USING VISUAL PHONICS AS A STRATEGIC INTERVENTION TO INCREASE LITERACY BEHAVIORS FOR KINDERGARTEN PARTICIPANTS AT-RISK FOR READING FAILURE

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The article presents a model of an effectively implemented visual phonics intervention program for kindergarten children at high risk for reading failure in a general education classroom. There is a growing body of professional literature documenting the effectiveness of visual phonics for children who are hard-of-hearing or deaf. There is little information on the benefits of visual phonics for hearing participants at high risk for reading failure. The preliminary findings of this study suggest that See the Sound/Visual Phonics (STS/VP) intervention in the classroom is appropriate for children who are falling behind using the regular curriculum. Post-intervention gains were noted on both the *Dynamic Indicators of Basic Early Literacy Skills* (DIBELS) and the curriculum based assessment for participants who participated in the STS/VP intervention. The data also suggest that participants performed similarly to their grade level peers who were at benchmark based on DIBELS and who did not receive the STS/VP intervention. Results are discussed in terms of future research opportunities.

Key words: See the Sound/Visual Phonics, at-risk/struggling readers, phonemic awareness, initial phonics, Visual Phonics

A primary task of schools is to teach young children to read. Teaching reading is a complex task, further complicated by the fact that this intricate skill is more difficult for some participants to learn than others (Bursuck & Damar, 2007; Moats, 2000). In addition, children enter schools with varying levels of pre-reading skills, thus requiring different levels of instruction. The challenge for teachers of reading is to meet the diverse instructional needs of all children in their classrooms.

Once children fall behind in reading, a challenging instructional task becomes even more difficult. Children who are behind in reading at the end of the first grade usually continue to be behind at the fourth grade and throughout their schooling (Francis, Shaywitz, Stuebing, Fletcher, & Shaywitz, 1996; Hall & Moats, 1999; Juel, 1988; McGuinness, 2004, 2005; Stanovich & Siegel, 1994). Consequences for participants who do not learn to read proficiently are often dire. Children who are poor readers are at increased risk for having behavior problems (Walker, Colvin, & Ramsey, 1995; Walker & Severson, 2002), special education placement (Snow, Burns, & Griffin, 1998), and low paying jobs as adults (Chhabra & McCardle, 2004).

On the other hand, proficient reading remains the most essential skill required for academic success (Chhabra & McCardle, 2004). The ability to identify those children who need extra assistance can allow teachers

to target their instruction to benefit all children. The last decade has seen an intensive effort to identify participants that are at risk or high risk for reading failure and to intervene before they experience failure (Kame'enui et al., 2006). For example, the *Dynamic Indicators of Basic Early Literacy Skills* (DIBELS) (Good, Kaminski, Smith, & Laimon, 2001) has proven to be an effective assessment and predictive tool for early reading success/failure.

The DIBELS is an assessment tool that allows teachers to determine if a participant is demonstrating the appropriate level of pre-reading and reading skills for his or her grade level and age. In other words, it answers the question of whether the participant is on target (at benchmark) in prerequisite skills to be a proficient reader at the end of third grade. If the participant is on target then the current instruction should be continued. However, if the participant is not on target that participant should receive additional explicit instruction with the intensity of the intervention based on the degree to which the participant is below benchmark standards. Unfortunately, many teachers do not know what to do with the results of the DIBELS assessment, particularly how to modify instruction or provide more intensive instruction in problem areas.

Curriculum-based measures (CBM) are an assessment tool that can be used to supplement DIBELS. CBMs are generally probes of particular performances on skills related to the on-going classroom instruction. We discuss one effective modification for teaching kindergarten children letter/sound relationships using the DIBELS and CBMs as the dependent variables.

Important indicators of future reading difficulties in young children are deficits in phonemic awareness skills (Ehri, 2004; McGuinness, 2004, 2005). That is, young children who are at risk for reading failure have difficulty discriminating between the sounds in English words and consequently they have difficulty associating the sounds with the appropriate letters. Letter sound relations require a child to perceive individual sounds and associate the sounds with letters. This two-fold task encompasses both phonemic awareness and beginning phonics instruction, crucial prerequisites for mastering the alphabetic code.

Bowey and Francis (1991) found that kindergarten participants who were nonreaders did not have adequate phonological awareness skills. Similarly, Catts, Fey, Tomblin, and Zhang (2002), in a longitudinal study involving 604 young children, found that over 70% of poor readers had a history of phonological awareness or oral language deficits in kindergarten. These phonological deficits persisted throughout high school, preventing participants from becoming proficient readers (MacDonald & Cornwall, 1995).

The National Reading Panel (NRP) (National Institute of Child Health and Human Development, 2000), in examining the empirical literature on teaching reading, indicated that a balanced and effective reading program should include instruction or practice in five areas: phonemic awareness, phonics, fluency, vocabulary, and text comprehension. Specifically, the NRP found that direct and systematic instruction of phonemic skills are important for building reading skills. Explicit instruction in phonemic awareness is essential for preventing reading failure for young participants otherwise at-risk for poor reading achievement (Pullen & Justice, 2003). In recent years there has been an increase in empirically based commercial materials designed to teach phonological skills such as *Phonemic Awareness in Young Children* (Adams, Foorman, Lunberg, & Beeler, 1998), *Phonological Coding: Phonemic Awareness* (Haughton, 1999), *Ladders to Literacy* (O'Connor, Notari-Syverson, & Vadasy, 1998), and *Phonological Awareness Training for Reading* (Torgesen & Bryant, 1994). These

programs have proven to be effective in boosting many children's pre-reading skills; yet teachers may still be confounded with instructional-resistors or those children who, despite the use of empirically validated instructional tools and the best efforts of the teacher, are not making adequate progress. These participants are often placed at the tertiary level of intervention (needing an individualized, intensive level of intervention to reach the same level of performance as their same-age peers).

This raises the need for two additional considerations in teaching pre-reading skills. The first is the need for frequent assessments to determine the effectiveness of instruction for each child (Fletcher, Lyon, Fuchs, & Barnes, 2007). Second is the need to identify additional instructional strategies that might be useful for children who are at-risk for reading failure. There is a particular need for instructional strategies that are structured for the teacher and learners yet are flexible enough to meet the individualized needs of learners, when implemented in small groups or one-on-one

See the Sound/Visual Phonics (STS/VP) is a unique intervention tool that provides a hand sign for every phoneme in the English language. The hand signs mimic some aspect of the mouth, tongue and throat movements one makes when producing the sound and, in some cases, provides visual or kinesthetic links to letter shapes. Written symbols (simple line drawings of the hand signs) can be placed under complex vowels, digraphs, and irregular spellings to clarify sounds in printed context for struggling readers (a similar, though not as complete, orthographic modification to text was also employed by Engelmann and Brunner (1995) in the *Reading Mastery I* curriculum). This approach puts the intervention at the level of sounds, not letters, making sound concrete and tangible, providing a unique and stable foundation for phonemic awareness (See discussion in Morrison, Trezek, & Paul, 2008; Wang, Trezek, Luckner, & Paul, in press). Its unique and precise characteristics have yielded success in deaf education (Narr, 2008; Trezek & Malmgren, 2005; Trezek & Wang, 2006; Trezek, Wang, Woods, Gampp, & Paul, 2007).

Trezek and Malmgren (2005) used STS/VP with *Corrective Reading-Decoding A* curriculum (Campbell, 1988; Gregory, Hackney, & Gregory, 1982) to teach letter-sound identification in isolation, letter-sound identification within words, and word decoding to middle school participants with hearing impairments. The results of a pre-post-test design indicated that combining STS/VP with the *Corrective Reading-Decoding A* curriculum was effective in producing significant gains ($z = 2.941$, or almost 3 stanines) on the three dependent variables, regardless of degree of hearing loss among participants.

Trezek and Wang (2006) conducted a 1-year evaluation of the effects of STS/VP and *Reading Mastery I* curriculum (Engelmann & Brunner, 1995) with kindergarten and 1st grade participants who were deaf and/or hard-of-hearing. Standardized assessments were used to evaluate the effects of instruction. The results indicated that all participants demonstrated gains in word reading, pseudoword reading, and reading comprehension. Narr (2008) also found support for the use of STS/VP with kindergarten through 3rd grade participants with hearing impairments. Specifically, the participants demonstrated improvement on rhyming judgments and decoding.

Trezek et al. (2007) examined the effects of adding STS/VP to the *LACES* reading curriculum (a reading curriculum developed by a school district for its students) on standardized measures of beginning reading skills for kindergarten and first grade participants who were deaf and/or hard-of-hearing. The results suggested that after 1 year of STS/VP and *LACES* reading

instruction, participants demonstrated statistically significant increases on standardized measures.

Researchers are only beginning to assess the effectiveness of STS/VP with hearing children who are at risk for reading failure. An unpublished action study (Slausen & Carrier, 1992) showed that STS/VP helped kindergarten children with low language skills. Based on the Slausen and Carrier study, anecdotal evidence from schools that had used STS/VP with the *Open Court* reading curriculum (Interview, Cushing, 2003), and the positive results with participants who are deaf or hard-of-hearing (probably one of the most difficult populations to teach phonemic awareness to), we decided to try STS/VP as an intervention tool for low-performing kindergarten children. Given the weak effects of other tested interventions (see Al Otaiba & Fuchs, 2002 for a review) and the history of success with STS/VP in deaf education, we attempted to investigate the effectiveness of STS/VP as an intervention for hearing children with low phonemic awareness skills. The purpose of this investigation was to extend the STS/VP approach to teach phonemic awareness and initial phonics to kindergarten children identified as at-risk for reading failure.

The specific research questions we addressed were a) Do kindergarten children identified as at-risk for reading failure show gains on DIBELS assessments after receiving instruction in phonemic awareness and initial phonics via STS/VP? b) If so, how do those gains rival those of their grade–level, non-risk peers? c) What are the effects of STS/VP instruction on the identification of letter-sound relations? d) Do participants learn letter-sound relations taught with the STS/VP written code in fewer teaching trials than letter-sound relations taught without the STS/VP written code? e) Do participants identify letter-sound relations taught with STS/VP correctly more frequently than those letter-sound relations taught with typical classroom instruction?

METHOD

Participants & Setting

The classroom teacher recommended participants who needed intervention. Twelve participants who returned permission letters allowing them to participate in the study were tested using the DIBELS (*Dynamic Indicators of Basic Early Literacy Skills*, 6th Edition), the K-2 test of benchmark skills. The specific skills assessed were: Initial Sound Fluency (ISF), Letter Naming Fluency (LNF), Phoneme Segmentation Fluency (PSF), Nonsense Word Fluency (NWF), and Word Use Fluency (WUF).

We selected the lowest five performing participants (as compared to their grade level peers who were at benchmark based on DIBELS data) for the STS/VP intervention. The group targeted for intervention, then, was comprised of three girls and two boys who ranged in age from 5 to 6 years old. Al was repeating kindergarten and was the oldest student in the intervention group; he was also deaf in one ear. Sue, Fawn, Al and Ike were receiving free or reduced lunches.

The intervention took place late in the Kindergarten year (March 22) and ended May 11 (two weeks earlier than expected because of school construction) and started with the most common sounds inaccurately identified. Letter-sound relations were selected when the majority of participants were unable to express the letter-sound relation on the NWF subtest of the DIBELS. It is important to note that these were letter-sound relations previously taught via large-group instruction using the *Horizons* reading curriculum and/or via small group guided reading instruction. This instruction continued for the duration of the study for the non-STS/VP participants. Regular classroom instruction consisted of the introduction of two letter-sound relations.

Letter-sound relations were introduced with a song, flash cards, and a word that started with the target sound. Students were asked, in a large group format, to make the letter sound after it had been modeled. Additional activities included blending and sounding out words and writing the corresponding letter. These activities were completed individually or in small-group settings. Instruction typically lasted about 2 hours per day for each letter-sound relation.

For the intervention, the first author and/or the classroom teacher conducted teaching sessions at least 3 times per week for approximately 10-12 minutes each in a small group of two to four students. Total intervention time varied across participants from 3.5 hours to 5.5 hours, depending on the participant's performance.

PROCEDURES

Baseline

The K-2 test of benchmark skills served as one baseline measure for all participants (both those selected for the STS/VP intervention and those who received regular classroom instruction). Participants selected for the STS/VP intervention also participated in a curriculum-based baseline measure for each target letter-sound relation. Five probes for the current target letter-sound relation for each participant were conducted in each session. Probes consisted of the experimenter presenting a sentence containing at least five opportunities to respond to the target letter-sound relation to each participant. Participants were instructed to point to and say the sound for any letters or words they knew. Baseline probes were conducted until data indicated a steady or decreasing trend. If baseline data indicated mastery of the letter-sound relation (the participant emitted the letter-sound relation correctly for 80%-100% of probes) this letter-sound relation was not taught to that participant. This sequence was repeated for each target letter-sound combination for all participants.

STS/VP Intervention

A generic lesson plan was developed for delivering instruction. A dialogue using the /ow/ sound is presented in Figure 1.

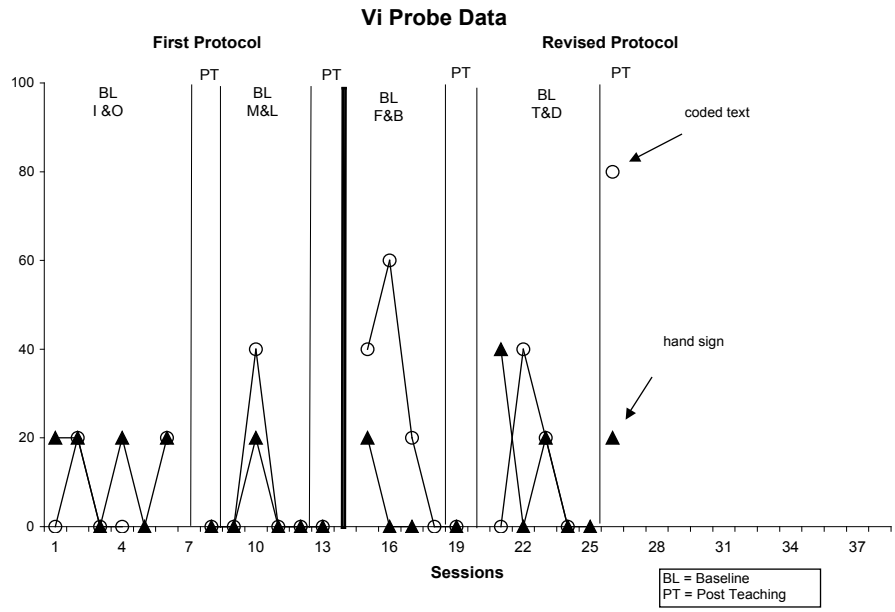

Figure 1. Vi probe data for hand sign (/i/, /m/, /f/, /t/) and coded sounds (/o/, /l/, /b/, /d/).

Table 1
Behaviors to Teach the STS/VP Hand Sign

Step	Teacher Behavior	Participant Behavior
1	"Watch my mouth while I say /ow/" and says /ow/ in an exaggerated fashion Teacher repeats the step twice	Watch and listen
2	Teacher says, "Now you try it with me" Teacher says the /ow/ sound Repeats twice	Participant says the /ow/ sound Repeats twice
3	Teacher says, "I'm going to show you a hand sign that looks and feels like /ow/" The teacher demonstrates the hand sign while saying /ow/. Teacher repeats the step twice.	Watch and listen
4	Teachers says, "Now you try it with me" Teacher says the /ow/ sound while making the hand sign Repeats twice	Participant says the /ow/ sound while making the hand sign Repeats twice
5	Teacher says, "show me the /ow/ sound and the hand sign four times."	Participant says the /ow/ sound and makes the corresponding hand sign. Participant repeats three times
6	Teacher presents the participant with five words that contain the target sound	Participant reads the words, making the corresponding hand sign each time she comes to the target sound
7	Teacher gives the participant a sentence with 5 words containing the target sound embedded	Participant reads the passage, making the corresponding hand sign each time she comes to the target sound

Table 2
Behaviors to Teach the STS/VP Hand Sign and Written Symbol

Step	Teacher Behavior	Participant Behavior
1	"Watch my mouth while I say /ow/" and says /ow/ in an exaggerated fashion Teacher repeats the step twice	Watch and listen
2	Teacher says, "Now you try it with me" Teacher says the /ow/ sound Repeats twice	 Participant says the /ow/ sound Repeats twice
3	Teacher says, "I'm going to show you a hand sign that looks and feels like /ow/" The teacher demonstrates the hand sign while saying /ow/. Teacher repeats the step twice.	Watch and listen
4	Teachers says, "Now you try it with me" Teacher says the /ow/ sound while making the hand sign making the hand sign Repeats twice	 Participant says the /ow/ sound while Repeats twice
5	Teacher says, "show me the /ow/ sound and the hand sign four times."	Participant says the /ow/ sound and Makes the corresponding hand sign. Participant repeats three times
6	Teacher says, "To remember what letters make the sound /ow/, I can draw a picture of the hand sign and write it under the letters to help practice the words. This is what the secret code for /ow/ looks like". The teacher draws the code no more than ten variant spellings and says, "the /ow/ sound starts with the mouth wide open and closes to a tight O or pucker; the hand signal (shows all fingers extended) starts wide and ends like the mouth closing (moves the fingers to touch the thumb and closes the hand); the code looks like what the hand does and reminds me what sound to make	Watch and listen
8	Teacher presents the participant with five words that contain the target sound with the written symbol below the corresponding letters	Participant reads the coded words, making the corresponding hand sign each time she comes to the target sound
9	Teacher gives the participant a sentence with 5 words containing the target sound embedded	Participant reads the sentence, making the corresponding hand sign each time she comes to the target sound

Detailed lists of teacher behaviors to teach letter sounds using only the hand sign or to teach letter sounds using both the hand sign and the written code are depicted in Tables 1 and 2, respectively. The primary difference between hand sign only and coded text sessions was the introduction of and inclusion of a written code below the letter(s) that were representative of a particular phoneme. For example, in the hand sign only teaching sessions, participants were shown the hand sign for a particular phoneme and read text without additional written cues. In the coded text sessions, participants were shown the hand sign *and* a written code representative of the hand sign. This code was included under the target letter(s) during teaching sessions, but not during baseline and intervention probes.

Strategies for effective group instruction (see Heward, 1994) were used during STS/VP instructional sessions. For example, teachers incorporated a quick pace of instruction, with several opportunities for each participant to respond interspersed across participants. In addition, simple instruction-following activities (e.g., high fives; brief movement exercises such as directions to stand up, sit down, wiggle, etc.) were used to build momentum in participant responding and to keep participants on-task.

Revised STS/VP Intervention

Initially, mastery criteria required participants to perform the target behavior at 80% accuracy for only one instructional session. In addition, participants were not required to identify which letter within a word corresponded to the sound and hand sign they produced. Participant data suggested low levels of retention on dependent measures and problems with discrimination when two target letter-sound relations were presented in the same word. We added a discrimination task that required participants to point to the letter(s) (in a field of three or more) that made the target sound and to identify the letter(s) within a word that corresponded to the sound and hand sign they produced (see Table 3 for the steps added to the revised protocol). In addition, the mastery criterion was revised so that participants were required to meet 80% correct sound identification across two teaching sessions for the last seven to seventeen sessions of intervention (varied based on participant performance).

Table 3
Behaviors for the Revised Teaching Protocol

Step	Teacher Behavior	Participant Behavior
5a	Presents the learner with a field of at least three letters and asks the learner to "point to the letters that make the sound /ow/ "while making the corresponding hand sign	Points to the corresponding letter
6/7 8/9	After the participant reads the sound and makes the corresponding hand sign, also asks the participant to point to the corresponding letter.	Points to the corresponding letters

Post-Tests

After all target letter-sound relations had been taught for each participant, two post-tests were administered. The *DIBELS K-3* benchmark was administered for all participants except Inga who was absent on the day of testing. Participants who received the STS/VP intervention were also given a CBM that required the participants to identify the sounds they knew within the context of sentences. Each child identified sounds in three sentences containing mostly sounds they had been taught with STS/VP, and three sentences containing mostly sounds they had been taught in the classroom but not taught with STS/VP.

Data Collection and Analysis

Experimenters (including the classroom teacher) recorded participant responding during baseline and teaching sessions and graphed the data after each teaching session. Data were collected for correct and incorrect responses for the following behaviors: (a) imitating the target speech sound chorally, (b) emitting the target speech sound individually, (c) imitating the target speech sound and making the corresponding hand sign chorally, (d) imitating the target speech sound and making the corresponding hand sign individually, (e) receptively identifying the letter that made the corresponding speech sign (added in protocol revision to aid in discrimination), (f) emitting the speech sound and/or the corresponding hand sign for the target sound (as identified by the participant) embedded in a single word, and (g) emitting the speech sound and/or the corresponding hand sign for the target sound (as identified by the participant) embedded in single words within a sentence. Criteria for mastery were set at 80-100% of sounds identified and then emitted correctly with the corresponding visual phonics hand sign when presented with the letter.

On the CBM, data were collected on correct and incorrect identification of letter-sound relations for sounds taught with STS/VP and sounds taught without STS/VP. Data were calculated by dividing the total number of letter-sound relations taught or untaught by the number of correct letter-sound relations taught or untaught and multiplying by 100. These data were analyzed to determine if participants were able to identify more letter-sound relations that were taught using STS/VP than were taught during regular classroom instruction (described above).

Interobserver Agreement

Interobserver agreement (IOA) data were collected by the experimenters and the classroom teacher for 35% of baseline sessions, 30% of hand sign sessions, and 27% of coded text teaching sessions. The mean IOA for baseline sessions was calculated by dividing the total number of agreements by the total number of opportunities and multiplying by 100. The mean IOA for baseline sessions was 97.8% (range, 60% to 100%). The mean IOA for hand sign and coded text teaching sessions was 98% (range, 0% to 100%) and 97% (range, 20% to 100%), respectively. While overall IOA was high, initial baseline and intervention sessions produced low agreement. Following the first baseline and experimental sessions, experimenters and the classroom teacher recalibrated scoring procedures to ensure future agreement. Specifically, data recorders clarified definitions of the target responses to include the correct emission of the phoneme and production of the hand-sign in treatment conditions, but not in baseline conditions, as participants would not be able to emit a correct response without prior instruction on the STS/VP hand sign in baseline.

Treatment Integrity

The third author conducted STS/VP training with the first and second authors and the classroom teacher. STS/VP training sessions consisted of modeling, rehearsal, and feedback for each phoneme, hand sign, and written code. The initial training lasted approximately 6 hours. Review sessions (brief reminders of hand signs or written codes for each phoneme) were conducted prior to each teaching session and lasted for no longer than 5 minutes each.

During the study, data were collected on the experimenters' ability to arrange the instructional sessions and implement the correct teaching procedures for each condition. Another experimenter or the classroom teacher collected data for 47% of baseline sessions, 28% of hand sign only sessions, and 20% of coded text teaching sessions. Treatment integrity was calculated by dividing the number of steps conducted correctly by the total number of steps and multiplying by 100. The mean treatment integrity for baseline sessions was 90.9% (range, 75% to 100%). The mean treatment integrity for hand sign and coded text teaching sessions was 98.6% (range, 93% to 100%) and 98.9% (range, 94% to 100%), respectively.

Experimental Design

A non-concurrent multiple baseline across participants and sounds with an embedded multielement design was used to assess the effects of the STS/VP intervention. Additional support for the findings was obtained from the pre- and post- *DIBELS* and the curriculum-based measures for letter-sound relations that were taught with STS/VP and those taught through the regular classroom curriculum.

RESULTS

Figures 2-6 show the results obtained for each participant in hand sign and coded text baseline and probe sessions. Data are presented in dyads (closed triangles representing the sound taught with the hand sign only and open circles representing the sound taught with the written code), or pairs of letter sound relations taught in each condition, respectively (e.g., on Vi's graph /i/ was taught via hand sign only and /o/ was taught via the written code).

Baseline and probe data showed little difference between coded text and hand sign conditions. For some participants, there seemed to be an advantage to either the coded text or hand sign only conditions, but differences were not notable enough to draw strong conclusions. Post-teaching probes showed minimal post-teaching gains after instruction using the first teaching protocol. After the revised teaching protocol was implemented (indicated by the bold phase change line), each participant showed post-teaching gains on at least one sound taught.

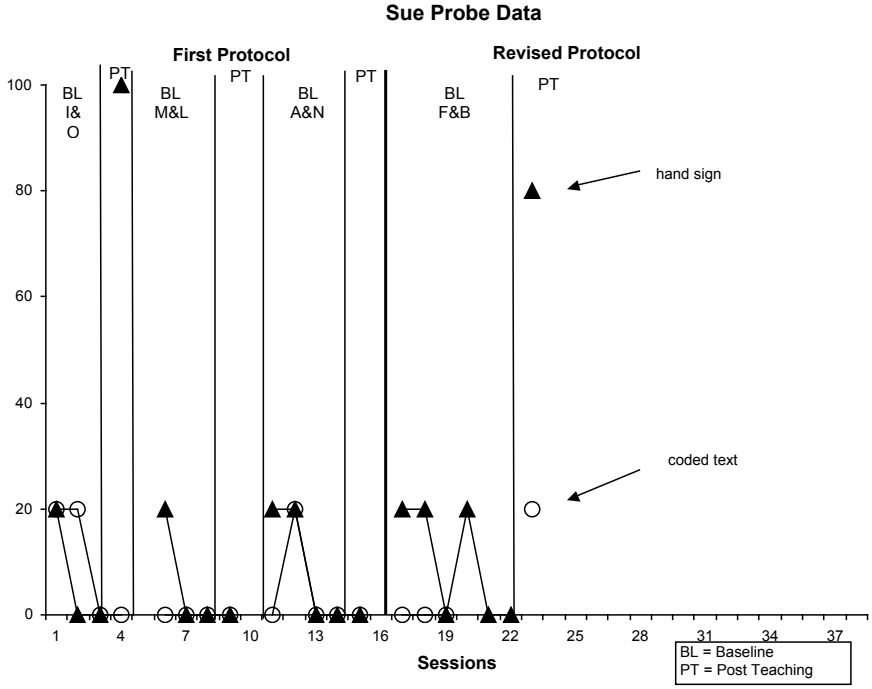

Figure 2. Sue probe data for hand sign (/i/, /m/, /a/, /f/) and coded sounds (/o/, /l/, /n/, /b/).

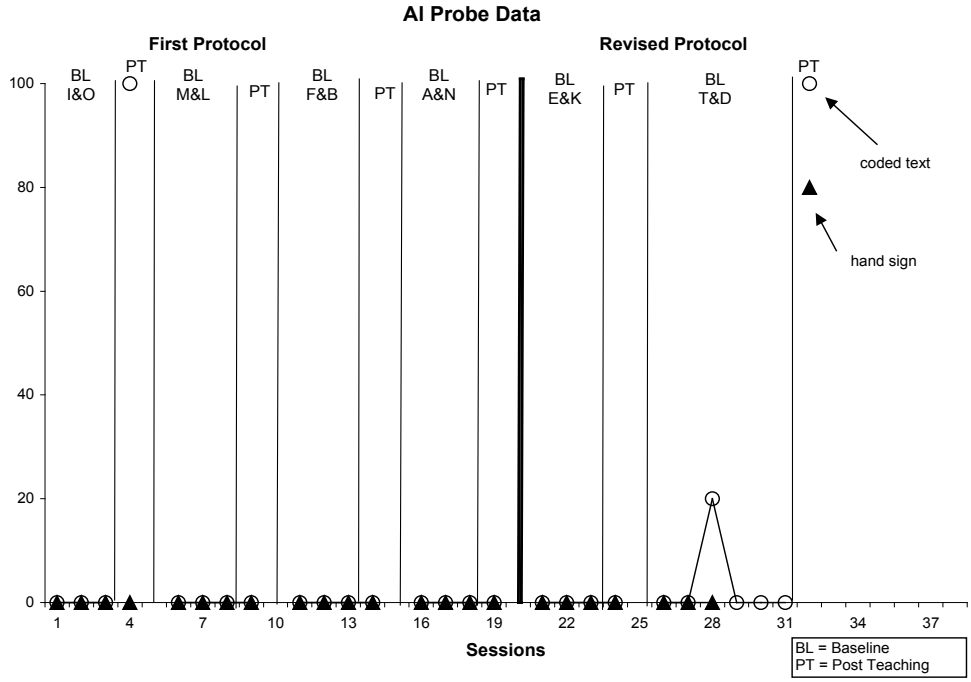

Figure 3. Al probe data for hand sign (/i/, /m/, /f/, /a/, /e/, /t/) and coded sounds (/o/, /l/, /b/, /n/, /k/, /d/).

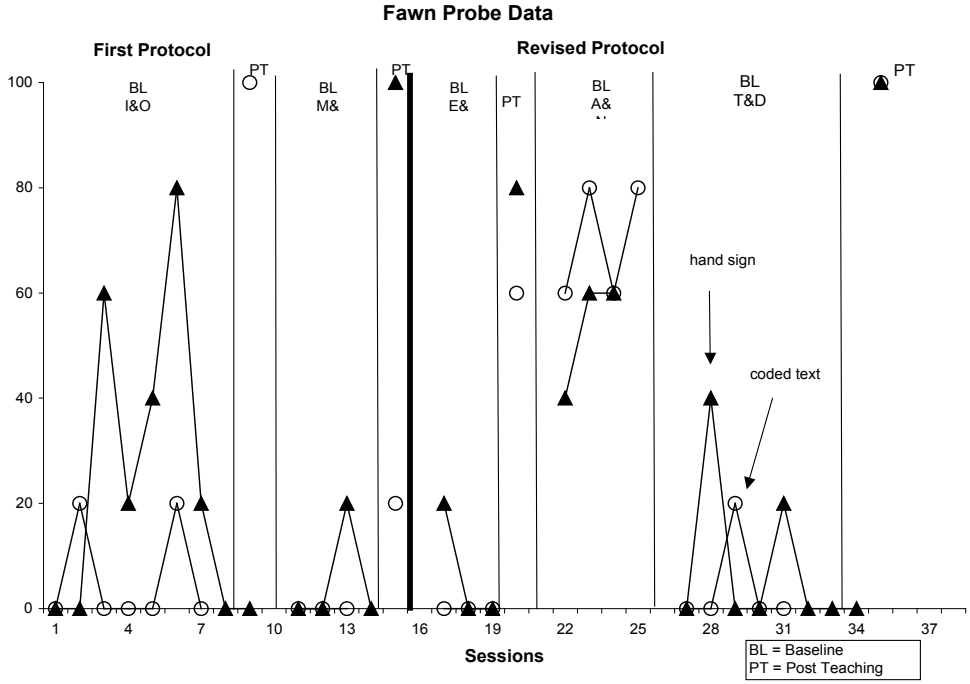

Figure 4. Fawn probe data for hand sign (/i/, /m/, /e/, /t/) and coded sounds (/o/, /l/, /k/, /d/).

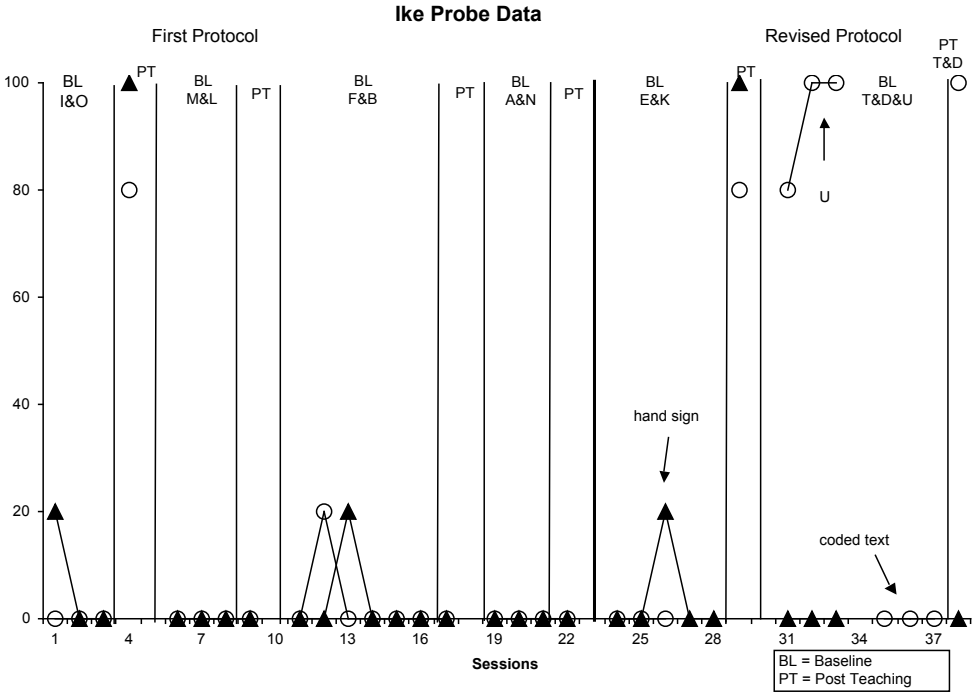

Figure 5. Ike probe data for hand sign (/i/, /m/, /f/, /a/, /e/, /t/) and coded sounds (/o/, /l/, /b/, /n/, /k/, /d/).

Pre- and post-scores from the DIBELS K-2 and K-3 benchmark assessments for participants who received the STS/VP intervention and for those who did not receive the STS/VP intervention are summarized in Table 4. The data suggest post-intervention gains for each participant in almost all DIBELS assessment areas, with the exception of Al in nonsense word fluency and Ike in word use fluency. The most notable gains were produced in word use fluency, followed by notable gains in phoneme segmentation fluency. It is interesting to note post-intervention scores for the participants who did not receive additional instruction using STS/VP. One non-STS/VP-participant scored markedly lower in both phoneme segmentation fluency and nonsense word fluency than participants who received the intervention. However, comparisons of pre- and post-DIBELS scores for those participants who received STS/VP and those who did not receive STS/VP yield mixed conclusions. In some instances, gains for those who did not receive STS/VP were much smaller than those obtained by participants who received STS/VP, but the reverse can also be said. In general, the trend for the lowest performing participants was clearly positive, rivaling the gains of the other seven, non-STS/VP participants in the class; participants who received STS/VP did not fall even further behind their non-STS/VP classmates.

Table 4
Pre- Post-test: DIBELS K-2 & K-3: Correct Responses in One Minute

Participant	ISF		LNF		PSF		NWF		WUF	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Vi*	12	N/A	7	16	6	36	2	6	0	22
Sue*	8	N/A	29	71	15	52	7	28	27	82
Al*	7	N/A	24	67	26	53	1	2	12	62
Fawn*	6	N/A	6	19	0	4	0	7	0	20
Ike*	12	N/A	22	56	3	18	0	12	0	0
Reed	9	N/A	36	65	4	43	26	53	0	23
Inga	23	N/A	32	N/A	46	N/A	23	N/A	23	N/A
Ward	18	N/A	57	113	8	19	56	115	4	45
Lou	29	N/A	44	94	20	24	34	52	20	60
Xing	18	N/A	30	62	28	61	29	63	26	57
Phoenix	17	N/A	51	96	29	72	24	62	23	57
Isabel	15	N/A	23	47	6	13	14	29	8	23

*Indicates participants who received the STS/VP intervention.
Note: ISF= initial sound fluency, LBF = letter name fluency, PSF = phoneme segmentation fluency, NWF = nonsense word fluency, WUF = word use fluency

Table 5
The Results of Curriculum Based Measures for Target Participants.

Participant	Number of opportunities to respond to letter/ sounds taught with STS/VP	Sounds correctly identified	Number of opportunities to respond to sounds not taught with STS/VP	Sounds correctly identified
Vi	55	50 (91%)	37	6 (16%)
Sue	55	50 (91%)	37	9 (24%)
Al	55	42 (76%)	37	4 (11%)
Fawn	55	37 (67%)	37	8 (22%)
Ike	55	29 (53%)	37	3 (8%)

On CBMs (see Table 5), participants who received instruction in STS/VP responded correctly on more opportunities to identify letter/sounds taught with STS/VP than those that were taught via regular classroom instruction. For example, Vi correctly responded on 50/55 (91%) opportunities to identify sounds only taught with STS/VP and correctly responded on 6/37 (16%) opportunities to respond to sounds only taught during regular classroom instruction. Similar performance on CBMs is noted across participants (STS/VP sounds, range, 53% to 91%; non-STS/VP sounds, range, 8% to 24%).

DISCUSSION

Early intervention is critical for participants who are at risk for reading failure. Without early intervention, these participants will probably continue to perform below their same age peers (Francis et al., 1996; Hall & Moats, 1999; Juel, 1988; Stanovich & Siegel, 1994). They are more likely to develop behavior problems (Walker et al., 1995; Walker & Severson, 2002) and require more restrictive educational placements (Snow et al., 1998). These outcomes perpetuate a cycle of reading failure. Adults with poor reading skills are more likely to have low-paying jobs or be unemployed than adults with proficient reading skills (Chhabra & McCardle, 2004) trapping many of them in poverty.

There is a high correlation between socioeconomic status (SES) and performance in school (Chhabra & McCardle, 2004) suggesting that children of adults who had poor reading skills are likely to have reading difficulties as well. Thirty percent of fourth-graders in America score below a basic level on national reading assessments. This percentage is even greater in low-income districts (Lee, Grigg & Donahue, 2007). If early intervention is not provided, we are setting the stage for an on-going cycle of reading failure that affects future generations of learners.

The preliminary findings of this study suggest that STS/VP intervention in the classroom may be appropriate for children who are falling behind with the regular curriculum. Post-intervention gains were noted on both the DIBELS and the CBM for

participants who participated in the STS/VP intervention. The data also suggest that STS/VP participants continued to improve on DIBELS assessments rather than falling further behind. Once the revised teaching protocol was implemented, gains were also noted on at least one letter-sound relation for each participant on pre- post-test measures of letter-sound identification for target letter-sound relations. It is likely that STS/VP offers a cost effective intervention strategy that could assist teachers of reading to interrupt the cycle of reading failure.

Still, there are several methodological limitations to the current study. First, we intended to evaluate the differential effects of STS/VP intervention with and without the written symbol using a multielement design. These data did not suggest a difference within or across participant performance of the target skills, or in the rate of acquisition across the two variations of the independent variable. Before intervention, target participants did not correlate phonemes to printed text.

There are also concerns related to interpretations of experimental control with the revised protocol and experimental design and implementation. The teaching protocol revision, the choice to intervene prior to steady-state responding, and the use of a non-concurrent multiple baseline design were decisions made from a clinical standpoint in an attempt to provide necessary intervention to participants in a timely manner. A non-concurrent multiple baseline design limits the strength of the conclusions that can be drawn if a concurrent multiple baseline design were used instead (c.f., Carr, 2005; Johnston & Pennypacker, 1993). The intervention was revised partially through the experiment and it is unclear if the revised teaching protocol would have produced the same gains had the first teaching protocol not been conducted first. It is possible that the gains noted in DIBELS scores and CBMs were due to chance or some other extraneous variable such as increased instructional time regardless of the STS/VP intervention. The teaching protocol was also implemented for a few participants on a handful of letter-sound relations when baseline trends were decreasing rather than stable. This suggests the influence of an additional variable that may have continued to be in effect even after the start of intervention.

Nevertheless, data collected in baseline and post-teaching sessions using the revised teaching protocol suggest preliminary evidence for the use of STS/VP to teach specific letter-sound relations with and without the written code. Some participants did make gains from pre- to post-assessment on one or more of the dependent measures. Still, these results were obtained with a small group of participants and statistical analyses were not conducted. Furthermore, only one post-teaching probe was conducted and probes were conducted for letter-sound relations within words rather than in isolation. It is possible that gains noted would dissipate over time or that testing skills in isolation (individual letter or letter combinations) would have produced different results.

STS/VP has some advantages as an intervention strategy. First, STS/VP has one distinct hand movement for each phoneme, thus eliminating any ambiguity. The hand gestures are tied to articulation and residually to letters, allowing struggling readers to make sound tangible and concrete, slow down the speech stream (see discussion in Morrison et al., 2008), and make the vital letter/sound connections that have eluded them. Second, it is easy to learn (6 hours) and inexpensive. An initial investment of $50 to $100 (usually including training fees) will serve a classroom teacher for many years. Materials are not consumable, and no additional manuals or materials are required. Third, it keeps children active and focused on the concept being taught.

The importance of hand movements in learning is an emerging field with promising findings (Cook & Goldin-Meadow, 2006) and STS/VP offers refined hand movements representing each sound. Later, its hand signs and symbols could be used effectively to help children overcome the vagaries of English phonics where letters represent more than one sound. While not assessed in the current investigation, different hand signs correspond to long and short vowel sounds or sounds representative of different letter combinations. STS/VP can be implemented with relatively few, low-cost materials that can be used with any curriculum. For instance, this study was conducted in a literacy collaborative classroom while previous research was conducted in Direct Instruction classrooms, yet both environments produced positive results.

However, we are not suggesting that STS/VP replace existing strategies for effective reading instruction, or that STS/VP be strongly advocated without further investigation. This study provides a preliminary investigation of the effects of STS/VP as an intervention for hearing children at risk for reading failure. Too often instructional strategies and curricula are adopted without sufficient research to support their use. STS/VP has empirical support for its success as a strategy to teach individuals who are deaf to read phonetically (Narr, 2008; Trezek & Malmgren, 2005; Trezek & Wang, 2006; Trezek et al., 2007) and others have presented the rationale for extending its use to individuals who are at risk for reading failure (see Morrison et al., 2008; Wang et al., in press, for reviews).

We believe this study is useful to researchers and clinicians for two reasons. First, the study highlights the challenges associated with assessing the effects of STS/VP on reading behaviors from a single subject research method perspective. Namely, given that STS/VP is meant to serve as a supplement to an existing curriculum, it is difficult to assess the effects of VP without linking it to a specific reading curriculum. Future research can be constructed to address the methodological limitations of the current study from a research-based perspective (e.g., using a multiple baseline across behaviors or participants design). Second, this study provides preliminary support for the inclusion of an STS/VP intervention for participants at risk for reading failure. The generic lesson plan offers a framework for incorporating such a strategy into any existing reading curriculum or teaching strategy.

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