep-2023
Expedited Categories: 07
Requesting Waiver of Informed Consent: No
Re-review frequency: Annually
Number of subjects approved: 6
LSU Proposal Number:

By: Alex Cohen, Chairman

Continuing approval is CONDITIONAL on:

1. Adherence to the approved protocol, familiarity with, and adherence to the ethical standards of the Belmont Report, and LSU's Assurance of Compliance with DHHS regulations for the protection of human subjects*
2. Prior approval of a change in protocol, including revision of the consent documents or an increase in the number of subjects over that approved.
3. Obtaining renewed approval (or submittal of a termination report), prior to the approval expiration date, upon request by the IRB office (irrespective of when the project actually begins); notification of project termination.
4. Retention of documentation of informed consent and study records for at least 3 years after the study ends.
5. Continuing attention to the physical and psychological well-being and informed consent of the individual participants, including notification of new information that might affect consent.
6. A prompt report to the IRB of any adverse event affecting a participant potentially arising from the study.
8. SPECIAL NOTE: When emailing more than one recipient, make sure you use Bcc. Approvals will automatically be closed by the IRB on the expiration date unless the PI requests a continuation.

* All investigators and support staff have access to copies of the Belmont Report, LSU’s Assurance with DHHS, DHHS (45 CFR 46) and FDA regulations governing use of human subjects, and other relevant documents in print in this office or on our World Wide Web site at http://www.lsu.edu/research

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Vita

Kayla Therese Martin, born in Metairie, Louisiana, worked as a City Year Corps member and Speech-Language Pathology Assistant (SLPA) in Metairie and New Orleans after receiving her Bachelor’s degree of Science in Communication Sciences and Disorders, with a minor in Spanish, from Southeastern University of Louisiana in May of 2018. Upon completion of her master’s degree, she will begin work as a Clinical Fellow in order to achieve all supervised practicum hours required in order to obtain her Certificate of Clinical Competence to practice as a fully licensed Speech-Language Pathologist. She hopes to work in some capacity with education and has a particular interest in language and reading acquisition, as well as how cultural and linguistic differences affect clinical practice.