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The Effects of Cued Speech on Phonemic Awareness Skills

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The Effects of Cued Speech on Phonemic Awareness Skills

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Abstract

Research suggests phonemic awareness is enhanced through multimodality training. Cued Speech is a multimodality system that combines hand signs with mouth movements to represent phonemes of the spoken language. This system has been utilized successfully in developing phonological awareness with children with hearing loss. However, no research is available on its effectiveness with children who are not deaf or hard-of-hearing. The efficacy of the use of Cued Speech for the enhancement of phonological skills in typically developing 1st grade students was evaluated in this study. Twenty-six 1st graders identified as low-achieving readers by their classroom teachers were administered the PPVT-4 to match participants across three assigned research groups: no intervention (NI), phonemic awareness training auditory only (AO), or phonemic awareness training with Cued Speech (CS). Pre- and post-test scores were compared on six different skills from the Phonological Awareness Test 2 (PAT-2). Results indicated that the Cued Speech intervention group made more gains based on Phonological Awareness Test 2 pre- and post-intervention scores. Although no statistical significance was found when all three groups' post-intervention scores were compared, the CS group did show significant gains across its participants.

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I would like to express my deepest appreciation to my committee members, Dr. Angela Anthony, Mrs. Jean Smitley, Dr. Tena McNamara, and Dr. Nicole Mulvey, for all their support, time, and dedication throughout this project. Their help and guidance in lesson plans and small group intervention was crucial to this project. I could not have completed this without all of you.

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Introduction

Phonological awareness is defined as one's ability to analyze the sound system of a language (Schuele & Boudreau, 2008). Melby-Lervag, Lyster, and Hulme (2012) described phonological awareness as an "individual's ability to reflect upon and manipulate the sound structure of spoken words" (p. 323). Both definitions allude to the importance of an individual's understanding of his or her spoken language separate from printed language. The National Reading Panel (2000) describes phonological awareness as a term often used to encompass the many aspects of sound awareness skills, such as phonemic awareness, which is specifically defined as a child's ability to manipulate spoken sounds of a language. Phonemic awareness is closely related to literacy skills, and is one of the best indicators in predicting a child's reading success (Ehri, Nunes, Willows, Schuster, Yaghoub-Zadeh, & Shanahan, 2001; National Reading Panel, 2000; Bear & Barone, 1998; Wagner, 1988; Anthony & Francis, 2005, Hulme, & Snowling, 2012; Levag, Solveig, & Hulme, 2012).

Studies have shown that phonological awareness training benefits both children with typical language development and children with speech and language impairments (Gillon, 2000; Hatcher, Hulme, & Snowling, 2004; Lundberg, Frost, & Peterson, 1988, Scanlon & Vellutino, 1996; van Kleck, Gillam, & McFadden, 1988). Research has also shown that incorporating multisensory modalities in phonological awareness training enhances success (Fazio, 1997; Joshi, Dahlgren, & Boulware-Gooden, 2002; Oakland, et al., 1998).

Research has suggested a correlation exists between vision and speech perception, and also with speech perception and literacy abilities (Woodhouse, Hickson, & Dodd, 2009). Cued Speech, a system of handshapes which visually represent speech sounds, has been shown to enhance the phonological awareness skills and reading skills of deaf and hard-of-hearing students (Koo, Crain, LaSasso, and Eden, 2008; Bouton, Bertoncini, Serniclaes, & Cole, 2011;

Lasasso, Crain, and Leybaert, 2003). Thus, Cued Speech as a visual support system may enhance phonological and phonemic awareness skills for other populations. However, little research has been completed with populations of children outside of the deaf and hard-of-hearing community.

The goal of the current study was to analyze the effect of Cued Speech on the development of phonological awareness skills of typically developing children. Twenty-six 1st grade students, identified by their classroom teachers as low performing readers, were recruited for this study. Participants were divided into three groups (no intervention, auditory only phonemic awareness training, and phonemic awareness with incorporated Cued Speech training) and received intervention twice a week for 20 minutes over the course of six weeks. It was hypothesized that the CS group would make the most gains on the PAT-2 post-test.

Literature Review

Phonological Awareness

Phonological awareness is defined as one's ability to analyze the sound system of a language (Schuele & Boudreau, 2008). Melby-Lervag, Lyster, and Hulme (2012) described phonological awareness as an "individual's ability to reflect upon and manipulate the sound structure of spoken words" (p. 323). Both definitions allude to the importance of an individual's understanding of his or her spoken language separate from printed language. There are three basic levels of phonological awareness: 1) word and syllable awareness, 2) rhyme awareness, and 3) phoneme awareness (Sterling-Orth, 2004). Each level encompasses many skill sets that range in complexity. Such skills include separating words into syllables, rhyming, alliteration, blending, onset-rime segmentation, segmenting initial and final sounds, segmenting words into sounds, and deleting or manipulating phonemes (Schuele & Boudreau, 2008).

Goldsworthy (1998) outlined the developmental hierarchy for phonological awareness skills. At age 3 years, children begin to play with words and produce familiar rhymes (in sing-song fashion or nursery rhymes). At age 4 years, children begin to segment words into syllables and at age 5 years count the syllables in words. At age 6, blending, segmenting and deleting skills begin to develop at the phoneme level, and at age 7 years children begin to manipulate phonemes and to segment, blend and delete phonemes at the word and phrase level. The following chart summarizes the phonological development milestones.

Table 1

Developmental Hierarchy of Phonological Awareness

Age	Skills
3 years	Playing with words
	Produce familiar rhymes
4 years	Segmenting words into syllables
5 years	Count syllables in words
6 years	Blending. segmenting, and substituting phonemes
7 years	Manipulating syllables and phonemes
	Segment, delete, and blend phonemes

Goldsworth (1998)

The National Reading Panel (2000) describes phonological awareness as a term often used to encompass the many aspects of sound awareness skills, such as phonemic awareness. However, phonemic awareness is specifically defined as a child's ability to manipulate spoken sounds of a language. Phonemic awareness is considered a complex level of phonological awareness, is most closely related to literacy skills, and is one of the best indicators in predicting a child's reading success (Ehri, Nunes, Willows, Schuster, Yaghoub-Zadeh, & Shanahan, 2001; National Reading Panel, 2000; Bear & Barone, 1998; Wagner, 1988; Anthony & Francis, 2005, Hulme, & Snowling, 2012; Levag, Solveig, & Hulme, 2012). Research studies vary in the terms used to define manipulation of the phoneme. Some studies refer to phonological awareness and some refer to phonemic awareness. Phonemic awareness will be used throughout this study when the skill involves manipulation at the phoneme level.

Phonological Awareness and Literacy

The English language system is configured of 41 phonemes (sounds) and 26 graphemes (letters). Words are made up of graphemes representing specific phonemes which are then decoded by the reader (Ehri et al., 2001). Decoding is one's ability to recognize the written/printed grapheme and attach sounds to it in order to read the word. It is understanding and applying the relationship between letters and sounds. Sufficient phonological awareness skills are needed to be a successful decoder. For example, blending is a phonological awareness skill that must be mastered in order to successfully decode words. Blending is defined as taking specific phonemes or graphemes and combining them to create words that are decoded by the reader. In order to be a successful decoder, or reader, a child must be able to first hear the sounds of a language and understand the sounds' properties as related to graphemes (Bear & Barone, 1998). The process of associating letters and sounds together defines letter knowledge. Letter knowledge, along with phoneme awareness, is a strong predictor of decoding abilities (Hulme & Snowling, 2012; Hulme, Bowyer-Crane, Carrol, Duff, & Snowling, 2012).

It is important that a child acquires a strong academic foundation in phonological awareness skills to ensure satisfactory development in reading (Hulme, & Snowling, 2012). Hulme and Snowling (2012) summarized and analyzed the causal effects that most influence students' abilities in learning to read. One such influence was the quality of instruction a child received in the area of phonics. "[Phonics] based reading instruction…is more effective than less systematic approaches" (Hulme, & Snowling, 2012). Instruction that explicitly teaches children to sound out unfamiliar words and focuses on letter-sound relationships was an effective method to reading instruction (decoding). Other factors that affect a child's reading ability relates to the strength of knowledge in such skills as letter knowledge, phoneme awareness, and rapid automatized

naming. Rapid automatized naming is defined as measures of a child's ability to correctly name letters, colors, numbers or pictures as fast as possible. The alphabetic principle describes the relationship between printed and spoken sounds. Phoneme awareness includes a child's ability to manipulate or make judgments about sounds in spoken language. The findings of Hulme and Snowling (2012) indicated that for reading success, two of the three main reading predictors (phoneme awareness and letter knowledge), when explicitly taught in classrooms, have been shown to statistically improve decoding abilities.

A quantitative meta-analysis conducted by Bus and van IJzendoorn (1999) reviewed 36 studies testing the efficacy of phonological awareness training programs on phonological awareness skills. In addition, 34 of the 36 studies were reviewed to assess the effects of phonological awareness on overall reading skills. The outcome measures analyzed for phonological awareness were phoneme segmentation, phoneme blending, and sound deletion. Results of this analysis concluded "phonological training reliably enhance (d) phonological [blending and segmenting] and reading skills" (Bus & van IJzendoorn, 1999). Thus, a relationship between phonological awareness skills, literacy skills, and academic achievement was found. A sufficient foundation in phonological awareness skills is necessary for overall reading success.

Muter, Hulme, Snowling and Stevenson (2004) conducted a 2-year longitudinal study to investigate the relationship between early phonological skills, letter knowledge, grammatical skills, and vocabulary knowledge as early predictors of reading comprehension and word recognition. Participants for this study included 90 elementary school children (53 girls, 37 boys) ranging in ages 4 years 2 months to 5 years 2 months. At the time of the study, all participants were entering into their first term of structured schooling. Data was collected at three equidistant

times throughout the 2-year course of the study, via a variety of standardized tests. At test time 1, the participants were administered six subtests from the Phonological Abilities Test (rhyme detection, rhyme production, phoneme completion, phoneme deletion, rhyme oddity, letter knowledge), the British Picture Vocabulary Scale II (BPVS II), and the Hatcher Early Word Recognition Test. At test time 2, all test time 1 assessments, excluding the BPVS II, were re-administered, as well as the Word Order Correction Test, Morphological Generation Task, and the British Abilities Scales II (BAS II). At test time 3, the Hatcher Early Reading Test was administered, along with the first 50 words of the BAS II and a test of prose reading ability. During the course of the 2-year study, participants were taught to read in the regular classroom using a highly structured approach with a strong emphasis on phonics. Results of this study indicated that word recognition skills were directly correlated with phonological skills. Specifically, phoneme awareness and letter knowledge were strong predictors of word recognition skills, whereas grammar skills and vocabulary knowledge were more related to reading comprehension. As supported by previous studies, reading abilities are strongly correlated with phonological, specifically phonemic awareness skills.

Without a strong phonemic awareness foundation, children can be at risk for deficits in reading skills or reading impairment. Reading impairment, as proposed by Bishop and Snowling (2004), can be divided into a two-dimensional model. These two dimensions are phonological and non-phonological skills. To target the reading difficulties associated with either dimension, Bowyer, et al. (2007) conducted a study to compare the effects of a direct teaching strategy targeting letter knowledge, phoneme awareness, and reading practice on basic decoding skills. Participants for this study included 76 children with a mean age of 4 years, 9 months. Participants were assigned to one of two groups: phonology (sound study) with reading (P+R) or

oral language (OL). Intervention was daily over the course of 20 weeks. Service delivery for intervention sessions was either individual or in small groups. P+R group received intervention in the areas of letter-sound knowledge, phonemic awareness (blending, deleting and segmenting), and basic level book reading. OL group received intervention in the areas of vocabulary, comprehension, inference generation, and narrative skills. Data was gathered at 4 different time points. The first point (t1) was at pre-study, the second (t2) at 10 weeks, the third (t3) at 20 weeks, and the fourth (t4) at five months post-study. Data was collected via word-level reading, vocabulary, and grammar tests. Results of this study indicated participants in the P+R group made gains in phonemic awareness skills necessary for decoding and the OL group showed gains in the areas of grammar skills and vocabulary which is necessary for reading comprehension. In terms of early reading skills acquisition, the P+R group made more gains; furthermore, emphasizing the importance of explicit phonemic awareness training.

Hulme, et al. (2012) conducted a similar study on the causal role of phoneme awareness and letter-sound knowledge had in learning to read. Participants for this study included 8 children (average age 5 years 0 months) at risk for reading deficits. Participants were randomly assigned to one of two groups: phonology and reading or oral language. Intervention in the phonology and reading group focused on phoneme awareness and letter-sound knowledge. Intervention in the oral language group focused on vocabulary, grammar, and narrative skills. Each participant received 20 weeks of intervention, alternating each day with a 30 minute group session or an individual 20 minute session. Data was collected at four different time points using standardized assessment for phonological skills (via the Test of Phonological Awareness) and literacy (via reciting the sounds of the alphabet, Early Word Reading Test, The Graded Nonword Reading Test, and 5 or 10 word spelling tests). At Point 1, before intervention began, the Block Design of

the WPPSI-III, spelling test, and the Early Word Reading Test were administered. At Point 2, 10 weeks into intervention, the Early Word Reading Test and spelling test was administered. At Point 3, 20 weeks into intervention, the Test of Phonological Awareness (blending, segmenting, deleting subtests), spelling test, and Early Word Reading Test was administered. At Point 4, five months post-intervention, the Early Word Reading Test, Graded Nonword Reading Test (decoding subtest), and spelling test were administered. Results of the assessments administered indicated that the participants across group showed improvements from Point 1 scores to Point 4 scores. However, the phonology and reading group scored higher than the participants in the oral-language group across assessments. Hulme et al. (2012) concluded that although both intervention strategies showed increases in reading abilities, the intervention strategy directly targeting letter-sound knowledge and phoneme awareness improved early reading abilities more effectively than the oral language strategy.

Phonological Processing

One's ability to read, or learn to read, begins with a cognitive foundation of phonemic awareness and phonological processing skills. Phonological processing is a related skill to phonemic awareness in that both occur in the absence of print. Essentially, phonological processing is one's ability to cognitively process that sound system of a language. After this foundation is solidified, reading skills are "built" on top of that foundation. Wagner (1988) conducted a meta-analysis to study the relationship between reading and phonological processing skills. The relationship between reading and phonological processing skills was based on four phonological processes (cognitions) necessary for successfully reading. The first process was analysis. Analysis was defined as involving segmenting words into units. Units can either be defined as syllables or individual phonemes. The second process described was synthesis, which

involves combining (blending) individual segments or units into the whole word. This process can also be associated with the word and syllable awareness level. The third process was coding/lexical access. "Examples of tasks that involve coding in the context of lexical access include naming objects as rapidly as possible and making the lexical decision of whether strings of letters is a word or a nonword" (Wagner, p. 263). The fourth process was coding/working memory. Working memory was described as an important process for beginning readers, because the reader must identify the initial sounds of a word, store the initial information while retrieving the subsequent sounds, and then blend all the phonemes together to decode the word. Without phonological memory, blending is highly unlikely to occur (Wagner, 1988). After an analysis of 16 studies (a total of 1,200 children/participants), all four cognitive processes of analysis, synthesis, coding/lexical access, and coding/working memory were found to contribute to reading skills. Thus, phonological processing skills are a key component in the reading-learning process of a child.

Francis, Fletcher, Maxwell, and Satz (1989) examined the causal relationship between verbal-cognitive (phonological processing skills), nonverbal-perceptual skills (auditory discrimination skills) and reading abilities of early elementary students. Participants for this study included 220 male students. Participants were evaluated at the kindergarten, 2nd and 5th grade levels. One hundred and six of the participants were identified as mildly or severely reading disabled. The remaining participants were placed in the control group. Language skills were measured via oral reading fluency, the Peabody Picture Vocabulary Test, and the Similarities subtest of the Wechsler Intelligence Scale for Children. Nonverbal abilities were measured through the Beery Test of Visual Motor Integration, Embedded Figures, and Recognition Discrimination. Reading achievement was assessed by the instructional reading

level of the participant and IOTA Word Test. A structural equations model was used to assess the relationship between verbal skills, nonverbal skills, and reading achievement. Results of this study concluded that nonverbal-perceptual skills showed no significant impact on the development of reading skills. However, verbal-cognitive skills showed to have the most significant impact on reading achievement between grades 2 and 5. Phonological processing and phonemic awareness skills are related under the reading skills umbrella. In order for a child to begin to acquire phonemic awareness skills, he/she must first be able to internalize and cognitively process the sounds of a language. After the child can cognitively process a sound's differences, similarities, and meaning to a language's sound system, they can begin to manipulate the sounds and create the phonemic awareness foundation that later reading-learning will be built upon. Results of Francis, et al. (1989), strongly suggest that reading success is influenced by a child's phonemic awareness foundation.

Visual Supports for Teaching Phoneme Properties

Studies have shown that phonological awareness training benefits both children with typical language development and children with speech and language impairments (Gillon, 2000; Hatcher, Hulme, & Snowling, 2004; Lundberg, Frost, & Peterson, 1988, Scanlon & Vellutino, 1996; van Kleck, Gillam, & McFadden, 1988). Research has also shown that incorporating multisensory modalities in phonological awareness training enhances success (Fazio, 1997; Joshi, Dahlgren, & Boulware-Gooden, 2002; Oakland, et al., 1998). Programs utilizing visual supports often used in the field of speech-language pathology include Lindamood Phoneme Sequencing (LiPS), Visual Phonics, and Cued Speech.

LiPS. The LiPS program was developed with the purpose of helping children with poor phonemic awareness by teaching strategies to improve decoding, identifying blends, and

identifying individual sounds in words (U.S. Department of Education, 2010). LiPS utilizes a multi-sensory approach that teaches children to focus on the actions of their articulators (i.e. lips, tongue, teeth) to increase awareness of sounds. Children are first taught to identify and classify speech sounds by how sounds are formed in the mouth. Next, the program focuses on tracking and sequencing sounds, nonsense words, and words utilizing visual concepts (e.g. colored squares, visual diagrams, hand signals, and letter tiles). Studies have shown that LiPS is an effective intervention tool for improving phoneme awareness, phonemic awareness skills, speech intelligibility and decoding skills (ProEd, Inc., 2011). Success of this program can be attributed to its multisensory approach.

McIntyre, Protz, and McQuarrie (2008) conducted a study to determine the effects of the LiPS program on phonemic awareness skills of first-grade students both at-risk and not-at-risk for reading difficulties. Participants for this study included 45 1st grade students. Prior to and following intervention, each participant was screened in the areas of phoneme identity, phoneme blending, symbol recognition (i.e. upper and lower case letter recognition), and sound-symbol association for lower case letters. After receiving training, teachers implemented the LiPS program in their classroom during reading/phonemic awareness instructions. Pre- and post-treatment data from this study indicated that all participants made gains in phonemic awareness and letter/sound association skills. However, the participants considered at-risk for reading difficulties made greater gains when compared to the participants who were considered not-at-risk. Thus, the use of a multisensory approach is effective in teaching phonemic awareness and may have greater benefit for at risk learners.

Visual Phonics. Visual phonics is a multimodality approach for teaching children literacy skills while enhancing phonological awareness skills. Visual phonics is comprised of a

combination of hand shapes and written symbols representing the movement of articulators (Narr, 2008). Although visual phonics was originally developed for use with children who are deaf/hard-of-hearing, visual phonics can be used for hearing children to help provide a strong base for phoneme awareness.

Gardner, Cihon, Morrison, & Paul (2013) conducted a study to evaluate the effectiveness of using visual phonics to teach phonemic awareness and phonics skills to typically developing kindergarten children. Participants for this study included six kindergarten children. Pre-study, initial sound fluency and letter naming fluency were tested using the DIBELS, 6th edition, K-1 test of benchmark skills. Following visual phonics training and classroom teaching, participants were presented with a sentence that contained five words/opportunities containing the letter-sound relationship just taught in the classroom. Each participant was asked to identify the targeted letter/sound in the sentence. A response was counted as correct if the participant identified the correct letter, produced the correct sound associated with that letter, and if the correct hand signal was used. The word did not have to be read correctly for the response to be counted as correct. Each letter-sound target was taught until the participant reached 80% accuracy (4/5 correct responses). After criterion was met, assessments were conducted 1 week and one month post-intervention. Such assessments included the DIBELS K-2 benchmark subtests of letter naming fluency, phoneme segmentation fluency, and nonsense word fluency. Intervention lasted five months. Each participant was tested for retention of information taught in the classroom regarding letter-sound relationships. Maintenance data was collected one week and one month post-intervention. Results of this study indicated all participants improved in letter-sound relationship knowledge. Several indicators were identified as a root to the success of visual phonics in this study. One was that visual phonics was a flexible tool easily translated and

adapted to the regular education classroom. Another reason was that the uniqueness of each hand signal marks each different letter sound relationship as a different entity that allows for better memory/information retention by the participant. A third reason was that visual phonics met the needs of several different types of students in an inclusive setting. Another finding of this study was that participants maintained skills learned through visual phonics both at the one week and one month post-intervention time points. Thus, the findings of this study indicated visual phonics to be an effective method for teaching phoneme awareness skills. A limitation of visual phonics is that it can be taxing on memory skills. An alternative multimodality system, which is relatively easy to learn and can be mastered quickly, is Cued Speech.

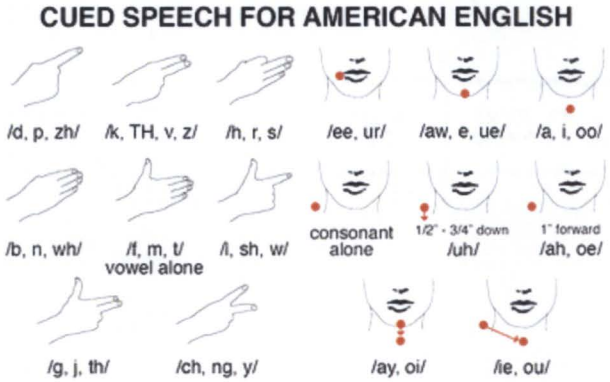
Cued Speech. Research has suggested a correlation exists between vision and speech perception, and also between speech perception and literacy abilities (Woodhouse, Hickson, & Dodd, 2009). From birth, hearing infants become aware of the association between lip movements and speech sounds by matching auditory and visual stimuli. Deaf infants lack such exposure and as a result, have deficits in speech and language acquisition throughout infancy and childhood. To reduce this deficit, deaf and hard-of-hearing infants and children are sometimes taught the relationship between lip movement and speech sounds in multi-modal ways. One such modality is Cued Speech.

Cued Speech was invented in 1967 by Dr. R. Orin Cornett at Gallaudet University (LaSasso, Crain, & Leybaert, 2010). Cornett (1992) defined Cued Speech as "a visual communication system designed for use with and among hearing-impaired people…it utilizes eight handshapes, placed in four different locations near the face, to supplement….spoken language [through] vision alone" (p. 17). The original purpose of Cued Speech was to give deaf and hard of hearing children manual access to spoken language at the phoneme level. Various combinations of

handshapes and placement represent each of the 45 distinct phonemes in the English language, as Figure 1 illustrates.

Figure 1

Cued Speech Chart



(cuedspeech.org, 2014)

It should be noted that Cued Speech should not be confused with sign language. Sign language, such as American Sign Language (ASL), is a form of communication that can stand on its own where signs may represent whole words or phrases. Speech or verbal output is not required to use ASL. Cued Speech, however, is a spoken communication supplement. Users of Cued Speech must accompany the hand signals with verbal output. This is because many sounds are cued using the same hand shape and placement combinations, the difference lying in how the sound looks when spoken (i.e. it is a system used in conjunction with lip reading, hence placements near the lips).

Cued Speech offers a direct connection to literacy skills by allowing a visual representation of the phonemes of the language system. In order to learn to read, children need access to the sound system of their language. However, some children are not able to do this successfully through audition, but have greater success through the implementation of a visual or auditory-visual system. Cued Speech grants deaf and hard-of-hearing children visual access to that sound

system, which enhances their phonological awareness and as research has shown, increases their literacy abilities, which could be considered similar to that of typically hearing peers (Movallali & Rafi, 2012).

Koo, Crain, LaSasso, and Eden (2008) studied the effect of communication modality on phonological awareness skills and sequential recall of linguistic items in deaf and hearing children of different communication backgrounds. Participants for this study included 51 subjects from the Washington, D.C. area. Fourteen participants were deaf, native users of American Sign Language (ASL), 9 participants were deaf users of Cued Speech, 8 participants were deaf oral users of English, 10 participants were hearing native users of ASL, and 10 participants were hearing native English speakers. All deaf participants were either born deaf or became deaf before reaching the age of 2 years and exhibited a loss greater than 85dB HL. Participants were tested for an intelligence quotient (using the Weschler Abbreviated Scale of Intelligence), word identification fluency (using the Test of Silent Word Reading Fluency), reading comprehension (using the Passage Comprehension subtest of the Woodcock-Johnson III), phoneme detection (using the Phoneme detection test), and memory (using the Spatial Span subtest from the Wechsler Memory Scale-III and the Wechsler Adult Intelligence Scale-III Digit Span and the Visual Version of the Digit Span). Data was analyzed using one-way ANOVAs. Results indicated significant differences between groups in the areas of reading comprehension, short-term memory, and phonemic awareness, with deaf ASL participants scoring the lowest across assessments. Scores attained by the deaf Cued Speech and deaf oral participants were not significantly different from each other or from the hearing participants. Results of this study help to solidify the notion that Cued Speech enhances phonemic awareness skills on par with that of typically developing children. Outcomes of this study suggest that Cued Speech may help

facilitate the development of academic and cognitive skills to the competency level of typically developing learners.

Bouton, Bertoncini, Serniclaes, & Cole (2011) assessed the reading and reading-related skills of deaf children with cochlear implants. Nine children had exposure to Cued Speech. The abilities of the children with cochlear implants were compared to two control groups of hearing children. One group was matched by chronological age, the other by reading level. Participants for this study included 8 male and 10 female children, ages 7 years, 11 months to 11 years, with cochlear implants. All children had been implanted at least 5 years. Participants were assessed on a phonemic awareness task of similarity judgment (e.g. name three pictures and indicate the two that began with the same sound), phonological short-term memory word span task (e.g. repeat a set of phonologically similar words and another set of phonological dissimilar words), and a reading task (e.g. 30 pseudo words and 30 irregular words read aloud). Performance scores of each task were compared across groups. Results of this study showed that exposure to Cued Speech affected performance across all assessments. The Cued Speech exposure group scored similar to that of both hearing control groups. Findings of this study further demonstrate the phonological benefit of Cued Speech is comparable with that of auditory benefit experienced by typically hearing children. Outcomes of this study suggest Cued Speech can be an adequate supplement to the development of phonemic awareness and eventual reading skills.

Lasasso, Crain, and Leybaert (2003) investigated the effects of Cued Speech exposure on rhyme generation in deaf students. Participants for this study included 20 prelingually deaf and 10 hearing individuals ages 16 to 23 years of age. Participants were divided into groups depending on their previous experience with Cued Speech; groups were either deaf cuers (DC), deaf non-cuers (DNC), or hearing. Participants were given a rhyming test packet containing 54

target words. The task was to write as many rhyming words as possible to each target word. Responses were scored based on the number of total words, number of nonwords, and the number of real words. Based on the number of rhymes produced, the raw score rankings (of highest to lowest) were hearing, DC, and DNC, with no significant difference between the DC and DNC groups. However, the DNC group scored significantly lower than the hearing group. The hearing group and the DC produced more correct responses (e.g. real word responses) than the DNC group. The DNC group showed a pattern of producing more orthographically similar words, despite if it created a real word or not. Thus, the Cued Speech group was able to produce a variety of orthographically different rhymes similar to that of the hearing group (e.g. go, though, throw). Considering there was no significant difference between the scores of the hearing group and the DC group (and the significant difference between the DNC group and hearing group), Cued Speech could be attributed to the DC group's rhyming success and similar performance to that of the hearing group. Sterling-Orth (2004) identified rhyme awareness as part of the umbrella of phonological awareness skills. The study conducted by Lasasso, Crain, and Leybert (2003) demonstrate the influence Cued Speech can have of rhyming awareness, thus enhancing phonological awareness.

Rationale

Reading success is closely related to academic success. Phonemic awareness skills are foundational for literacy skills, which must be explicitly taught for most children (Ehri, Nunes, Willows, Schuster, Yaghoub-Zadeh, & Shanahan, 2001; National Reading Panel, 2000; Bear & Barone, 1998, Wagner, 1988; Anthony & Francis, 2005, Hulme, & Snowling, 2012, Levag, Solveig, & Hulme, 2012). Research has shown that visual supports successfully supplement phonemic awareness training (Dale and Hayden, 2013; Gardner III, et al., 2013; Gilbert &

Swiney, 2007; Hulme, et al., 2012; McIntyre, Protz, & McQuarrie, 2008). Gardner, Cihon, Morrison, & Paul (2013) found that visual systems such as visual phonics provided a novel way for students, even those with special educational needs, to remember and apply the rules associated with phonemic awareness skills. In addition, Cued Speech has been shown to be effective in teaching phonological awareness skills to children who are deaf and hard-of- hearing (Koo, Crain, LaSasso, and Eden, 2008; Bouton, Bertoncini, Serniclaes, & Cole, 2011; LaSasso, Crain, and Leybaert, 2003).Children who are deaf or hard-of-hearing are at risk for deficits in literacy; statistics show that children who are deaf rarely read past a 4th grade level. However, Koo, Crain, LaSasso, and Eden (2008) found Cued Speech enhanced the phonemic awareness skills of children who are deaf and hard-of-hearing equal to that of the hearing control group. Thus, Cued Speech could be a visual support system used to help low-achieving readers strengthen their phonemic awareness skills. No research is available on the effects of Cued Speech for the development of phonemic awareness with typically developing children. The purpose of this study is to investigate the effects of Cued Speech on phonemic awareness skills on identified low-achieving reading students in a regular education classroom.

Research Questions

1. Following phonemic awareness intervention, is there a significant difference between groups (i.e., no intervention, phonemic awareness training auditory only, and phonemic awareness training with Cued Speech) on pre- and post-testing scores for the Phonological Awareness Test-2?
2. Is there a significant difference between pre- and post-intervention scores within the intervention groups:
    a. No intervention?

b. Auditory only?

c. Cued Speech?

3. Do 1st grade students show greater gains in phonemic awareness skills following phonemic awareness training paired with Cued Speech compared to:

a. No intervention?

b. Auditory specific phonemic awareness training?

Methods

The purpose of this study was to examine the effects of Cued Speech on a phonemic awareness training program. This effect was measured via the change in phonemic awareness skills as measured by pre- and post-study scores on the Phonological Awareness Test 2 (PAT-2). Participants were matched based on results obtained on the Peabody Picture Vocabulary Test 4 (PPVT-4) to form three groups: no treatment (NI), auditory only training (AO), and phonemic awareness training with Cued Speech (CS).

Participants

Participants for this study were typically developing 1st grade students that attended a central Illinois elementary school. Students from four different classrooms were recruited. Each classroom teacher identified low-achieving readers based on daily classroom performance in their respective classroom (e.g. reading activities in class, reading levels, and phonological awareness skills). Consent forms were sent home with each prospective participant, signed, and returned to the classroom teacher (see Appendix B). In addition, prior to assessment and intervention, participants were asked to give verbal consent to participate in the study. A total of 33 permission slips were returned for 19 males and 14 females, ranging in age from 6 years-5 month to 7 years- 3 months of age (see Table 1). Participants who achieved a raw score of 9 or 10 on four or more subtests of the PAT-2 were not included in this study because they would have no gains to show via the assessment. Before final testing, one participant in the No Intervention research group moved out of the district and did not complete the study. Initial scores from this participant were not included in any results analysis. A total of 26 students completed intervention and testing measures. The following table summarizes the division of participants into the research groups.

Table 2

Classroom Information

Intervention Group	Number of Students	Gender Breakdown (males/females)
No Treatment (NT)	8	5/3
Auditory Only (AO)	9	2/7
Cued Speech (CS)	9	3/6

Instrumentation

Participants were administered the Peabody Picture Vocabulary Test 4 (PPVT-4). Scores from the PPVT were used to ensure participants were matched after being divided into one of three groups: no treatment (NT) group, auditory only training (AO), and phonemic awareness with Cued Speech (CS) group. Groups consisted of an approximate even number of students from each classroom to control for teacher-bias.)

PPVT-4. The PPVT-4 is a standardized assessment that evaluates one-word receptive vocabulary skills. The child is presented with four different pictures and prompted by the clinician (e.g. "show me cat") to identify the picture that matches the stimulus word. The test requires a pointing response to pictured stimuli presented in a field of four. The PPVT-4 also provides a cognitive baseline, as it has been shown to correlate with intelligence (IQ scores) (Dunn & Dunn, 2007). Scores obtained were used to match participants by performance levels into one of the various research groups (i.e. scores were used to insure equal aptitude across research groups). Research groups contained similar scoring students across classrooms. The NT group averaged a standard score of 104, the AO group 102, and the CS group 107. A detailed summary of PPVT scores across groups and participants is located in Appendix C.

PAT-2. The PAT-2 is a phonological and phonemic awareness test. The *Segmentation*, *Isolation*, *Deletion*, and *Blending* subtests were administered at the phoneme level. Scores on the PAT-2 represent the participant's ability to correctly perform the tasks in each subtest. The *Segmentation* subtest required participants to separate sounds in words (e.g. tell me all the sounds in the word "cat"), *Isolation* subtest required participants to identify initial, medial, and final sounds in words (e.g. what is the first sound in "cat"), *Deletion* subtest required participants to eliminate a sound in a word and identify the remaining word (e.g. say "cat" without the /k/ sound), and *Substitution* required participants to replace phonemes in words using manipulatives (e.g. change the word "top" to "tap') . The PAT was administered pre-and post-intervention to document baseline skills and progress made by each participant.

Course of Treatment

Intervention was provided outside the classroom for the AO and CS groups twice a week for 20 minutes over the course of 6 weeks. The AO group was seen first, followed by the CS group. The NT group received no additional intervention and remained in the classroom for traditional classroom instruction. The AO group received phonological awareness intervention with lesson plans explicitly focusing on the skills of blending, segmenting, and deleting phonemes. The CS group intervention consisted of the same lesson plan as the AO group, with the addition of Cued Speech; a visual representation of target phonemes. Initially, the clinician explained to the students in the CS group that hand signals called cues would be used to represent the sounds in the words during each lesson. Students were introduced to each hand sign, but not required to learn the Cued Speech system in its entirety. However, students were encouraged to follow along with the clinician's hand signals. Table 2 summarizes the treatment groups and intervention approaches.

Table 3

Intervention Design

Group	Intervention Description	Location
No Treatment (NT)	No intervention received	In-classroom
Auditory Only (AO)	Phonological awareness lesson (auditory only feedback)	Pulled out of classroom
Phonological Awareness with Cued Speech (CS)	Phonological awareness lesson with incorporated Cued Speech models	Pulled out of classroom

Intervention Plan

Specific skills identified as being developmentally appropriate and essential to academic success at the 1st grade level were isolation, segmentation, deletion, and substitution. Each week's intervention methods/materials were derived from the *Sourcebook of Phonological Awareness Activities: Children's Classic Literature* and *A Sound Start: Phonemic Awareness Lessons for Reading Success.* Isolation required participants to identify either the first, middle, or final sound in words, segmentation required the participant to separate and identify sounds in words, deletion required participants to identify a word if one sound was omitted, and substitution required each participant to replace a given sound in a word with a different sound to create a new word. Each skill were targeted for 3 sessions. For the CS group, clinician feedback to the student incorporated the cued speech (e.g. target word cued back to the student). Materials included a beach ball, picture cards, colored wooden cubes, and music clips. Table 3 outlines the intervention schedule. A more detailed lesson plan is located in Appendix C.

Table 4

Intervention and Skills Targeted

		Skills Targeted
Week 1	Session 1	Isolation –Initial Phoneme
	Session 2	Isolation –Final Phoneme
Week 2	Session 1	Isolation – Middle Phoneme
	Session 2	Segmentation -CVC words
Week 3	Session 1	Segmentation of CVCC words
	Session 2	Segmentation of CCVC words
Week 4	Session 1	Deletion of initial phoneme
	Session 2	Deletion of final phoneme
Week 5	Session 1	Deletion- Initial/Final phoneme
	Session 2	Substitution – Initial Phoneme
Week 6	Session 1	Substitution- Medial Phoneme
	Session 2	Substitution- Final Phoneme

Data

Data was collected pre- and post-intervention via the PAT-2. The statistical differences between pre- and post-intervention overall raw scores and subtest scores within groups and between groups were analyzed by ANOVA. Results were compared between groups, within groups, and across participants. During each intervention session, data was also taken for each participant. Data measured in each session gauged the participant's understanding of the

materials presented (i.e. responses to verbal and picture prompts). To check reliability and validity of intervention and scores obtained, 25% of the intervention sessions were shadowed by the faculty members of the thesis committee. Independent data was collected and compared to the primary clinician's. Any discrepancies in data collection were discussed until both parties reached a conclusion about the participant's response to a particular prompt. Intervention was found to be valid and consistent across research groups and reliability was 98%. In addition, blind evaluators (graduate and undergraduate students) were recruited from the Eastern Illinois University (EIU) Communication Disorders and Sciences (CDS) department to administer the post-intervention assessments to eliminate researcher bias.

Results

The current study researched the effect of Cued Speech on phonemic awareness intervention with 1st grade students compared to 1st grade students who received either no intervention or auditory only phonemic awareness intervention. Data was collected pre- and post-intervention using subtests of the PAT-2. Tables 5-7 in Appendix E summarize each participant's pre- and post-intervention PAT-2 raw scores.

Pre- versus post-intervention scores on the PAT-2 were explored using an ANOVA analysis. No significant difference was found between the three intervention groups on the overall PAT-2 scores. However, upon further analysis, significant differences within groups were noted between the pre- and post-intervention scores on various individual subtests. In addition, when comparing average gains between groups, differences were also observed.

Results Within Groups

No intervention (NI). A paired-samples *t* test was conducted to evaluate changes in PAT-2 scores within the NT group. No significant difference was found overall between the pre- and post-intervention test scores, $t\,(7) = -2.29$, $p>.05$. However, a significant difference was found for the Medial Phoneme Isolation subtest, $t\,(7) = -.89$, $p<.05$.

Auditory only (AO). A paired-samples *t* test was conducted to evaluate changes in PAT-2 scores within the AO group. No significant difference was found overall between the pre- and post-intervention, $t(8) = -1.46$, $p>.05$. However, a significant difference was found for the Final Phoneme Isolation subtest, $t\,(8) = -2.67$, $p<.05$.

Cued Speech (CS). A paired-samples *t* test was conducted to evaluate changes in PAT-2 scores within the CS group. A significant difference was found overall between the pre- and post-intervention scores, $t\,(8) = -2.76$, $p<.05$. Significant differences were also found for the

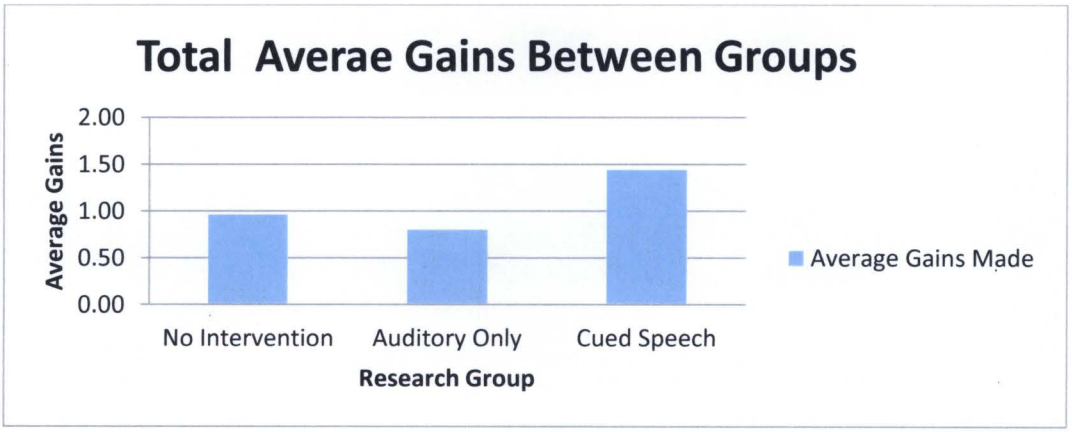
Medial Phoneme Isolation, t (8) =-2.59, p<.05, and Deletion, t (8) = -4.46, p<.05, subtests. The CS group made more gains in more subtests and overall when compared to the other intervention groups.

Between Groups Comparison

Average gains were calculated by subtracting the pre - from the post -intervention PAT-2 raw score for each subtest. Each of these gains was combined to calculate a numerical value for the gains made in each group. The NI group made an average gain of +0.96, AO an average gain of +0.80, and CS an average gain of +1.44. Overall the CS group made more gains compared to the NI and AO groups. Average gains were calculated by combining the average gains made in each subtest and averaging them together. The following figure summarizes total average gains made.

Figure 2

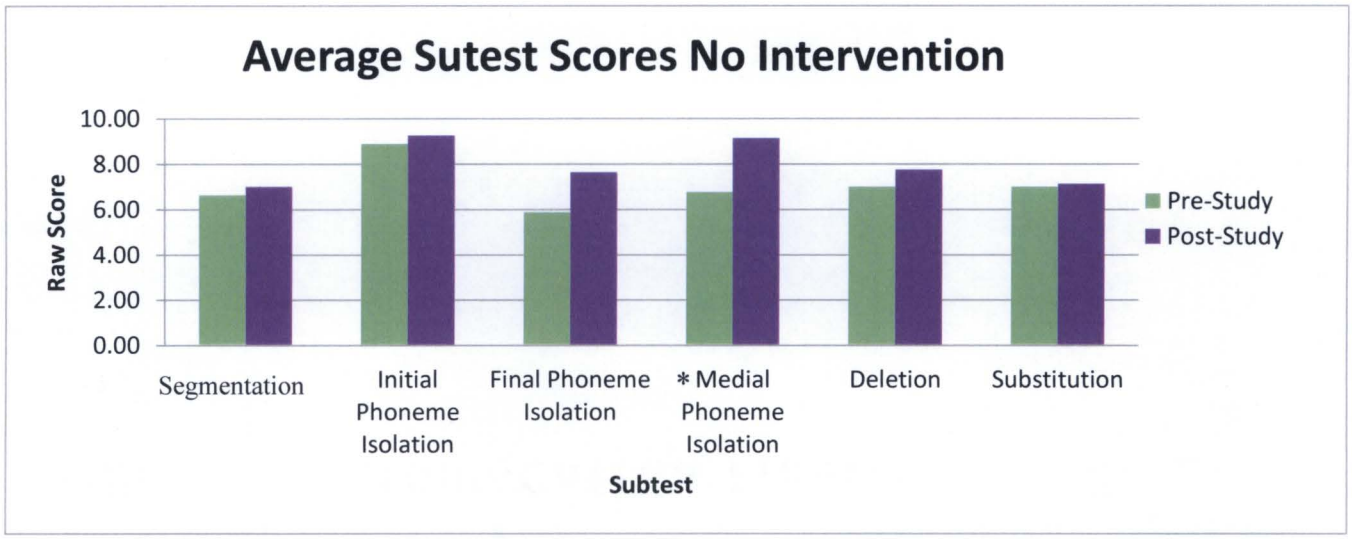
Total Average Gains Between Groups



Figures 3, 4, and 5summarize the average gains made by each group for each subtest. The total gains are represented in Figure 2 above.

Figure 3

Average Subtest Scores No Intervention

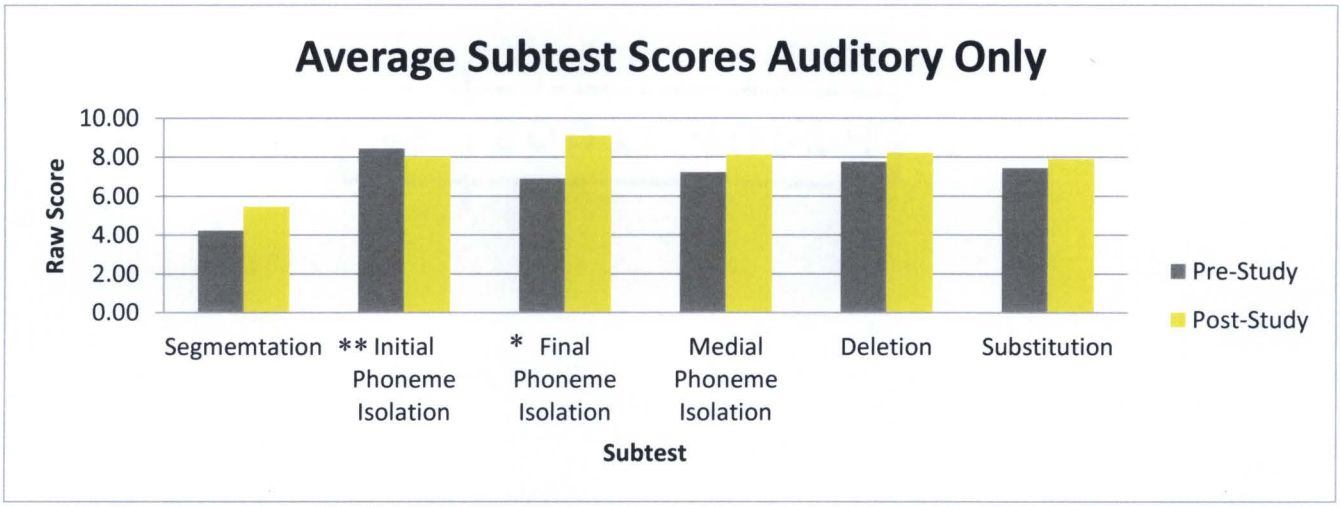


**significant change*

The NI research group scored an average of 6.63 on *Segmentation* pre-study and 7.00 post-study (+0.37), *Initial Phoneme Isolation* pre-test average score was 8.88 and post-test was 9.25 (+0.37), *Final Phoneme Isolation* pre-study average score was 5.88 and 7.63 post-study (+1.75), *Medial Phoneme Isolation* average scores were 6.75 pre-study and 9.13 post-study (+2.38), *Deletion* average scores were 7.00 pre-study and 7.75 post-study (+0.75), and *Substitution* average scores were 7.00 pre-study and 7.13 post-study (+0.13). Overall, an average gain of +0.96 was seen across subtests between pre- and post-study test scores.

Figure 4

Average Subtest Scores Auditory Only

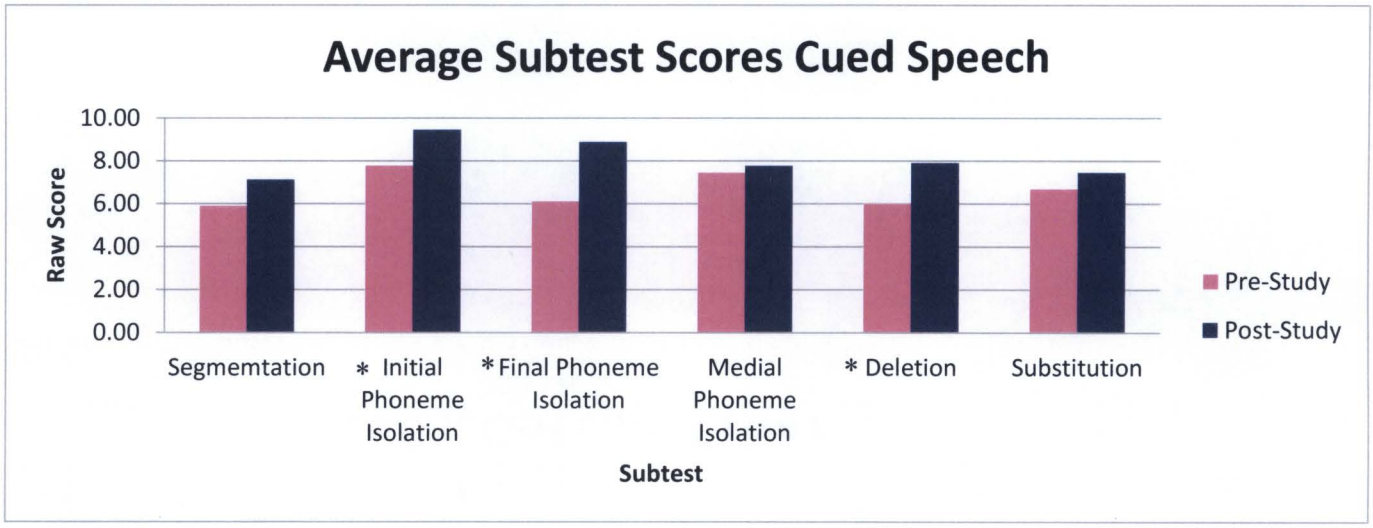


**significant change ** negative change*

Average scores of the *Segmentation* subtest were 4.22 pre-study and 5.44 post-study (+1.22), *Initial Phoneme Isolation* average scores were 8.44 pre-test and 8.00 post-test (-0.44), *Final Phoneme Isolation* average scores were 6.89 pre-study and 9.11 post study (+2.22), *Medial Phoneme Isolation* average scores were 7.22 pre-study and 8.11 post-study (+0.89), *Deletion* average scores were 7.76 pre-study and 8.22 post-study (+0.46), and *Substitution* average scores were 7.44 pre-test and 7.89 post-test (+0.45). Overall an average gain of +0.8 was observed across subtests between pre- and post-study test scores. This gain of +0.8 was the smallest gain of the three research groups.

Figure 5

Average Subtest Scores Cued Speech



**significant change*

Average scores for the *Substitution* subtest were 5.89 pre-study and 7.11 post study (+1.22), *Initial Phoneme Isolation* average scores were 7.78 pre-study and 9.44 post-study (+1.66), *Final Phoneme Isolation* average scores were 6.11 pre-study and 8.87 post study (+2.76), *Medial Phoneme Isolation* average scores were 7.44 pre-study and 7.76 post-study (0.32), *Deletion* average scores were 6.00 pre-study and 7.89 post-study (+1.89), and *Substitution* average scores were 6.67 pre-study and 7.44 post-study (+0.77). Overall a gain of +1.44 was observed between pre- and post-study test scores. The gain of +1.44 was higher than the other two research groups. Individual participant test scores are located in Appendix E.

Discussion

The purpose of this study was to examine the effects of incorporating Cued Speech into a phonological awareness training program for 1st grade students who were low achievers in reading. This study investigated potential differences between groups on post-intervention scores, change between pre- and post-intervention scores, and compared gains of the CS, NI, and AO groups. Although no significant difference between groups was found, some significant gains were seen in individual subtests in each intervention group. However, when comparing average raw score gains, the CS group made the most progress between pre- and post-testing. Findings of this study indicated that all three intervention groups made gains in PAT-2 scores. Overall, all the participants in all groups seemed to do better with isolation skills in general. These gains could be attributed to a curricular focus on this skill in particular compared to other skills.

Although the NI group did show gains, the gains made were less than the CS group. This could suggest that a multimodality supplement added to effective teaching and appropriate curriculum led to an improvement in phonemic awareness over and above growth fostered by classroom instruction.

The AO group also made fewer gains than the CS group. Previous research has shown that students will make gains in explicitly taught skills when participating in a phonemic awareness training program. The results of the current study support the research that has shown that the use of visual systems is a more powerful teaching tool than solely teaching skills auditorily. For example, in the research of McIntyre, Protz, and McQuarrie (2008) and Gardner, Cihon, Morrison, & Paul (2013) it was found that the LiPS program, another multisensory approach to phonemic awareness learning, enhanced the skills of at risk readers more so than

their not at risk counterparts. Such findings suggest multisensory modality teaching is effective for the at risk populations. In addition, Gardner, Cihon, Morrison, & Paul (2013) found that multisensory modalities (e.g. visual phonics) provided novel ways to remember and apply phonemic awareness skills. Such findings can help explain the success of the CS group: multisensory approaches enhanced their success. This was seen in one participant from the CS group, who by the second and third sessions was attempting to cue back to the clinician while participating in the intervention activities. In this instance, Cued Speech mimicked the effects of other recognized phonemic awareness training programs, such as LiPs and visual phonics.

Previous research has also documented the benefit of Cued Speech on the phonemic awareness skills of deaf students (Koo, Crain, LaSasso, and Eden, 2008; Bouton, Bertoncini, Serniclaes, & Cole, 2011; Lasasso, Crain, and Leybaert, 2003). The current study provided preliminary evidence to the benefit of Cued Speech to a different population of students – those who are low achieving readers in first grade. The results of the current study, similar to the results of Lasasso, Crain, and Leybaert (2003), supported the claim that Cued Speech can enhance phonemic awareness skills in students exposed to it. Students in the CS group on average improved more than students in the other groups. In addition, in the current study, one participant (#23) achieved a standard score of 75 (see Appendix C) and was considered one of the lower achieving students in her class. Initial PAT-2 raw scores were lower than others in the CS group. However, her post-intervention PAT-2 scores, as well as processing skills noted during her post-testing (e.g. clinician noted her talking out-loud to reach her answer, less impulsive in answering), showed an increase in her understanding of specific phonemic awareness skills (e.g. Substitution, Isolation) (See Appendix E). Although most of her scores

were still below that of the other participants, she was able to "catch-up" in the Initial Isolation subtest, an early phonemic awareness skill in terms of development.

Clinical Implications

Results of this study suggest that Cued Speech enhances learning of phonemic awareness skills and further supports the use of visual supplements in phonemic awareness training. In the Response to Intervention (RTI) approach implemented in most schools (ASHA, 2015), students could benefit from CS taught in either Tier 1 or 2 in the classroom or small groups. Research has shown that multisensory systems and CS help low-achieving or at-risk students in 1st grade classrooms. Implementation of CS (or another multisensory system incorporating visual cues) in classroom phonemic awareness lesson, taught either by the school SLP or classroom teacher, could provide the extra support those students need to catch up with typically achieving peers. Research has shown visual phonics to be easily adaptable to the classroom setting and meet the needs of various students (Gardner, Cihon, Morrison, & Paul, 2013). CS is another system that could potentially be equally adaptable and useable in the classroom.

Although future research is needed with larger participant numbers to validate the use of Cued Speech in phonemic awareness intervention programs or with incorporating Cued Speech into the regular education classroom, the preliminary results of the current study warrant the investigation of field use of CS. With reading standards becoming more high-level with each passing grade level, at-risk students have the potential to fall further behind. CS can provide a medium to help build specific reading skills keeping students from falling into the Tier 3 category or needing more intensive services. The results of this study support the use of CS or visual supports in phonemic awareness teaching and intervention.

Strengths of the Study

The present study investigated the effect of Cued Speech on phonemic awareness skills of low achieving 1st grade readers. The methodology of the current study allowed for Tier 2 styled intervention to specifically target various phonemic awareness skills. This type of setting, as opposed to large group or classroom style teaching allowed for a more intimate and focused teaching setting, which ultimately benefited the students better than a larger group setting. For example, one of the participants in the CS group was able to cue back to the clinician by the end of the intervention cycle, showing she had a positive response to CS, which could have benefited her in post-intervention testing. Also, raw scores were used to measure the progress of each student. Raw scores proved to be more sensitive that standard scores in measuring gains made by each student and group. A majority of the students scored within the average range of standard scores, thus less progress would have been shown compared to raw scores. Additionally, experimenter bias was controlled by the use of different individuals administering the pre- and post-intervention assessment. Graduate and undergraduate, and faculty from the communication disorders and sciences department at Eastern Illinois University administered the assessments.

Limitations and Future Research

Although results of this study were promising, several limitations contributed to the results. One such limitation was the number of participants used. Intervention group sizes were small and could have impacted the statistical analysis of the data. For further investigation, it is recommended that a larger number of participants be used. Statistical analysis of data would be stronger. In addition, larger groups of participants would allow for greater generalization of results.

Another limitation of the study could have been intervention design. The CS and AO groups had 9 participants in each and had intervention for 20 minutes twice a week. Since the students required individual feedback on their responses to the clinician's prompts, a smaller group would have been more efficient and allowed the clinician to give more feedback and examples, which could have produced more significant results. Also, duration and intensity are important factors to consider when conducting intervention. For future research, in addition to smaller group sizes (e.g. 3 groups of 3 instead of 1 group of 9), increasing the number of sessions per week might also be beneficial. All of the afore-mentioned factors could have altered the structure and design of the group intervention and could have potentially produced better results.

Another suggestion for future research would be to integrate Cued Speech intervention into regular classroom education. Cued Speech has been shown to help in developing phonemic awareness skills. More research is needed to investigate if Cued Speech can be established in the regular education classroom as a preventative teaching strategy. Research has shown Cued Speech to be beneficial, and it could potentially enhance phonemic awareness skills taught in the regular education classroom.

Furthermore, to investigate the effects of CS intervention on later reading achievement, a longitudinal study is recommended. If a student receives CS intervention in early elementary years (e.g. 1st grade), research would be needed to measure the achievement of that student in later elementary grades (e.g. 4th or 5th grades). This study provides preliminary evidence of potential success; however, more investigation is needed to measure the longevity of potential success. All are suggestions to further the knowledge of the effects of CS on academic, specifically reading, achievement of students exposed to it.

Conclusions

Currently, there is little research to bridge the gap between Cued Speech, use in populations other than the deaf and hard-of-hearing, and phonemic awareness skills for those other populations. However, research has shown the need for explicit phonemic awareness instruction which incorporates the use of multimodality teaching strategies (Fazio, 1997; Joshi, Dahlgren, & Boulware-Gooden, 2002; Oakland, et al., 1998). By establishing a foundation in phonemic awareness skills, students are more likely to be academically successful and develop strong reading skills (Ehri, Nunes, Willows, Schuster, Yaghoub-Zadeh, & Shanahan, 2001; National Reading Panel, 2000; Bear & Barone, 1998; Wagner, 1988; Anthony & Francis, 2005, Hulme, & Snowling, 2012; Levag, Solveig, & Hulme, 2012).

The results of the current study provide preliminary evidence that Cued Speech can be modified and used with students who are low-achieving in reading to improve phonemic awareness skills. Although further research is needed to fully understand the potential of incorporating CS into the classroom or small group settings, CS could provide an alternative means to establish a strong phonemic awareness foundation in students.

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Appendix A

IRB Approval

September 30, 2014

Jessica Phillips
Communication Disorders and Sciences

Thank you for submitting the research protocol titled, "The Effects of Cued Speech on Phoneme Awareness Skills of Typically Developing 1st Graders" for review by the Eastern Illinois University Institutional Review Board (IRB). The IRB has approved this research protocol following an expedited review procedure. IRB review has determined that the protocol involves no more than minimal risk to subjects and satisfies all of the criteria for approval of research.

This protocol has been given the IRB number 14-116. You may proceed with this study from 9/30/2014 to 9/29/2015. You must submit Form E, Continuation Request, to the IRB by 8/29/2015 if you wish to continue the project beyond the approval expiration date. Upon completion of your research project, please submit Form G, Completion of Research Activities, to the IRB, c/o the Office of Research and Sponsored Programs.

This approval is valid only for the research activities, timeline, and subjects described in the above named protocol. IRB policy requires that any changes to this protocol be reported to, and approved by, the IRB before being implemented. You are also required to inform the IRB immediately of any problems encountered that could adversely affect the health or welfare of the subjects in this study. Please contact me, or the Compliance Coordinator at 581-8576, in the event of an emergency. All correspondence should be sent to:

Institutional Review Board
c/o Office of Research and Sponsored Programs
Telephone: 581-8576
Fax: 217-581-7181
Email: eiuirb@www.eiu.edu

Thank you for your assistance, and the best of success with your research.

Richard Cavanaugh, Chairperson
Institutional Review Board
Telephone: 581-6205
Email: recavanaugh@eiu.edu

Appendix B

Parental Consent Forms

Greetings! My name is Jessica Phillips and I am a graduate student at Eastern Illinois University studying speech-language pathology. For a master's thesis, I am currently researching the effects of Cued Speech on the development of phonological awareness skills of typically developing 1st grade students.

- **Purpose of Study**

Phonological awareness defines our ability to think about the sounds of the English language and involves such skills as blending sounds into words, segmenting sounds in words, and rhyming. When a child then learns to read, these skills are translated to printed sounds and words and are foundational skills needed to be successful readers. Cued Speech is a visual system that represents the sounds of the English language through hand shapes and hand placements around the mouth. It is hypothesized that using a visual system, such as Cued Speech, to teach phonological awareness (a primarily auditory skill) will strengthen students' phonological awareness abilities; thus, helping to develop reading skills. There is minimal to no risk by participating in this study and your child can be withdrawn from the study at any time as per your request.

- **Procedures**

This study will include students from two first-grade classrooms, with one group of students acting as the control group (group A) and the other as the experimental group (group B). Group A will not initially receive Cued Speech instruction. However, group B will receive 20 minutes of Cued Speech instruction twice a week for six weeks during the regular school day. Cued Speech lessons will incorporate specific skills of blending sounds, segmenting sounds, and substituting sounds.

Assignment to the groups is random and will be determined at a later date. All children participating in the study will be tested using the P. J. Test of Receptive Communication and the Blending, Segmenting, and Substitution subtests of the Phonological Awareness Test. These tests will be given pre- and post- study to measure each child's progress.

- **Potential Risks and Discomfort**

There are no psychological or physical risks. If your child refuses to participate in the activities, they will be allowed to participate in another activity and Cued Speech intervention will be attempted at another time.

- **Potential Benefits to Subjects and/or Society**

Participants will have the opportunity to receive Cued Speech instruction to potentially improve their phonological awareness skills. When phonological awareness skills are improved, reading skills may also improve. Professionals in the field will have the opportunity to incorporate Cued Speech into the educational setting, based on evidence from this study.

- **Confidentiality**

Any information that is obtained from this study that can be identified with your child will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of storing observation data in a locked file cabinet at the EIU Speech-Language-Hearing Clinic. When presenting results of the study, pseudonyms will be used to protect the identity of the participants. Test forms will be stored in a locked drawer in Dr. McNamara's office and only available to Jessica Phillips (researcher), Dr. Tena McNamara (faculty mentor) and Dr. Angela Anthony (department chair).

- **Participation and Withdrawal**

Participation in this research study is completely voluntary. If you give permission for your child to participate in this study, you may withdraw your child at any time without consequences.

- **Identification of Investigators**

If you have any questions or concerns about his research, please contact Jessica Phillips or Dr. Tena McNamara at 217-581-2712 or the EIU Speech-Language-Hearing Clinic, 600 N. Lincoln Ave, Charleston, IL 61920.

- **Rights of Research Subjects**

If you have any questions or concerns about the treatment of human participants in the study, you may call or write:

Institutional Review Board
Eastern Illinois University
600 Lincoln Ave.
Charleston, IL 61920
Telephone: (217)581-8576
E-mail: eiuirb@www.eiu.edu

You will be given the opportunity to discuss any questions about your rights as a research subject with a member of the IRB. The IRB is an independent committee composed of members of the University community, as well as lay members of the community not connected with EIU. The IRB has reviewed and approved this study.

If you would like your child to participate in this study, please sign and return the attached permission slip to your child's classroom teacher. If you have any questions or concerns, please do not hesitate to contact me (217-246-5095) or my supervisor, Dr. Tena McNamara (217-581-8488). Also, if you want to know more about Cued Speech, I encourage you to explore the website www.cuedspeech.org.

Sincerely,

Jessica Phillips, B.S.
Communication Disorders and Sciences

I, _____, as a parent of a student at Cumberland Elementary School in Toledo, Illinois, have been contacted in regards to the research study being conducted by Jessica Phillips in conjunction with her graduate thesis.

I give permission for my child, _____, to participate in the study being conducted by Jessica Phillips. I understand what the procedures of this study will entail.

Sincerely,

_____
(Name)

_____
(Date)

Appendix C

PPVT Scores

Intervention Group	Participant	PPVT Standard Score	Group Average
NT	1	108	104
	2	81	
	3	106	
	4	110	
	5	110	
	6	116	
	7	100	
	8	108	
AO	10	112	102
	11	83	
	12	90	
	13	104	
	14	104	
	15	109	
	16	90	
	17	114	
	18	112	
CS	19	96	107
	20	111	
	21	120	
	22	101	
	23	75	
	24	124	
	25	114	
	26	105	
	27	121	

Appendix D

Intervention Procedures by Target Skill

Isolation

- Session 1
  - Initial Isolation
    - Introduction
      - Explain that words are made up of sounds (e.g. cat has three sounds, /k/ /a/ /t/). Today we are talking about the first sound we hear in words. So, in "cat" the first sound is /k/.
        - Verbal feedback and modeling is given to the SO group. Verbal feedback coupled with Cued Speech is given to the CS group. This is done for all activities in all sessions.
    - Skill Practice
      - Activity: Name Game
        - Anyone know the first sound in your name?
        - Have all the participants stand.
        - Clinician calls out various sounds.
        - Participants sit when they hear the first sound in their name called.
      - Activity: Pictures on a Ball
        - Provided 9 different pictures of CVC, CCVC, and CVCC words taped to a beach ball:
        - Each child says first sound of picture when the ball is rolled to them. (individual data point)
          - Verbal feedback and modeling is given to the SO group. Verbal feedback coupled with Cued Speech is given to the CS group.
      - Provided a different set of 9 different pictures of CVC, CCVC, and CVCC words :
        - Pictures are placed in a circle on the floor.
        - Music is played. Participant stands on a picture when music stops and identifies the initial sound.
    - Review initial sounds in words.
- Session 2
  - Final Sounds
    - Introduction

        - Review initial sounds in words. Emphasize today's focus is on final sounds (e.g. Last time we said the first sound in the word "cat" is /k/, today we are talking about sounds at the end of words. Let's think about the last sound in "cat.")
    - Skill Practice
        - Activity: Name Game
            - Anyone know the last sound in your name?
            - Have all the participants stand.
            - Clinician calls out various sounds.
            - Participants sit when they hear the last sound in their name called.
        - Activity: Shopping Bag
            - Provided a bag full of random items (e.g. glasses, spoons, small toys, writing utensils)
            - Participants take turns pulling an item out of the bag.
            - Each item is named
            - Participant identifies final sound in name of item.
        - Activity: Musical Chairs/steps
            - Provided a different set of 9 different pictures of CVC, CCVC, and CVCC words :
            - Pictures are placed in a circle on the floor.
            - Music is played. Participant stands on a picture when music stops and identifies the final sound.
    - Review final sounds in words
- Session 3
    - Middle Sounds
        - Introduction
            - Review that words have initial and final sounds (e.g. what is the first sound in "cat"? The last sound?). Emphasis will be made that this session's target sound is the middle sound (for CVC words).
        - Skill Practice
            - Activity: Pictures on a Ball
                - Provided 9 different pictures of CVC words taped to a beach ball:
                - Each child says middle sound of picture when the ball is rolled to them. (individual data point)
            - Activity: Musical Chairs/steps
                - Provided a different set of 9 different pictures of CVC words
                - Pictures are placed in a circle on the floor.

- Music is played. Participant stands on a picture when music stops and identifies the initial sound.

- Review Initial, Final, Medial Sounds

Segmentation

- Session 1 (CVC)
  - Introduction
    - Review how words are divided into sounds. Explain that today's task is to separate the sound in words (e.g. what are all the sounds in the word "cat"?)
  - Skill Practice
    - Activity: Pictures on a ball (as described above): children segment the sounds of their picture (individual data)
    - Activity: Segmentation Beads:
      - Participants string beads on pipe cleaners and use them to represent sounds in words (individual data).
      - Clinician will give each participant a picture. They will identify the picture and segment the sounds.
  - Review segmentation of CVC words
- Session 2 (CVCC)
  - Introduction
    - Review Sounds in words – using CVC (e.g. tell me the sounds in "cat" then CVCC words (e.g. tell me the sounds in "lamp")
  - Skill Practice
    - Activity: Blocks: each participant receives a set of blocks and a different picture card. They will segment the word they have (individual data, 3 different pictures)
    - Activity: Musical (Feet) Chairs (as described above): children segment sounds of words they stand on (individual data)
  - Review segmentation of CVC and CVSS word forms
- Session 3 (CCVC)
  - Introduction
    - Review Sounds in words- CVC, CVCC, CCVC
  - Skill Practice
    - Activity: Using Segmentation beads from Session 1, children will be given 3 pictures to segment. (Individual Data)
    - Activity: Pictures on a ball: All word forms will be represented. Participant must segment sounds of picture (Individual Data)
  - Review segmenting all word forms

Deletion

- Session 1
  - Initial Sounds
    - Introduction:
      - Review that words have first and last sounds. Ask participants to delete first sound in words (e.g. what sounds are left when we delete /k/ from "cat")
    - Skill Practice
      - Activity: Throw away the sound:
        - Given colored blocks and picture cards, participants "throw away" the initial block (sound) and identify the remaining sounds.
      - Activity: Musical chairs: participant deletes initial sound of CVC word picture he is standing on.
    - Review deleting initial sounds
- Session 2 (Final)
  - Final Sounds
    - Introduction
      - Review first and last sounds in words. Emphasize that today we are throwing away the last sound instead of the first sound. Practice final deletion.
    - Skill Practice
      - Activity: Puzzle: Participants divided into teams of 3.
        - Clinician provides picture puzzle.
        - Participants put picture puzzle together and decide what final sound is.
        - That sound in thrown away (in pretend trash can) and remaining sounds identified.
    - Review final and initial sound deletion
- Session 3 (Initial and Final)
  - Initial and Final Sounds
    - Introduction
      - Review initial and final deletion and practice deleting initial and final sounds
    - Skill Practice
      - Activity: Blocks: eat participant gets picture puzzle and blocks. (individual data). Four puzzles will be completed.
        - Participant throws away phoneme (block) as specified by clinician.

        - Remaining sounds identified
    - Review deletion of initial and final sounds

Substitution

- Session 1
    - Initial sound in CVC, CCVC, CVCC word forms
        - Introduction
            - Review sounds in words (initial, medial, final). Talk about how sounds can be replaced in words to make new ones (e.g. what happens to "cat" if we change /k/ to /b/). Complete group practice to clarify target skill
        - Skill Practice
            - Silly Song Switch
                - Say "Today we are going to take a phrase from a song (book or nursery rhyme) and make a silly sound switch.
                - "Row, row, row, your boat, gently down the stream" and students repeat. • The teacher next says, "Let's switch a new sound for the /b/ in boat. Let's try /g/. What's the new phrase? • Students respond, "Row, row, row, your goat, gently down the stream." • Play continues with the teacher and students giving new sounds for the identified word in the phrase and saying the phrase with the silly switch.
                    - Individual data for each student when they respond with their target sound/word.
        - Review changing initial sounds in words
- Session 2
    - Medial Vowel- CVC, CCVC, CVCC
        - Introduction
            - Review substituting initial sounds and introduce substituting medial sounds (e.g. what happens if we change the /a/ in "cat" to /o/? We get "cot").
            - Talk about middle sounds.
            - As a group, substitute middle sound example words.
        - Skill Practice
            - Activity: Give each student five or six blocks.
                - Provide the students with a picture set.
                - Student must change one cube (sound) to make the "word" match the picture.
            - Activity: Picture puzzle will be provided. Clinician will provide medial sound to substitute

        - Review substituting initial and medial sounds.
- Session 3
    - Final- CVC, CCVC, CVCC
        - Introduction
            - Review substituting initial and medial sounds. Introduce substituting final sounds (e.g. what happens when I change the /t/ in "cat" to /p/).
            - Practice substituting final sounds.
        - Skill Practice
            - Activity: Silly Song activity (as described above) modified for final sounds.
            - Activity: Musical Chairs/steps
                - Student lands on a picture (e.g. "bag")
                - Clinician asks participant to identify picture and change final sound.
        - Review segmentation of all word positions

Appendix E

PAT Score Summaries

Table 5
No Intervention Pre- and Post-PAT Raw Scores

	Segmentation		Initial Isolation		Final Isolation		Medial Isolation		Deletion		Substitution	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
1	5	4	6	9	1	7	3	9	7	9	3	3
2	6	8	10	10	9	10	7	9	6	5	10	7
3	5	5	9	10	1	3	5	9	7	8	5	4
4	6	7	10	10	6	9	8	9	7	7	8	8
5	9	8	7	6	7	6	7	9	6	7	10	8
6	7	10	10	10	7	8	8	9	9	10	3	8
7	5	10	9	10	9	9	8	10	7	9	7	9
8	10	4	10	9	7	9	8	9	7	7	10	10

Table 6
Auditory Only Pre- and Post-PAT Scores

	Segmentation		Initial Isolation		Final Isolation		Medial Isolation		Deletion		Substitution	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
10	6	3	8	9	5	10	8	7	6	9	10	9
11	7	4	10	10	7	9	8	8	7	8	9	8
12	8	5	10	0	9	7	7	7	4	5	8	9
13	0	4	5	40	4	10	8	8	8	7	7	8
14	1	5	10	7	8	10	8	9	9	10	2	10
15	2	4	7	6	8	8	7	7	8	8	7	8
16	0	8	10	10	6	10	2	9	10	10	9	10
17	10	8	8	10	7	8	9	9	8	8	6	0
18	4	8	8	10	8	10	8	9	9	9	9	9

Table 7
Cued Speech Pre- and Post-PAT Scores

	Segmentation		Initial Isolation		Final Isolation		Medial Isolation		Deletion		Substitution	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
19	4	9	1	9	0	10	4	7	6	9	10	9
20	5	10	10	10	9	10	8	9	8	9	8	9
21	9	10	10	10	6	9	8	8	6	8	7	8
22	4	6	8	7	5	9	9	9	6	8	5	7
23	0	0	6	10	0	2	1	2	0	2	0	4
24	7	7	7	9	8	10	8	8	6	9	10	10
25	8	4	10	10	10	9	9	8	7	10	9	8
26	8	9	9	10	8	10	10	8	8	7	8	5
27	8	9	9	10	9	10	10	10	7	9	3	7