The purpose of the current study is to expand upon the effectiveness of using Visual Phonics in conjunction with Direct Instruction reading programs (B. J. Trezek & K. W. Malmgren, 2005; B. J. Trezek & Y. Wang, 2006) and to explore the results of utilizing Visual Phonics to supplement another phonics-based reading curriculum for students who are deaf or hard of hearing. Twenty students with various degrees of hearing loss in kindergarten and first grade as well as 4 teachers participated in the study. Results of the investigation reveal that, given 1 year of instruction from a phonics-based reading curriculum supplemented by Visual Phonics, kindergarten and first-grade students who are deaf or hard of hearing can demonstrate statistically significant improvements in beginning reading skills as measured by standardized assessments.

The Reading First initiative of the No Child Left Behind (NCLB) Act calls for states and local school districts to implement comprehensive, scientifically based reading programs and practices for children beginning in kindergarten (No Child Left Behind [NCLB], 2004). The definition of “research-based” relies heavily on the findings of the National Reading Panel (2000), which indicate that effective reading instruction should include five components: (a) phonemic awareness, (b) phonics, (c) fluency, (d) vocabulary, and (e) comprehension. In response to this Federal directive, many states and school districts are in the process of evaluating and/or creating reading curricula not only to meet these mandates but also to improve educational outcomes for students.

According to the most recent data available from the National Center for Educational Statistics (2005), approximately 87% of students identified as hearing impaired spend a large portion of their school day in the general education environment. Given this current placement arrangement, coupled with the move toward instructional strategies that include phonemic awareness and phonics skills, identifying successful means of accessing this type instruction for students who are deaf or hard of hearing is critical.

In their recent publication, Teaching Reading to Children Who Are Deaf: Do the Conclusions of the National Reading Panel Apply?, Schirmer and McGough (2005) indicated that despite the evidence that skilled deaf readers are able to access phonological information, there is little evidence to support “whether deaf readers can be taught to use phonological information effectively in word recognition” (p. 109). These authors also indicated that educators need to investigate alternative methods of teaching phonemic awareness and phonics skills to children who have limited or no access to the phonemes (sounds) of English.

Since the publication of the Schirmer and McGough (2005) review, two intervention studies have been published summarizing the effectiveness of using Visual Phonics (International Communication Learning Institute [ICLI], 1996) in conjunction with a Direct Instruction reading program (see Trezek & Malmgren, 2005; Trezek & Wang, 2006). Visual

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Phonics, a system of 46 hand cues used in conjunction with spoken language, can be employed to augment auditory information and provide students who are deaf or hard of hearing with a multisensory (auditory, visual, tactile, and kinesthetic) representation of the phonemes in the English language (Waddy-Smith & Wilson, 2003). Results of these inquiries revealed extreme promise for improving word recognition skills for students with varying degrees of hearing loss at both the elementary and secondary levels.

The current study seeks to expand upon the aforementioned studies and explore the results of utilizing Visual Phonics to supplement another phonics-based reading curriculum. This investigation was guided by the following research question: Given 1 year of instruction from a phonics-based reading curriculum supplemented by Visual Phonics, can kindergarten and first-grade students who are deaf or hard of hearing demonstrate improvements in beginning reading skills as measured by standardized assessments of (a) Sentence Writing Phoneme, (b) Sentence Writing Spelling, (c) Phonemic Awareness Segmentation, (d) Phonemic Awareness Deletion, (e) Phonics Onsets, and (f) Phonics Rimes?

Method

Participants and Setting

The regional Hearing Impaired program utilized in this study is located in a large, urban, Midwestern school district in the United States. According to the annual report published by the school district, this district serves approximately 60,000 students in its 139 schools. Demographic information from the district indicates that approximately 63% of district students are African American, 31% Caucasian, 2% Asian, and 4% Hispanic. The regional program for students who are deaf or hard of hearing housed in this district served approximately 200 students in preschool through high school during the school year in which the study took place.

Four teachers and 20 students in kindergarten and first grade served as study participants. All four classrooms adhered to a Total Communication philosophy. The definition of Total Communication varies from location to location. In some environments it has been defined as “whatever works for a particular child” (Paul, 2001, p. 237) such as speech, speechreading, audition, signs, print, or a combination of these items. In other situations, Total Communication has been used to describe the simultaneous use of speech and sign language. In this article, we use Total Communication to describe the philosophy of education (whatever works for the particular child) and the terms simultaneous communication (simultaneous use of speech and sign) and oral/aural (no sign system used) to describe the communication mode used in the classrooms.

The two kindergarten classes and one first-grade classroom used a simultaneous communication mode, whereas the other first-grade classroom utilized an oral/aural approach. Convenience sampling was utilized in this study; therefore, students were placed in four cohorts based on their classroom placement. Demographic information for student participants was obtained from the cumulative records on file at the school. Of the 20 student participants, 70% (n = 14) were reported to be Caucasian, 25% (n = 5) African American, and 5% (n = 1) Asian. There were an equal number of male and female participants included in the study.

Unaided pure-tone average in the better ear indicated that student participants had varying degrees of hearing loss ranging from mild to profound (30–112 dB), with 10 students using cochlear implants. At the onset of the study, kindergarten students ranged in age from 5 years 0 months to 6 years 5 months, with an average age of 5 years 6 months. First-grade students ranged in age from 5 years 7 months to 8 years 8 months with an average age of 6 years 6 months. See Tables 1 and 2 for a summary of degree of hearing loss, age, and classroom placement for participants.

Teacher questionnaires were distributed to gather information about participants’ teaching certifications, highest degree earned, years of teaching experience, gender, and ethnicity. All participants held a Bachelor’s degree and Pre-K through 12 state Hearing Impaired certification. Three of the four teachers had acquired a Master’s degree and had additional certification in the area of Elementary Education. Years of teaching experience ranged from 22 to 30 years with an average of 26 years. All four female teacher participants reported their ethnicity as Caucasian.
Procedure

Teaching materials. LACES is the title of the literacy program developed by a variety of professionals in the local school district where the study took place. This reading program was created in an effort to (a) increase the success rate of students on the state proficiency test, (b) to comply with the Federal government’s NCLB mandate, (c) to include more components of the National Reading Panel’s findings, and (d) to meet the need of aligning the district’s reading curriculum with the new state academic content standards.

For kindergarten and first-grade students, there are five major components included in the 90-min of daily instruction from the LACES curriculum; literacy board, read aloud, vocabulary, reading and enrichment, and reteaching. During the literacy board portion of the lesson, teachers provide explicit instruction in phonemic awareness and phonics. Specifically, instruction focuses on letter recognition, letter formation, learning letter-sound correspondences, and spelling high-frequency words. Once students have learned several letter-sound relationships, a blending strategy is taught. Students are prompted to read words like a snail (sound by sound), like a bird (singing or blending the sounds together), and then finally like a rabbit (reading the word at a normal rate of speech). This segment of the lesson typically lasts for 20 min.

The purpose of the read-aloud section of the lesson is to provide teachers with an opportunity to model fluent reading and to expose students to a variety of literature genres and multicultural literature. This portion of the lesson usually lasts for 10 min.

Table 1  Summary of hearing loss, age, and classroom placement for kindergarten participants (n = 9)

| Student number | Degree of hearing loss—unaided pure-tone average in better ear | Age at onset of study (year/months) | Classroom placement |
|----------------|---------------------------------------------------------------|-------------------------------------|---------------------|
| 1              | 76 dB                                                         | 5.0                                 | SC                  |
| 2              | 112 dB                                                        | 5.6                                 | SC                  |
| 3              | 75 dB                                                         | 6.2                                 | SC                  |
| 4              | CI                                                            | 5.1                                 | SC                  |
| 5              | CI                                                            | 6.5                                 | SC                  |
| 6              | CI                                                            | 5.11                                | SC                  |
| 7              | 70 dB                                                         | 5.0                                 | SC                  |
| 8              | CI                                                            | 5.9                                 | SC                  |
| 9              | CI                                                            | 5.6                                 | SC                  |

Note. CI, student utilizes a cochlear implant; SC, simultaneous communication classroom.

Table 2  Summary of hearing loss, age, and classroom placement for first-grade participants (n = 11)

| Student number | Degree of hearing loss—unaided pure-tone average in better ear | Age at onset of study (year/months) | Classroom placement |
|----------------|---------------------------------------------------------------|-------------------------------------|---------------------|
| 1              | 30 dB                                                         | 6.8                                 | Oral               |
| 2              | 35 dB                                                         | 6.1                                 | Oral               |
| 3              | 60 dB                                                         | 8.8                                 | Oral               |
| 4              | 75 dB                                                         | 8.0                                 | Oral               |
| 5              | 75 dB                                                         | 7.5                                 | Oral               |
| 6              | CI                                                            | 6.3                                 | SC                 |
| 7              | CI                                                            | 5.10                                | SC                 |
| 8              | CI                                                            | 6.1                                 | SC                 |
| 9              | CI                                                            | 5.7                                 | SC                 |
| 10             | 97 dB                                                         | 6.1                                 | SC                 |
| 11             | CI                                                            | 6.2                                 | SC                 |

Note. CI, student utilizes a cochlear implant; oral, oral/aural classroom; SC, simultaneous communication classroom.
Following the read-aloud segment, an additional 10 min of daily instructional time is reserved for teaching vocabulary. Teachers not only provide direct vocabulary instruction but also focus on word-learning strategies.

Reading selections from the Harcourt Brace Signatures reading series are used during the 30 min of instructional time devoted to reading. During this portion of the lesson, teachers provide instruction and modeling of age-appropriate reading strategies. Teachers begin this segment of the lesson by assessing students’ prior knowledge and building the necessary background information in order for students to understand and appreciate the reading selections. The reading portion of the lesson combines guided practice with feedback from the teacher and independent reading of passages. This portion of the lesson concludes with comprehension activities that include answering questions, summarizing, reflecting, and sharing.

The final 20 min of instructional time is reserved for enrichment and reteaching. Depending on the needs of students, teachers may work with individual students, small groups, or the entire class to review various sections of the lesson or to extend beyond the content and scope of a lesson.

For each grade level, four instructional manuals have been developed to guide the instruction students receive over the course of the four quarters of the school year. Each manual contains 8 weeks of instructional materials, and one manual is completed per quarter. For kindergarten students, the sequence of guides is labeled K.A, K.1, K.2, K.3, and K.4. The K.A level is intended for students who lack the prerequisite skills to begin the K.1 manual at the start of the school year. For first-grade students, manuals 1.1, 1.2, 1.3, and 1.4 have been created.

In order to determine the appropriate starting point in the LACES program, an individually administered benchmark assessment is utilized. This assessment requires students to orally read a story, and measures of reading rate, accuracy, and comprehension determine students’ placement. The initial placement in the LACES curriculum also indicates the sequence of curriculum students will receive throughout the school year. For example, if the assessment indicates initial placement in the K.A curriculum, students will receive instruction from this curriculum manual in the fall and complete the K.3 curriculum during the fourth quarter of the school year. Similarly, if the assessment indicates initial placement in the 1.2 curriculum, first-grade students would receive instruction from the 1.2, 1.3, 1.4, and 2.1 curriculum guides during their first-grade year. Although the placement assessment is individually administered, the performance of the group of students as a whole is considered to determine the initial manual placement for the class.

According to the initial benchmark assessment, all the kindergarten participants in Cohorts 1 and 2 began instruction with the K.A manual and were instructed through level K.3 by the end of the school year. Students in Cohort 3 (first-grade participants 1–5) began instruction in manual 1.1 and ended the school year with manual 1.4, whereas students in Cohort 4 (first-grade participants 6–11) began instruction in manual 1.2 and completed the school year with manual 2.1.

Prior to the onset of this study, teacher participants had 1 year experience implementing the LACES curriculum with students. Teachers reportedly experienced great difficulty utilizing the curriculum with students that first year due to its strong emphasis on teaching beginning reading and spelling skills using a phonics-based approach. In order to address this issue, Visual Phonics was utilized in this study.

Visual Phonics. Visual Phonics is the abbreviated title for See the Sound/Visual Phonics (STS/VP), which is a multisensory system of 46 hand cues and written symbols used in conjunction with speech and speech-reading to represent aspects of the phonemes of a language and the grapheme–phoneme relationships. This system was developed in 1982 by the ICLI to help individuals with profound hearing loss master letter–sound correspondence and gain access to the phonemic features of the English language (Waddy-Smith & Wilson, 2003). Similar to the French Borel-Maisonny method and German Phonembestimmte Manual System of Schulte, Visual Phonics is a system of oral/aural plus manual representation of phonemes (see discussion in Reynolds & Fletcher-Janzen, 2002). This multimodal representation of phonemes can be used to assist students who are deaf or hard of hearing or other struggling readers who experience difficulties to
appropriately and adequately access the phonological components of English language.

Visual Phonics can be used with deaf or hard-of-hearing students using a variety of communication methodologies because it is an instructional tool rather than a communication system. Another distinguishing feature of Visual Phonics is that it represents the phonemes which are the building block of a language; thus, it is directly designed to assist the students in manipulating the phonemes and acquiring phonemic awareness and phonics skills. Finally, the articulatory features of the sound are mirrored in the Visual Phonics hand cues and the gestures reflected in the written symbol. For example, the cue for the /p/ sound is produced by placing your thumb and fingers together in a flat “o” position by the corner of your mouth with your fingers facing forward. The hand is then moved slightly forward and the fingers opened quickly to represent the puff of air produced by this sound. The quick motion used to produce this cue also helps reinforce that /p/ is a stop sound. In contrast, continuous sounds are produced using a slower hand movement. For example, the cue for the /f/ sound is produced by placing your fingers and thumb together in an “o” shape at the corner of your mouth with your palm facing you. The four fingers are then slowly raised off the thumb to represent the air being blown upward as this sound is produced.

In this study, the intention was to use Visual Phonics as the primary means of implementing the literacy board section in the LACES lesson. However, teachers reportedly used Visual Phonics throughout the lesson to not only reinforce the skills taught in the literacy board portion of the lesson but also to teach vocabulary, word-learning strategies, and to enhance comprehension. Although written symbols are part of the Visual Phonics system, only the hand cues were utilized in this intervention.

Teacher training. The four teachers received training in Visual Phonics from the first three authors during the spring quarter of the 2004–2005 school year. The training was conducted over a 1-month period and contained four elements: initial training in Visual Phonics, lesson demonstration, lesson observation, and three 30-min focus group meetings. The initial Visual Phonics training session was conducted in one 2-hr session after school. At this training, the teachers were given a STS/VP resource guide produced by the ICLI (1996). The hand cues were then presented and practiced until teachers could produce each cue independently. Training in Visual Phonics and ability to purchase the resource guide and other materials is only available through a trainer licensed through the ICLI. The first author was a licensed Visual Phonics trainer at the time of this study.

A week following the initial training session, the first focus group meeting was held. In this session, the teachers and researchers reviewed the production of the Visual Phonics cues, and the teachers discussed their experiences in using the cues with their students over the past week. Following the first focus group meeting, a lesson demonstration session was scheduled. The first author visited each classroom to model a lesson to give the teachers an example of how to use Visual Phonics as an instructional tool. A lesson focusing on phonemic awareness and phonics skills using the book *Hop on Pop* by Dr. Seuss (1963) was demonstrated in each classroom. The second focus group meeting was held following the lesson demonstration to answer teachers’ questions and prepare for the lesson observations.

The first and second authors conducted a 45-min observation in each classroom to see how the teachers were incorporating Visual Phonics into their lessons and observe student responses. Informal anecdotal field notes were collected by each observer and compared following the observations to evaluate the consistency of observation from observer to observer. In each of the observation sessions, field notes revealed consistent information relevant to the observation and correct use of Visual Phonics cues by teacher and student participants. Following these observations, the third and final focus group meeting was held. In this meeting, the teachers discussed their experiences using the Visual Phonics cues. All teachers expressed that they found the lesson demonstration to be very valuable in knowing how to implement Visual Phonics in the classroom.

At the onset of this study, each teacher had received training in Visual Phonics and had experience using it with students during instructional activities.
The teachers began using Visual Phonics to supplement the instruction the students received from the LACES curriculum during the 2005–2006 school year. The first author served as a consultant for the implementation, conducting observations, providing consultation and monitoring fidelity of implementation on a quarterly basis. Informal anecdotal field notes were again used to document the use of Visual Phonics cues by teacher and student participants.

Measures. The Dominic Reading and Writing Assessment Portfolio (DeFord, 2001) was utilized by the district as a pretest–posttest measure to evaluate student progress in the LACES curriculum beginning in the 2003–2004 academic year. Teachers received training in conducting this assessment from district personnel prior to the onset of this study. According to the administrative procedures of this test, students in kindergarten (n = 9) were administered three subtests: Sentence Writing Phoneme, Sentence Writing Spelling, and Phonemic Awareness Segmentation, whereas students in first grade (n = 11) were administered the above subtests plus three additional subtests: Phonemic Awareness Deletion, Phonics Onsets, and Phonics Rimes. Subtests were individually administered to students by their classroom teachers.

The scores for the Sentence Writing Phoneme and Sentence Writing Spelling subtests are collected through one test task. This task begins with the teacher reading a story to the student. Once the story has been heard in its entirety, the teacher repeats the story, word by word, and the student writes each word on a form provided in the test manual. The sentences can be repeated as slowly and as many times as necessary. Upon completion of this task, responses are analyzed to determine (a) the appropriateness of the student’s analysis of sounds in words and (b) how many whole words are spelled correctly. Therefore, this analysis results in a separate phoneme and spelling score. Although the sentences differ from kindergarten to first grade, the maximum number of points for each portion of this subtest is the same; 50 points for phonemic analysis and 18 points for total number of words spelled correctly.

To begin the Phonemic Awareness Segmentation subtest, teachers must demonstrate how this subtest is administered. Four rows of vertical boxes ranging from two boxes to five boxes are placed before the student. The test administrator then demonstrates how to slide coins into each of the boxes to represent the number of sounds in a word being produced slowly. The teacher demonstrates three real words and one nonsense word. After completing this demonstration, the student is orally presented with 15 nonsense words to complete this subtest. The student then slides a coin into each box to represent the number of sounds in the word. For example, if the student was presented with the word man, he or she would slide a coin into the row of three vertical boxes, thus demonstrating that the word man contains three sounds.

For the Phonemic Awareness Deletion subtest, a student is orally presented with 15 words and then asked what word is left when a particular sound is deleted. For example, the student may be asked, “What word is left when you take the /c/ off the beginning of call?” or “What word is left when you take the /l/ from the middle of play?” Test items represent a variety of sounds produced in various positions within words (e.g., beginning, middle, and end).

As with the Sentence Writing Phoneme and Sentence Writing Spelling subtests, scores for the Phonics Onsets and Phonics Rimes are also collected with one test task. To administer this subtest, the teacher places a list of onsets (initial letters or cluster of letters) and rimes (spelling patterns) before the student and asks the child to say the sound produced by a letter or combination of letters. For example, the student would see the onset /f/ and be required to produce the /f/ sound. Similarly, when given the rime represented by the letters -in, the student would be required to produce both the short /i/ and /n/ sounds.

Teachers were required to administer Form A of the Dominic Assessment as a pretest measure in the fall and Form B of the assessment as a posttest measure in spring. The fourth author, the reading specialist employed at the school at the time of the study, scored the Sentence Writing Phoneme and Sentence Writing Spelling subtests for all study participants to ensure accuracy and consistency of scoring procedures. The remaining subtests were scored by each individual teacher. Upon completion of the assessments, teachers submitted the raw scores to the fourth
The author who created a cumulative record of scores for students in the program.

Test items for students in classrooms where simultaneous communication was the communication mode were administered using a combination of speech, sign language, and Visual Phonics, whereas students placed in the classroom using an oral/aural mode used a combination of speech and Visual Phonics. Decisions regarding what method of communication to use during test administration were consistent with the procedures used by teachers during reading instruction. For example, teachers in the classrooms using speech and sign language simultaneously usually paired simultaneous communication with the corresponding Visual Phonics cues during activities that required students to identify individual phonemes in a word or spell words. Therefore, when asked to perform a similar task on the Dominie, a similar procedure was used.

Students responded to test items using a combination of signs, fingerspelling, vocalizations, and Visual Phonics cues which were consistent with responses provided during reading instruction. If a student chose to utilize a vocalization during the administration of the test, the proper vocal sensation (voiced vs. unvoiced) had to be included in order for the student to receive full credit for their response. The type of amplification used by students as part of their school programming (e.g., hearing aid, assistive listening device, or cochlear implant) was also used during test administration.

Analysis. The Dominie Reading and Writing Assessment Portfolio (DeFord, 2001) was the standardized assessment used as a pretest–posttest measure of students’ reading achievement.

The raw scores for each subtest were analyzed by their descriptive statistics, and a paired-samples t test (two-tailed) was conducted to report the t value and p value. Pretest–posttest scores for the Sentence Writing Phoneme, Sentence Writing Spelling, and Phonemic Awareness Segmentation subtests were analyzed for each student in kindergarten and first grade (N = 20), whereas the additional pretest–posttest measures of Phonemic Awareness Deletion, Phonics Onsets, and Phonics Rimes were evaluated for the first-grade students (n = 11). Furthermore, for each dependent measure, the mean of the Difference Score (posttest raw score – pretest raw score) and the standard deviation of the Difference Score were calculated and the effect size was estimated using Cohen’s d.

Results

The pretest raw scores for all participants (N = 20) on Sentence Writing Phoneme ranged from 0 to 45 (M = 25.85, SD = 13.55), Sentence Writing Spelling from 0 to 14 (M = 6.45, SD = 4.27), and Phonemic Awareness Segmentation from 1 to 15 (M = 6.00, SD = 4.15). Meanwhile, the posttest raw scores for all participants (N = 20) on Sentence Writing Phoneme ranged from 19 to 49 (M = 40.30, SD = 8.42), Sentence Writing Spelling from 3 to 17 (M = 10.05, SD = 3.82), and Phonemic Awareness Segmentation from 3 to 15 (M = 11.90, SD = 3.65). Paired-samples t tests (two-tailed) were employed to calculate the difference between the raw scores obtained on the pretest and the posttest for these three dependent measures. Results of the analysis indicated that there was statistically significant difference between pre- and posttest scores on Sentence Writing Phoneme (t = −6.15, p = .000), Sentence Writing Spelling (t = −6.67, p = .000), and Phonemic Awareness Segmentation (t = −5.41, p = .000).

The Difference Scores (pretest score – posttest score) of all participants (N = 20) in Sentence Writing Phoneme (M = 14.45, SD = 10.51), Sentence Writing Spelling (M = 3.60, SD = 2.41), and Phonemic Awareness Segmentation (M = 5.90, SD = 4.88) were analyzed, and the effect size was estimated using Cohen’s d as 1.37, 1.49, and 1.21, correspondingly, which was considered large for all three dependent measures.

A similar pattern appeared in the three additional assessments administered to the first-grade (n = 11) participants. The pretest raw scores on the Phonemic Awareness Deletion subtest varied from 1 to 12 (M = 7.00, SD = 4.00), Phonics Onsets from 5 to 15 (M = 11.64, SD = 3.61), and Phonics Rimes from 0 to 12 (M = 5.55, SD = 3.72). The posttest raw scores on these three dependent measures varied from 6 to 15 (M = 11.36, SD = 2.46), from 10 to 17 (M = 14.82, SD = 2.23), and from 3 to 15 (M = 10.36, SD = 3.59).
respectively. Using the paired-samples \( t \) tests (two-tailed), we identified a similar statistically significant difference between the pre- and posttest scores on Phonemic Awareness Deletion (\( t = -4.86, p = .001 \)), Phonics Onsets (\( t = -4.32, p = .002 \)), and Phonics Rimes (\( t = -3.88, p = .003 \)). Furthermore, we calculated the Difference Score of first graders (\( n = 11 \)) on Phonemic Awareness Deletion (\( M = 4.37, SD = 2.98 \)), Phonics Onsets (\( M = 3.19, SD = 2.44 \)), and Phonics Rimes (\( M = 4.82, SD = 4.12 \)), and the estimated effect size was again large for all three dependent measures with \( d = 1.47, 1.30, \) and 1.17, respectively. See Tables 3 and 4 for a summary of raw scores on the Dominie Assessment for participants.

Stanine scores are raw scores that are normalized and placed on a scale with nine intervals with scores of 1, 2, and 3 indicating performance below average; 4, 5, and 6 average performance; and 7, 8, and 9 above-average performance. In order to evaluate the participants’ performance relative to stanines, the mean scores for the kindergarten and first-grade students had to be viewed separately. For kindergarten students, pretest scores on the Sentence Writing Phoneme ranged from 0 to 37 (\( M = 16.11 \)), Sentence Writing Spelling from 0 to 9 (\( M = 3.11 \)), and Phonemic Awareness Segmentation from 1 to 5 (\( M = 2.77 \)) with a reported stanine of 9 for Sentence Writing Phoneme and 4 for Sentence Writing Spelling. A stanine

| Student number | Sentence Writing Phoneme (50 points maximum) | Sentence Writing Spelling (18 points maximum) | Phonemic Awareness Segmentation (15 points maximum) |
|----------------|---------------------------------------------|---------------------------------------------|--------------------------------------------------|
|                | Pretest | Posttest | Pretest | Posttest | Pretest | Posttest | Pretest | Posttest |
| 1              | 2       | 34       | 1       | 5        | 2       | 15       |
| 2              | 14      | 44       | 4       | 10       | 2       | 15       |
| 3              | 6       | 33       | 1       | 8        | 4       | 12       |
| 4              | 18      | 44       | 4       | 10       | 1       | 14       |
| 5              | 17      | 43       | 2       | 9        | 5       | 14       |
| 6              | 27      | 41       | 4       | 9        | 1       | 10       |
| 7              | 0       | 20       | 0       | 3        | 1       | 3        |
| 8              | 24      | 41       | 3       | 8        | 4       | 12       |
| 9              | 37      | 47       | 9       | 11       | 5       | 15       |
| Mean           | 16      | 39       | 3       | 8        | 3       | 12       |

Table 3 Summary of raw scores on the Dominie Assessment for kindergarten participants (\( n = 9 \))

| Student number | Sentence Writing Phoneme (50 points maximum) | Sentence Writing Spelling (18 points maximum) | Phonemic Awareness Segmentation (15 points maximum) |
|----------------|---------------------------------------------|---------------------------------------------|--------------------------------------------------|
|                | Pretest | Posttest | Pretest | Posttest | Pretest | Posttest | Pretest | Posttest | Pretest | Posttest | Pretest | Posttest |
| 1              | 21      | 43       | 5       | 9        | 6       | 12       | 3       | 12       | 6       | 12       | 0       | 10       |
| 2              | 44      | 47       | 10      | 13       | 7       | 14       | 12      | 15       | 13      | 16       | 12      | 11       |
| 3              | 22      | 19       | 6       | 4        | 6       | 6        | 3       | 9        | 5       | 10       | 3       | 3        |
| 4              | 30      | 37       | 8       | 8        | 5       | 11       | 6       | 10       | 14      | 15       | 7       | 5        |
| 5              | 25      | 45       | 4       | 9        | 8       | 4        | 5       | 12       | 11      | 16       | 3       | 12       |
| 6              | 42      | 42       | 11      | 14       | 13      | 13       | 5       | 13       | 15      | 17       | 8       | 12       |
| 7              | 35      | 42       | 9       | 12       | 15      | 15       | 9       | 10       | 15      | 16       | 4       | 11       |
| 8              | 32      | 38       | 10      | 10       | 7       | 15       | 1       | 6        | 10      | 17       | 1       | 9        |
| 9              | 41      | 49       | 14      | 16       | 9       | 12       | 9       | 13       | 14      | 13       | 7       | 14       |
| 10             | 35      | 48       | 10      | 16       | 14      | 15       | 12      | 12       | 12      | 16       | 6       | 12       |
| 11             | 45      | 49       | 14      | 17       | 5       | 11       | 12      | 13       | 13      | 15       | 10      | 15       |
| Mean           | 34      | 42       | 9       | 12       | 9       | 12       | 7       | 11       | 12      | 15       | 6       | 10       |
score was not available in the Dominie Assessment manual for kindergarten students on the Phonemic Awareness Segmentation subtest at the beginning of the year.

Posttest scores for kindergarten students on the Sentence Writing Phoneme ranged from 20 to 47 ($M = 38.55$), Sentence Writing Spelling from 3 to 11 ($M = 8.11$), and Phonemic Awareness Segmentation from 3 to 15 ($M = 12.22$) with reported stanines of 6, 6, and 7, respectively. Although there was a decrease in the students’ average stanine score on the Sentence Writing Phoneme subtest, overall these scores indicate average performance for kindergarten students at posttest on all three test measures.

For the first-grade participants, pretest scores on the Sentence Writing Phoneme ranged from 21 to 45 ($M = 33.82$), Sentence Writing Spelling from 4 to 14 ($M = 9.18$), Phonemic Awareness Segmentation from 5 to 14 ($M = 8.64$), Phonemic Awareness Deletion from 1 to 12 ($M = 7.00$), Phonics Onsets from 5 to 15 ($M = 11.64$), and Phonics Rimes from 0 to 12 ($M = 5.55$, $SD = 3.72$). The corresponding stanine scores for first-grade participants were 7, 6, 4, 7, 5, and 7, indicating average performance on all six pretest measures.

Posttest scores for first-grade participants on the Sentence Writing Phoneme ranged from 19 to 49 ($M = 41.73$), Sentence Writing Spelling from 4 to 17 ($M = 11.64$), Phonemic Awareness Segmentation from 4 to 15 ($M = 11.64$), Phonemic Awareness Deletion from 6 to 15 ($M = 11.36$), Phonics Onsets from 10 to 17 ($M = 14.82$), and Phonics Rimes from 3 to 15 ($M = 10.36$). Stanine scores for these six subtests were 4, 5, 3, 5, 3, and 4, respectively, indicating average performance on the Sentence Writing Spelling, Phonemic Awareness Deletion, and Phonics Rimes subtests and slightly below-average performance on the Sentence Writing Phoneme, Phonemic Awareness Segmentation, and Phonics Onsets subtests. Although significant gains were noted on all six measures from pre- to posttest for the first-grade participants, there was a decrease in stanine scores on all six measures.

**Discussion**

The purpose of the current study was to evaluate the results of using Visual Phonics to supplement the instruction that kindergarten and first-grade students who are deaf or hard of hearing receive from the LACES reading curriculum. This evaluation was lead by the following research question: Given 1 year of instruction from a phonics-based reading curriculum supplemented by Visual Phonics, can kindergarten and first-grade students who are deaf or hard of hearing demonstrate improvements in beginning reading skills as measured by standardized assessments of (a) Sentence Writing Phoneme, (b) Sentence Writing Spelling, (c) Phonemic Awareness Segmentation, (d) Phonemic Awareness Deletion, (e) Phonics Onsets, and (f) Phonics Rimes?

It was hypothesized that the mean score at posttest would be greater than the mean score at pretest on all test measures, and the results of this study support the hypothesis stated. After receiving instruction from the LACES curriculum supplemented by Visual Phonics, the mean score of each cohort of students was higher at posttest when compared to pretest measures. In addition, the results of paired-sample $t$ tests indicated that the findings obtained on all test measures were statistically significant and the effect size was considered large.

Pretest measures indicate that the mean stanine scores of both kindergarten and first-grade participants were in the average range at the onset of this study. This finding alone is encouraging, given that many children who are deaf or hard of hearing typically lag behind their hearing peers in the area of reading (Allen, 1986; deVilliers, 1991; King & Quigley, 1985; Paul, 1998, 2001; Quigley & Paul, 1986; Trybus & Karchmer, 1977). One reason for this difference may be that the majority of participants in this study had attended a minimum of 2 years of preschool prior to their kindergarten year. Furthermore, the first-grade participants had been exposed to the LACES curriculum during their kindergarten year. Although the teachers reportedly experienced difficulty implementing the curriculum prior to the onset of this study, it is probable that many students benefited from instruction from the LACES curriculum alone. Finally, the first-grade participants had been introduced to Visual Phonics during their kindergarten year as part of the teacher training that was employed for this investigation.
Despite their strong performance at pretest, two of the six mean stanine scores for first-grade participants fell in the low-average range at posttest. In addition, when considering the stanine scores from pre- to posttest, there was a decrease noted on several subtests for both kindergarten and first-grade students. One explanation for this may be that the students who are deaf or hard of hearing included in this study were unable to make improvements on the test measures commensurate with the hearing students who comprised the normative sample of the Dominie Assessment. This is supported by research indicating that although the reading development of children who are deaf or hard of hearing appears to be qualitatively similar to that of hearing children, it is quantitatively different (Paul, 2001). In fact, compared to the typical 1-year grade level gain in reading achieved by most hearing students year to year, the annual growth rate for many students who are deaf or hard of hearing has been reported as a 2- to 3-month gain per year. Furthermore, the growth does not progress steadily from year to year (Trybus & Karchmer, 1977; Allen, 1986). This lead us to question whether the progress of the students in this study was relative to that of other students enrolled in the local school district.

Cumulative data reporting student performance on the six subtest of the Dominie Assessment were not available for review; however, results of the pretest–posttest benchmark assessments used to determine placement in the LACES curriculum were published in the district’s 2002–2004 annual report (Columbus Public Schools, 2003). During the 2002–2003 school year, the majority of the district’s 1,558 kindergarten students assessed at pretest placed in levels K.A (86%) and K.2 (12%) of the LACES curriculum. Results of the posttest benchmark assessment indicate that most of the districts’ 16,664 kindergarten students were performing at the K.2 (16%), K.3 (21%), K.4 (29%) 1.2 (11%) and 1.4 (11%) levels by the end of that school year. When comparing these results to that of the kindergarten students in this study, all kindergarten study participants began instruction in the K.A curriculum and completed the K.3 curriculum by the end of the school year.

In regards to the district’s 1,259 first graders assessed at the beginning of the 2002–2003 school year, 25% of students placed in the K.A curriculum, 26% at K.2, 15% at K.3, 15% at 1.1, and 7% at 1.2. By the end of the school year, posttest measures indicated that, of the 1,537 students tested, 11% tested at the 1.1 level, 8% at 1.2, 9% at 1.3, 28% at 1.4, 8% at 2.2, 7% at 2.3, and 20% at 2.4. Students in this study began instruction in either the 1.1 or the 1.2 curriculum and completed the 1.4 and 2.1 curriculum by the end of the year, respectively.

Although these data represent student performance during the first year of implementation of the LACES curriculum and current data may represent improved performance overall, it does provide some context in which to understand the performance of the study participants in relation to their hearing peers enrolled in the same local school district receiving instruction from the same phonics-based reading curriculum.

Social Validity

Several comments made by the participating teachers and observations of the first author indicate the social appropriateness of the instructional practices used in this study and the generalization of the reading and spelling skills acquired. Teachers indicated that the Visual Phonics cueing system allowed them to teach the phonics portions of the LACES curriculum that they previously struggled to address. For example, prior to learning Visual Phonics, it had been difficult for teachers to complete lesson activities that required students to identify words with the same initial sound when the words presented began with different letters. For example, teachers struggled to teach and reinforce activities such as asking students the following question: “What word has the same beginning sound as city? Coat, cake, kite or soap?” Similarly, students also had difficulty matching rhyming words or demonstrating an understanding of homophones such as weight and wait or new and knew. However, after the implementation of this study, teachers were readily able to teach and reinforce these lesson components and students could demonstrate mastery of these reading skills through the use of Visual Phonics.

The social appropriateness of the instructional practices was also evident in the students’ acquisition...
and generalization of spelling skills. For example, teachers and students could now use Visual Phonics together with fingerspelling to communicate the difference between a phoneme (sound) and a letter. Furthermore, the notion that that two letters can result in one phoneme (e.g., the letters ea together make the long /a/ sound), that different letter combinations can represent the same phoneme (e.g., /oo/ in school, /ou/ in group and /ew/ in new) and that some words contain silent letters (e.g., -e in cake) was also easier to communicate using the Visual Phonics cues. Students reportedly used the Visual Phonics cues to practice their weekly spelling flashcards with one another. Interestingly, students also spontaneously utilized the Visual Phonics cues to spell words outside of the LACES instructional periods. For example, when using the computers during recess time, one student asked another for a Web site address. Instead of using fingerspelling, the student responded using Visual Phonics cues.

Limitations

We recognize several limitations to the research. First, because the implementation of the LACES curriculum was required by the local school district for all students, it was impossible to include a comparison group in this study. In addition, because all classrooms utilized Visual Phonics as the means of implementing the curriculum, it is difficult to ascertain whether it was the LACES curriculum, the use of Visual Phonics system, or a combination of the two that had an effect on student performance. Future investigations of this type should employ a comparison group to mitigate these limitations. Second, due to the local school district’s standard, teacher participants were responsible for administering pre- and posttest measures to the students in their class. This raises the question of potential bias in administering and scoring test measures. In the current study, the fourth author was responsible for scoring two of the six measures administered to study participants. Whenever possible, future studies should employ test administrators and/or data collectors not directly involved with the implementation of the curriculum. Finally, the small sample size ($N = 20$) and the high number of students included in the study who utilized cochlear implants ($n = 10$) made it difficult to evaluate the effect of degree of hearing loss relative to performance on test measures. To alleviate this limitation, future inquiries should be conducted with larger numbers of students with varying degrees of hearing loss.

Conclusion

Results of this study indicate that given 1 year of instruction from a phonics-based reading curriculum supplemented by Visual Phonics, kindergarten and first-grade students who are deaf or hard of hearing can demonstrate improvements in beginning reading skills as measured by standardized assessments. Paired-samples $t$ tests (two-tailed) indicated a statistically significant difference between pre- and posttest scores for all six subtests evaluated and the effect size was considered large.

The findings of the present inquiry are consistent with those reported in previous studies of this type in which Visual Phonics was used to supplement the phonics-based Direct Instruction Reading Mastery I curriculum for kindergarten and first-grade children (Trezek & Wang, 2006) and the Corrective Reading-Decoding curriculum with middle school students (Trezek & Malmgren, 2005). Collectively, these three studies represent the initial step toward establishing a line of intervention research aimed at examining how students who are deaf or hard of hearing can be effectively taught to utilize phonological information in beginning reading tasks.

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