Preschoolers with Speech and Language Impairment: Case Studies from a Teacher-Delivered Phonological Awareness Program

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PRESCHOOLERS WITH SPEECH AND LANGUAGE IMPAIRMENT: CASE STUDIES FROM A TEACHER-DELIVERED PHONOLOGICAL AWARENESS PROGRAM

by

Katherine J. Wickham

A Thesis submitted to the Graduate College in partial fulfillment of the requirements for the degree of Masters of Arts Speech-Language Pathology Western Michigan University April 2013

Thesis Committee:

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Past and present research demonstrates early reading success related to phonological awareness (PA) instruction conducted individually or in small groups outside of the preschool classroom. This study investigated the effects of an explicit, intensive and teacher-delivered PA instruction for children with speech sound disorder and language impairment as part of the preschool curriculum. The investigator examined the performance of individual cases in both groups, those who received instruction and the control. Two participants in each of the experimental (E1 and E2) and control (C1 and C2) groups had standardized scores indicating deficits in speech and/or language. These children who received the instruction (E1 and E2) showed improvement in PA, but varied in their response to instruction compared to their typically developing peers. Unlike their typically developing peers, the control children (C1 and C2) made no gains but instead declined on PA skills over time. The findings of these case studies contribute to the existing literature by suggesting that an intensive and explicit, teacher-delivered PA instruction has the ability to yield a noticeable effect on PA development of speech and/or language impaired children. Explicit and intensive, teacher-delivered PA instruction should be examined further in experimental studies with larger samples.
ACKNOWLEDGEMENTS

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Katherine J. Wickham
# TABLE OF CONTENTS

ACKNOWLEDGEMENTS .......................................................................................................................... ii

LIST OF TABLES ...................................................................................................................................... v

LIST OF FIGURES ................................................................................................................................. vi

INTRODUCTION ........................................................................................................................................ 1

  Children with Speech Sound Disorder  
  and/or Language Impairment ........................................................................................................... 5

  Phonological Awareness ....................................................................................................................... 6

  Phonological Awareness with Preschool Children ............................................................................... 7

  Training Phonological Awareness in the Classroom ........................................................................... 8

METHOD ................................................................................................................................................. 12

  School Selection and Teacher Participants ......................................................................................... 12

  Child Participants ............................................................................................................................... 12

  Design .................................................................................................................................................. 13

  Assessment Procedures ....................................................................................................................... 13

  Assessment Administration and Scoring Reliability .......................................................................... 14

  Training for Early Childhood Educators ............................................................................................. 15

  Phoneme Awareness Instructional Program ......................................................................................... 16

  Fidelity .................................................................................................................................................. 17

RESULTS .................................................................................................................................................. 20

  Individual Treatment Results .............................................................................................................. 20

  Experimental Group ............................................................................................................................ 21
    Case E-1 ............................................................................................................................................ 21
Table of Contents-Continued

Case E-2........................................................................................................... 22
Control Group ................................................................................................. 25
Case C-1........................................................................................................... 25
Case C-2........................................................................................................... 26
Gains Made ...................................................................................................... 28
DISCUSSION ................................................................................................... 31
Variability in Improvement............................................................................. 31
Comparison of Experimental vs. Control Participants ......................... 33
Phoneme Blending and Segmentation ......................................................... 35
Explicit Instruction ......................................................................................... 36
Time-efficiency of Instruction ...................................................................... 36
Limitations and Clinical Implications ......................................................... 37
REFERENCES ................................................................................................. 39
APPENDIX ....................................................................................................... 43
BIBLIOGRAPHY ............................................................................................. 44
LIST OF TABLES

1. Weekly PA skills targeted and activities ....................................................... 18

2. Pre-instruction PA probes and post-instruction PA probes................................................................. 21

3. Results for children without speech sound disorder and/or language impairment (Mean and Gains)......................................................... 29

4. Gains made by experimental and control groups......................................................... 30
LIST OF FIGURES

1.1 Phonological Probe Data for Subject 1 of the Experimental Group................................................................. 23

1.2 Phonological Probe Data for Subject 2 of the Experimental Group................................................................. 25

2.1 Phonological Probe Data for Subject 1 of the Control Group ........................................................................ 27

2.2 Phonological Probe Data for Subject 2 of the Control Group ........................................................................ 28
INTRODUCTION

Phonological awareness is the knowledge that a word is comprised of distinct sounds that are separate from and unique to its meaning. An individual word is made up of phonemes, or individual speech sounds; by simply switching one sound in a word, the meaning can be changed. Phonological awareness is an important and crucial building block of early literacy. According to Gillon (2005), phonological awareness includes syllable awareness (e.g., segmenting words into syllables), onset-rime awareness (e.g., perceiving rhyming patterns in words or generating rhyming words), and phoneme awareness (e.g., segmenting words into phonemes). Within phonological awareness, the term phonemic awareness refers to the skills used to recognize individual phonemes and the ability to manipulate those sounds to form new words. Phonemic awareness is highly predictive of later reading and writing success (Gillon, 2004).

Speech sound disorder refers to the behavioral disorder characterized by speech-sound production errors associated with deficits in articulation, phonological processes, and cognitive linguistic processes (Stein et al., 2004). Children with speech sound disorder struggle to understand sound structures and how to manipulate sounds to form words, and often times have difficulty producing speech that is developmentally appropriate. Children with speech sound disorder also experience difficulty with phoneme awareness and are often outperformed by their typical peers (Peterson, Pennington, Shriberg, & Boada, 2009).

Children who have speech sound disorder may lack awareness of individual speech sounds and are thus at risk for difficulty with early reading. Phonological
awareness and the ability to phonologically decode are related to recognition of a word. In order to read a word, an individual must use phonological decoding skills in which they utilize their learned knowledge that a particular sequence of letters represents a word. The ability to decode and encode print simultaneously increases the awareness that words can be divided into sounds (Gillon, 2005). Instructional programs that enhance phonological awareness may be necessary for children who lack phonological awareness skills or who are at-risk for literacy difficulties.

Children with language impairment are also at risk for reading difficulties and are more likely to struggle with reading acquisition due to underlying deficits in phonological awareness and other linguistic skills. Starting in the preschool years, children must learn to develop a systematic approach for assigning meaning to their surroundings. They must find a way to express this meaning through language starting with a lexicon and syntax (i.e., rules that guide sentence structure). According to Catts, Fey, Tomblin, and Zhang (2002), “Reading is a language-based skill, and thus, deficits in language development can negatively affect reading achievement” (p. 1142). Catts (1993) reported that children with language impairment are at a higher risk for developing reading difficulties than children with impairment solely related to articulation or speech sound errors.

Peterson et al. (2009) have shown, however, that when a speech sound disorder is combined with language impairment, the risk for reading difficulties is at its highest. It has also been determined that children with co-occurring speech and language impairment were found to have lower reading performance than children with language impairment alone. By second grade, it was reported that these children with co-occurring
speech and language impairment had fallen well below typical peers in reading achievement. Children with co-occurring speech and language impairment have difficulty with reading because it is an interactive process where knowledge of vocabulary, syntax, story structure, phonological structure, as well as listening comprehension, combine and interact with orthographic knowledge to influence reading performance (Gillon, 2005).

The best predictor of early reading success appears to be phonological awareness skills rather than speech sound disorder, language impairment, or co-occurring speech and language impairment. Phoneme awareness skills, in particular, are the critical foundation for children to be able to separate words into their constituent sounds and decode grapheme correspondences. The difficulty, however, is in making these skills consciously known to the child; often speech-language pathologists who treat co-occurring speech and language impairment may indirectly target phonological awareness knowledge, but do not emphasize the skills and make them explicitly known (Gillon, 2005). Explicit instruction in phoneme awareness for at-risk preschool children may be necessary for subsequent learning of language and in turn early reading abilities. Some research suggests that children with co-occurring speech and language impairment are unable to learn phoneme awareness at a rate equal to their same-aged peers (Hesketh, Dima, & Nelson, 2007). However, according to Gillon (2005), children as young as four years of age with a known expressive phonological impairment can effectively learn skills at the phoneme level.
Although phonological awareness intervention for children with speech sound disorder and/or language impairment has been investigated (Gillon, 2005; Hesketh, Dima, & Nelson, 2007; Justice, McGinty, Cabell, Kilday, Knighton, & Huffman, 2010; Tyler, Gillon, Macrae, & Johnson, 2011; van Kleeck, Gillam, & McFadden, 1998), these studies were conducted in a clinical setting with a speech-language pathologist directing one-on-one or small group instruction. The integration of teacher-delivered, intensive phonological awareness instruction into preschool classroom environments is a topic of interest needing more in-depth research. Case studies of children with speech and/or language impairment that are exposed to this type of instruction exemplify the purpose of this study. According to Carson, Gillon, & Boustead (in press), in order to be considered an effective phonological awareness instruction, time-efficiency is a key consideration. Frequent and intensive sessions are components of time-efficiency, and based on research by Gillon (2005), 20 hours over a 10-week period is considered high-intensity and the optimal level of intensity for instruction focused at the phoneme level. According to Justice, Chow, Capellini, Flanigan, and Colton, (2003), young children who experience multiple risk factors that adversely affect their ability to gain skills leading to emergent literacy may benefit from a more explicit approach to instruction. Engagement in explicit instructional activities is the most efficient route to skill development (Kousoftas et al., 2009). Activities can be designed to target skills necessary for reading that may be compromised for children who are at risk, while also providing more structured opportunities for teacher interaction and feedback (Justice et al., 2003).
Children with Speech Sound Disorder and/or Language Impairment

According to Bird, Bishop, and Freeman (1995) children with speech sound disorder lack awareness of specific phonemes and are at risk for problems with early literacy. In addition, poor articulation, in the majority of children whose impairment is not due to physical impairment, is seen as the persistence of immature phonological processes. Children with speech sound disorder do not produce a full range of phonemes that are age-appropriate, despite being typical in all other aspects of development.

Stackhouse and Snowling (1992) discovered a link between children with speech sound disorder and literacy difficulties. These children did not perform well on phonological awareness tasks and their reading errors were due to an inability to understand the alphabetic principle. According to Wagner and Torgesen (1987), the English alphabetic system conveys language at the phonological level and is a way of visually representing spoken language. Although not all children with speech sound disorder will have difficulty with reading, there does seem to be some correlation between phonological impairment and problems with early literacy and spelling.

Children with language impairment are also at risk for reading difficulties, because these children have trouble with many phonological awareness and linguistic skills. According to Bird et al. (1995), the ability to do phonological awareness tasks, such as segmentation, is a language skill and is distinct from speech sounds and articulation. Furthermore, Bird et al. (1995) went on to state that children with expressive phonological impairments often have broader language problems, and their problems are often associated with difficulty in understanding syntactic structures or vocabulary in
written texts. However, children who are at the highest risk for reading difficulty are those with speech sound disorder and language impairment due to a lack of phonological awareness understanding and expressive language deficits.

**Phonological Awareness**

The foundation for emergent literacy is acquired within the period preceding formal literacy instruction, from birth to around six years of age for most children (Justice et al., 2003). Traditionally, research on stimulating phonological awareness skills has been conducted with typically developing kindergarten, and older, children. Ball and Blachman (1991) implemented a phoneme awareness program with typically developing kindergarten children. Their program was implemented by kindergarten teachers who were trained by the primary researchers. Results indicated that these typically developing children made gains in phoneme segmentation, letter sounds, reading, and spelling. Bird et al. (1995) studied literacy outcomes in children aged 5- to 7-years-old with expressive language impairment. The children were tested on phonological awareness skills and language abilities. Results indicated that children with expressive phonological impairments had extreme difficulty in carrying out phonological awareness tasks such as segmenting and blending, which are pertinent for literacy.

Gillon (2000) investigated the value of an integrated phonological awareness intervention for children aged 5-to 7-years-old who were identified as having language impairment. The children in the study who were language impaired demonstrated deficits in semantic and syntactic development as well as expressive phonological impairments. A phonological awareness program was provided with a focus at the phoneme level;
participants made significant gains in their phonological awareness skills and reading development compared to children in the control group who did not receive phonological awareness instruction. These results indicate this type of instruction may be an effective method to improve phonological awareness, speech production, and reading for children with speech and language impairment.

**Phonological Awareness with Preschool Children**

By teaching phonological awareness skills to preschool children, these children can begin to understand and differentiate between sounds and letters and will then be better prepared to experience success in early reading. Because children with speech and/or language impairments often present difficulties with early literacy, it is important to teach phonological awareness skills to children with speech and language disorders as early as possible (Fey, Catts, & Larrivee, 1995). Carson, Gillon, and Bousted (in press) stated, “PA knowledge allows children to link phonemes to graphemes that in turn support word decoding ability and subsequent reading comprehension” (p. 4). Some research suggests that children with co-occurring speech and language impairment are unable to learn phonological awareness at an equal rate of same aged peers (Hesketh, Dima, & Nelson, 2007); however, according to Gillon (2005) children as young as 4-years-old with a known expressive phonological impairment can effectively learn skills at the phoneme level.

Gillon (2005) conducted a study with 3-and 4-year-old children with moderate or severe speech impairment to determine if gains could be made in phonological awareness and early literacy. The phonological awareness instruction included specific activities to
facilitate phonemic awareness and letter knowledge while simultaneously improving speech. The results of the study indicated that phoneme awareness can be facilitated in children as young as 3-to-4-years of age. Gillon (2005) also found that teaching phonological awareness during the preschool years can result in early reading and spelling success for children with speech impairment.

To demonstrate the importance of phonological awareness as it relates to reading/writing for preschool children, one study involved a direct focus on the following phonological awareness skills: rhyme, alliteration, and phoneme detection. Bryant, MacLean, Bradley and Crossland (1990) found that these phonological awareness skills proved to be powerful predictors of reading and spelling. However, recent studies have shown that rhyme is not a strong predictor of reading and spelling (Muter, Hulme, Snowling & Stevenson, 2004). According to Lonigan, Burgess, and Anthony (2000) phonological sensitivity occurs in the preschool period and research shows that preschool children are developmentally ready to be taught phonological awareness skills.

**Training Phonological Awareness in the Classroom**

Historically, phonological awareness intervention for children with speech and language impairments has been provided at the most intensive level of intervention, where the child received one-on-one or group therapy guided by a speech-language pathologist or special education teacher (Gillon, 2005; Hesketh et al., 2007; Justice et al., 2010; Tyler, Gillon, Macrae, & Johnson, 2011; van Kleeck, Gillam, & McFadden, 1998). This approach allows more individualized focus on the child’s specific weaknesses; however, this style of intervention was implemented only when the child demonstrated
academic failure caused by a reading/language disorder. The child was then removed from the classroom for intervention, thus missing academic instruction. With the 2004 reauthorization of Individuals with Disabilities Education Act (IDEA) implementation of a new model of intervention known as response to intervention (RTI) (Koutsoftas, Harmon, & Gray, 2009) has been authorized. This model for the provision of special education services involves early identification of at-risk children rather than when they demonstrate academic failure. Those children who are not progressing at the same level as same-aged peers would then receive an intermediate level of instruction, such as in small groups with a speech-language pathologist.

RTI also involves monitoring the progress of children within the classroom. According to Kousoftas et al. (2009), progress monitoring is essential to guide instruction and to identify children who need more individualized instruction or who no longer require extra help. Recently, Kousoftas et al. (2009) asked whether or not explicit small group intervention would improve the phonemic awareness skill of beginning sound awareness in individual children. Results showed that small group instruction provided by teachers and speech-language pathologists worked for the majority of the children, as indicated by medium to large effect sizes. This study compared results between children who did and did not qualify for intervention suggesting that this type of instruction does help children gain beginning sound awareness.

Hesketh, Dima, & Nelson (2007) also utilized a small-group, speech-language pathologist-implemented approach in their study. Based on assessment scores, they assigned 4-year-old children who did not yet read and write to two groups, either a
phonological awareness or language stimulation intervention. Both interventions were explicit and provided in small groups by speech-language pathologists. Results indicated that significantly more children improved in the phonological awareness group than the language stimulation group for the majority of measures. For the most difficult tasks such as phoneme segmentation and phoneme manipulation through phoneme deletion or addition, only a few children successfully showed improvement. These findings demonstrate that it is possible to teach phoneme awareness tasks that are more difficult to children who do not yet read and write in a formal sense.

More recently, Carson, Gillon and Boustead (in press) guided a teacher-delivered approach to phonological awareness instruction with 5-year-old children. Children in two classrooms received this phonological awareness program from their teachers. Results indicate that children who received the phonological awareness instruction demonstrated higher level literacy outcomes than the children who followed the typical curriculum. In addition, children with spoken language impairments showed significant improvements in phonological awareness, reading, and spelling. These children were able to benefit from phonological awareness instruction and demonstrated higher level phonological awareness skills including phoneme blending and segmentation. Carson et al. (in press) discussed considerations necessary for a successfully integrated teacher-delivered phonological awareness instruction in the beginning reading curriculum. Time efficiency and duration of the program are key components for successful implementation. Carson et al. (in press) concluded from their study that an intensive, in-classroom instruction was time efficient and successful for this age group. However, further research is needed to
confirm whether this method of intervention implementation would yield the same results with preschool children and in particular, those with speech and/or language impairment.

The response of children with speech and language impairments to phonological awareness instruction provided in their preschool classroom is examined through single case studies in this thesis. Case study methodology is recognized as an important first step in evidence-based practice to determine if an intervention or instructional approach achieves positive outcomes with representatives from a particular population. Teachers delivered phonological awareness instruction that was explicitly and intensively focused at the phoneme level, as a supplement to the regular curriculum. The individual cases with speech and/or language impairment were integrated in the regular preschool classroom. The program was an adaptation of the Gillon Phonological Awareness Training Program (PAT) previously used with children with speech impairment (Gillon, 2005). The instruction was short and moderately-high in intensity at 20 minutes per day, four days a week for 10 weeks. The study examined the following hypothesis: Children with varying levels of speech sound disorder or language impairment would make gains in phonological awareness following the teacher-delivered instruction in the classroom, but would vary in the amount of gain and how much they benefitted from instruction.
METHOD

School Selection and Teacher Participants

Four children between the ages of 4;0 (years; months) and 4;11 were identified from the members of two preschool classrooms. These preschool classrooms were also part of a larger study along with their respective teachers. Both classrooms were located in the same county and were affiliated with Kalamazoo County (KC) Ready 4s. KC Ready 4s is a non-profit program based in Kalamazoo County, whose main purpose is to prepare preschool children for academic success through access to high quality early childhood education. The subject identification process involved first recruiting teachers from eligible center-based early childhood classrooms with matching SES levels from the 11 KC Ready 4s sites. The investigator provided teachers with information about the study, including an initial description of the study and a consent form, at an administrative meeting held by KC Ready 4s Executive Director at their preschool. Teachers were encouraged to ask questions about the study at the meeting, such as, how much involvement it would require, what the benefits would be, and if it would add stress to their jobs. The teachers voluntarily chose to participate based on the description of the study.

Child Participants

Children from the classrooms of the teachers who volunteered were eligible to participate in the larger study. It was expected that 10-15% of these participants would display a speech and/or language impairment and be potential cases for the current case studies based on prevalence data. Kalamazoo County Ready 4s Executive Director and
the research project coordinator, a certified speech-language pathologist, held an initial meeting with parents asking their permission for their child to participate in the larger project. At this meeting, parents had an opportunity to ask questions, and were also allowed to later contact the research project director via e-mail or phone to inquire further about the study and their child’s participation. Child participants were required to:

1. be 4-years-old,
2. have written parental permission to participate in the study,
3. have no sensory, neurological, and physical disabilities that would require specialized equipment to achieve accurate testing.

Parents consented to have their child’s data used for research purposes.

**Design**

In the larger study from which the four cases were selected, a quasi-experimental design was used to investigate phonological awareness and early literacy development of 4-year-old children who received a teacher-implemented phonological awareness program. This design included a delayed treatment approach, whereby the group randomly selected as the no-treatment control during provision of the classroom program in fall 2012, subsequently received the classroom program in spring 2013. All 4-year-old children in the classrooms of participating teachers received the instruction. Teacher data consisted of treatment fidelity observations that indicated absence/presence of key instructional components of the program. The research project director and project coordinator, both certified speech-language pathologists, made fidelity observations.

**Assessment Procedures**

The four case participants for this thesis were identified through a comprehensive baseline assessment of their speech, language, phonological awareness and early literacy
skills. Assessments occurred at the beginning of the school year as part of the larger study. The following frequently used standardized tests were utilized in the initial assessment of speech and language skills: the Clinical Evaluation of Language Fundamentals – Preschool 2nd Edition (CELF-P2; Wiig, Secord & Semel, 2004); the Goldman-Fristoe Test of Articulation-2nd Edition (GFTA-2; Goldman & Fristoe, 2000); and the Rhyme, Beginning Sound and Sound/Letter Correspondence subtests from the Pre-Reading Inventory of Phonological Awareness (PIPA; Dodd, Crosbie, McIntosh, Teitzel, & Ozanne, 2004). During these assessments, the child was asked to name pictures and complete tasks to evaluate speech pronunciation and language skills such as using endings on words, following simple directions, and repeating sentences spoken by the examiner. Participants’ hearing was also screened as part of the baseline assessment. The initial baseline assessment took approximately two hours per child and was scheduled at a mutually convenient time for the teacher and examiner. Parents were provided with a report of their child’s assessment results.

Specific phonological awareness abilities that were the focus of instruction were also assessed during the initial assessment, as well as at post-instruction assessments at the middle (December) and end (April) of the larger study to monitor gains made in phonological awareness and early literacy skills. The nonstandardized assessment involved the following phonological awareness tasks: rhyme oddity, initial phoneme identity, letter identification, phoneme blending, and phoneme segmentation.

Assessment Administration and Scoring Reliability

The investigator and fifteen graduate clinicians were trained in test administration
procedures for the standardized and nonstandardized assessments. The investigator and the graduate clinicians administered each assessment individually to each preschool child under the direct supervision of the research project coordinator. Children were tested in quiet areas of their respective preschools across a two-week time period for initial testing, and a day of testing for mid-year and end-year phonological awareness post-treatment assessments. Graduate clinicians scored assessments immediately after administration. The investigator and research project coordinator checked scoring of all assessments.

**Training for Early Childhood Educators**

Participating teachers received professional training on phonological awareness and how to implement the concentrated instructional program used in the larger project. This training was provided during a professional development lecture presented the investigator in September of 2012 before the program began. Teachers attended the lecture/discussion and participated in role-play activities similar to those used in the experimental study. Once the experimental study began, teachers were provided with weekly lesson/activity plans and materials during weekly mentoring sessions that were an hour long. The program was implemented for 20 minutes for four days, Tuesday through Friday each week. Lesson plans and progress were discussed with the teachers during a weekly mentoring session with the investigator that was held each Friday for the entire length of the program. During this weekly mentoring session, teachers were encouraged to ask questions regarding the program and activities, voice opinions about what worked well and what did not work well, and discuss methods for teaching students who were
advanced and those who were scored lower than their typically developing peers. One of the lead teachers and the assistant teachers attended the weekly mentoring session. The other lead teacher was shown the instructions on a subsequent day and was encouraged to contact me, the investigator, with any questions pertaining to the lesson. The investigator also completed a simple instruction log during the weekly mentoring session that required the teachers’ assessment of the instruction provided and impression of children’s responses; this log took 5-10 minutes to complete.

**Phoneme Awareness Instructional Program**

Once the baseline assessment was completed, children and their teachers were randomly assigned by classroom to either the phonological awareness instruction or a waiting control. The experimental participants received 10 weeks of a phonological awareness program adapted from the *Gillon Phonological Awareness Training Program* (Gillon, 2000b) provided in 20-minute sessions four times per week. The content of the program covers rhyme knowledge (through onset-rime), phoneme analysis, phoneme identity, phoneme segmentation, phoneme blending, and linking speech to print. The first four weeks of the program were concentrated on letter-sound knowledge of 23 letters, not including letters Q, X, or Y. The order of letter presentation followed the developmental order for typically developing children learning sounds and letter recognition. The fifth and sixth weeks of the program were concentrated on initial phoneme identity. The seventh and eighth weeks of the program were concentrated on phoneme blending and segmentation of both compound words and onset-rime words (e.g., f-un). The final two
weeks were concentrated on the most difficult phonological awareness skills, blending and segmentation of individual phonemes (Table 1.1).

Children in the larger study were divided into two groups and were taught the phonological awareness activities by two lead teachers and their assistant teachers. One group consisted of eight children and the other group consisted of six children. The investigator provided weekly packets to teachers containing daily scripts of activities, directions, and corresponding pictures. The scripts had precise dialogue that was to be used by the teachers and their assistants for all of the activities. However, the teachers and their assistants were to modify the activities for their group if they felt it would promote a higher level learning environment. The investigator carefully selected and planned scripts and activities that were adapted from the *Gillon Phonological Awareness Program* (PAT).

**Fidelity**

To ensure the content was accurately presented and the program’s purpose was maintained, fidelity of the instructional sessions was assessed during the 10 weeks. Of the 40 sessions, 20% of sessions were observed to guarantee the phonological awareness tasks were being delivered according to the instructions and activities planned. This accounted for observation which in addition to the review of daily logs resulted in recommended strategies for frequency and documentation of fidelity (Kaderavek & Justice, 2010). The research project director and research project coordinator checked the lesson plans in contrast with activities that were completed to guarantee that the phonological awareness skill that was targeted (e.g., letter-sound knowledge) was the one
that was designated for that specific week. Activities were allowed to be slightly altered by the teachers depending on the students’ abilities on a given day; however, the phonological awareness skill that was chosen for the week was intended to be the primary one that was targeted. A total of eight sessions of each teacher group were observed by either the research project director or the research project coordinator, in order to rule out biases and preserve the true nature of the research study.

Table 1. Weekly PA skills targeted and activities

<table>
<thead>
<tr>
<th>Week #: Sessions</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal/Skill</td>
<td>Focus: Initial Phoneme Identification</td>
<td>Focus: Initial Phoneme Identification</td>
<td>Focus: Initial Phoneme Identification</td>
<td>Focus: Initial Phoneme Identification</td>
</tr>
<tr>
<td>Week 4: 13-16</td>
<td>Blending &amp; Segmenting</td>
<td>1. Introduce Onset-Rime Blending with Magician’s Writing 2. Find Your Puzzle Partner</td>
<td>1. Introduce Onset-Rime Blending with Magician’s Writing 2. Find Your Puzzle Partner</td>
<td>1. Introduce Onset-Rime Blending with Magician’s Writing 2. Find Your Puzzle Partner</td>
</tr>
</tbody>
</table>
Table 1-Continued

<table>
<thead>
<tr>
<th>Week #:</th>
<th>Sessions</th>
<th>Goal/ Skill</th>
<th>Focus: Blending</th>
<th>Focus: Segmenting</th>
<th>Focus:</th>
<th>Focus:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week #:</td>
<td>Sessions</td>
<td>Goal/ Skill</td>
<td>Focus: Blending Compound Words</td>
<td>Focus: Segmenting Compound Words</td>
<td>Focus: Blending Compound Words</td>
<td>Focus: Segmenting Compound Words</td>
</tr>
<tr>
<td>Week #:</td>
<td>Sessions</td>
<td>Goal/ Skill</td>
<td>Focus: Blending Onset-Rime</td>
<td>Focus: Segmenting Onset-Rime</td>
<td>Focus: Blending Onset-Rime</td>
<td>Focus: Segmenting Onset-Rime</td>
</tr>
<tr>
<td>Week #:</td>
<td>Sessions</td>
<td>Goal/ Skill</td>
<td>Focus: Blending Phonemes</td>
<td>Focus: Segmenting Phonemes</td>
<td>Focus: Blending Phonemes</td>
<td>Focus: Segmenting Phonemes</td>
</tr>
</tbody>
</table>
RESULTS

The purpose of this study was to determine if children with speech sound disorder and/or language impairment, integrated in a typical classroom, would make gains in phonological awareness (PA) following explicit teacher-delivered instruction. To answer this question the investigator examined the performance of individual cases with speech and/or language impairment in both groups, those who received instruction and the control. Two participants in each of the experimental (E1 and E2) and control (C1 and C2) groups had standardized scores that placed them at the lower end of the normal range or just below, indicating difficulties with speech and/or language. According to Catts et al. (2001), it may be determined that children are at-risk for reading problems even when their current oral language status does not qualify them for speech and language services.

Individual case profiles are presented for both experimental and control participants with speech and/or language difficulties (Table 2). Data are presented for the pre-treatment assessment, before the 10-weeks of explicit instruction began, and the post-treatment assessment, after the 10-weeks of explicit instruction ended. In subsequent sections, individual results are reported and discussed.

**Individual Treatment Results**

Descriptive comparisons were used to determine whether the children with speech and language deficits in the experimental classroom that received the explicit phonological awareness instruction improved on phonological awareness tasks after training (Table 2). The pretest phonological awareness measures occurred before the 10-week explicit instruction began and are designated in the figures that follow as Probe 1;
posttest measures were obtained when explicit instruction ended and are designated as Probe 2. All skills targeted in the phonological awareness probes were taught during the 10-week instruction (see Table 1).

Table 2. Pre-instruction PA probes and post-instruction PA probes

<table>
<thead>
<tr>
<th></th>
<th>E-1</th>
<th>E-2</th>
<th>C-1</th>
<th>C-2</th>
</tr>
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<tbody>
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<td>Percent Correct-P1</td>
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<td>Percent Correct-P2</td>
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<tr>
<td>Percent Correct-P1</td>
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<td>Percent Correct-P2</td>
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<td><strong>Phoneme ID With Words</strong></td>
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<td></td>
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<td>Percent Correct-P1</td>
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<td></td>
</tr>
<tr>
<td>Percent Correct-P1</td>
<td>0</td>
<td>0</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Percent Correct-P2</td>
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<td>60</td>
<td>40</td>
<td>20</td>
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<td><strong>Phoneme Segmentation</strong></td>
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<td></td>
</tr>
<tr>
<td>Percent Correct-P1</td>
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<td><strong>Letter Name</strong></td>
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<td>Percentile Correct-P1</td>
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<td>15</td>
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<tr>
<td>Percentile Correct-P2</td>
<td>92</td>
<td>50</td>
<td>54</td>
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</table>

**Experimental Group**

**Case E-1**

From the experimental group, case E-1 demonstrated difficulties with language related tasks; E-I scored low on the following sections of the *Clinical Evaluation of Language Fundamentals – Preschool 2nd Edition* (CELF-P2; Semel, Wiig, & Secord, 2004); expressive vocabulary (9th percentile), core language vocabulary (25th percentile). Based on scores near or less than one standard deviation below the mean, difficulty with expressive language was determined. This case demonstrated articulation that is within normal limits (71st percentile) on the *Goldman-Fristoe Test of Articulation-2nd Edition*.
Three subtests of the *Pre-Reading Inventory of Phonological Awareness* (PIPA; Dodd, Crosbie, McIntosh, Teitzzel, & Ozanne, 2003) were administered with scores as follows; alliteration awareness fell at the emerging level (20-24th percentile), sound isolation fell at the basic level (45-49th percentile), and letter-sound knowledge fell at the proficient level (85-89th percentile).

As displayed in Figure 1.1, Rhyme Detection decreased from pre-instruction phonological awareness probe (P1) to post-instruction phonological awareness probe (P2) from 30 percent to 20 percent, showing that this phonological awareness skill did not improve with instruction. Phoneme Identity with Words improved from 58 percent on pretest to 92 percent on post-test; however Phoneme Identity without words (more difficult) fell from 40 percent to 30 percent demonstrating the importance of a letter-sound connection for this task. Letter Identification improved from 92 percent on P1 to 100 percent on P2, and the most difficult phonological awareness skills such as Phoneme Blending and Phoneme Segmentation increased; Phoneme Blending improved from 0 percent to 40 percent from P1 to P2 and Phoneme Segmentation improved from 0 percent to 20 percent from P1 to P2. Letter Name improved from 88 percent to 92 percent.

**Case E-2**

From the experimental group, case E-2 demonstrated difficulties with speech sound/articulation related tasks. This case demonstrated articulation that fell within the “normal range” but at the low end (21st percentile) on the *Goldman-Fristoe Test of Articulation-2nd Edition* (GFTA-2; Goldman & Fristoe, 2000). Articulation scores indicated that E-2 had a mild speech sound disorder. Scores fell within the average/above
average range on the following sections of the *Clinical Evaluation of Language Fundamentals – Preschool 2nd Edition* (CELF-P2; Semel, Wiig, & Secord, 2004); sentence structure (50th percentile), word structure (50th percentile), expressive vocabulary (75th percentile), core language vocabulary (61st percentile). Three subtests of the *Pre-Reading Inventory of Phonological Awareness* (PIPA; Dodd, Crosbie, 

![Figure 1.1 Phonological Probe Data for Subject 1 of the Experimental Group](image)

McIntosh, Teitzzel, & Ozanne, 2003) were administered; alliteration awareness fell at the basic level (60-64th percentile), sound isolation fell at the emerging level (15-19th percentile) which might be expected for a child who demonstrated difficulty with correct production of speech sounds, and letter-sound knowledge also fell at the emerging level
(15-19th percentile), another category that would be expected to be difficult for a child who demonstrated speech sound production difficulty.

As displayed in Figure 1.2, Rhyme Detection dramatically decreased from the pre-instruction probe (P1) of 60 percent to post-instruction probe (P2) of 20 percent showing that this phonological awareness skill did not improve with instruction. However Macmillan (2002) concluded that, based on three claims, the overall methodology of previous studies found no connection between rhyme awareness and reading and in fact supported no causal relationship between rhyme awareness and reading. The three claims were as follows: 1) rhyme awareness is not only related to, but is predictive of reading ability, 2) rhyme awareness affects or determines reading ability, and 3) rhyme awareness leads to the development of phoneme awareness. Phoneme Identity with Words improved from 33 percent on P1 to 70 percent on P2 and Phoneme Identity without words also improved from 66 percent to 83 percent. Letter Identification improved from 0 percent on P1 to the 42 percent on P2, demonstrating that letter knowledge is not strong for this subject. Phoneme Blending improved from 0 percent to 60 percent from P1 to P2 which is a significant finding for this subject as phoneme blending and segmentation are the strongest phonological awareness predictors of early reading ability (Wagner & Torgesen, 1987). Phoneme Segmentation remained static at 0 percent for both pretest (P1) and post-test (P2). Letter Name improved from 16 percent to 55 percent.
Control Group

Case C-1

From the control group, case C-1 demonstrated difficulties with speech sound/articulation related tasks. This case demonstrated articulation that fell within the “normal range” but at the low end (20th percentile) on the *Goldman-Fristoe Test of Articulation-2nd Edition* (GFTA-2; Goldman & Fristoe, 2000). Articulation scores indicated that case C-1 had a mild speech sound disorder. Scores fell within the average/above average range on the following sections of the *Clinical Evaluation of Language Fundamentals – Preschool 2nd Edition* (CELF-P2; Semel, Wiig, & Secord, 2004); sentence structure (63rd percentile), word structure (75th percentile), expressive
vocabulary (84th percentile), core language vocabulary (79th percentile). Three subtests of the Pre-Reading Inventory of Phonological Awareness (PIPA; Dodd, Crosbie, McIntosh, Teitzzel, & Ozanne, 2003) were administered; alliteration awareness fell at the emerging level (20-24th percentile), sound isolation fell at the proficient level (75-79th percentile) and letter-sound knowledge also fell at the proficient level (85-89th percentile).

As displayed in Figure 2.1, Rhyme Detection decreased from the pre-instruction probe (P1) of 60 percent to post-instruction probe (P2) of 30 percent showing that this phonological awareness skill did not improve with instruction. Phoneme Identity with Words improved from 92 percent on P1 to 100 percent on P2 and Phoneme Identity without words also improved from 70 percent to 100 percent. Letter Identification remained static at 100 percent for both P1 and P2. Phoneme Blending decreased from 60 percent to 40 percent from P1 to P2 and Phoneme Segmentation remained stable at 0 percent for P1 to P2. Letter Name decreased from 88 percent to 54 percent.

Case C-2

From the control group, case C-2 demonstrated difficulties with language related tasks; C-2 scored low on the following sections of the Clinical Evaluation of Language Fundamentals – Preschool 2nd Edition (CELF-P2; Semel, Wiig, & Secord, 2004); sentence structure (13th percentile), word structure (7th percentile), expressive vocabulary (2nd percentile), and core language (5th percentile). Based on scores less than one standard deviation below the mean, difficulty with expressive language was determined. This case demonstrated articulation that is within normal limits (36th percentile), although low average, on the Goldman-Fristoe Test of Articulation-2nd Edition (GFTA-2;
Goldman & Fristoe, 2000). However, these scores indicate that language ability was
more impaired than speech sound production. Case C-2 received the following scores on
the three subtests of the *Pre-Reading Inventory of Phonological Awareness* (PIPA; Dodd,

![Figure 2.1 Phonological Probe Data for Subject 1 of the Control Group](image)

Crosbie, McIntosh, Teitzzel, & Ozanne, 2003): alliteration awareness fell at the
emerging level (60-64<sup>th</sup> percentile), sound isolation fell at the basic level (0 percentile),
and letter-sound knowledge fell at the basic level (0 percentile), these scores
demonstrated lack of skills related to letter-sound knowledge. This case’s overall scores
indicate language impairment with deficits in receptive and expressive components.
As displayed in Figure 2.2, Rhyme Detection remained static from pre-instruction phonological awareness probe (P1) to post-instruction phonological awareness probe
(P2) at 40 percent. Phoneme Identity with Words decreased from 33 percent on P1 to 17 percent on P2; however, Phoneme Identity without words remained static at 40\(^{th}\) percent demonstrating weak letter-sound connection for this participant. Letter Identification improved from 42 percent on P1 to 50 percent on P2. Phoneme Blending decreased over time from 60 percent to 20 percent from P1 to P2 and Phoneme Segmentation remained at 0 percent for P1 and P2. Letter Name improved from 15 percent to 27 percent. This participant made gains in letter naming and identification, but did not make any significant gains in phonological awareness tasks related to early reading success.

![Figure 2.2 Phonological Probe Data for Subject 2 of the Control Group](image)

**Gains Made**

Gain scores were also calculated for the experimental and control cases and are
displayed in Table 4. In addition, gain scores were calculated for the experimental group and the control group from the larger study, without inclusion of the four participants with speech or language difficulties just described. Mean and gain scores (P2 Mean – P1 Mean) for each phonological awareness probe are displayed in Table 3. Although the gains were highly variable, the two cases examined here from the experimental group experienced gains that were similar to their typical peers; whereas the two control cases followed a dissimilar pattern to their typical counterparts.

| Table 3: Results for children without speech sound disorder and/or language impairment (Mean and Gains). |
|---------------------------------|--------------|-----------------|-----------------|
|                               | Letter ID    | Phoneme Segmentation | Phoneme Blending |
| Phone Name w/ words | 67.5 | 90.9 | 93.1 | 70 | 21.7 | 33.3 | 11.6 | 20 | 8 | 11.8 | 22.9 | 12.6 | 16.6 |
| 72.9 | 81.3 | 90   | 82.5 | 77.5 | 22.5 | 25   | 25   |
Table 4. Gains made by experimental and control groups

<table>
<thead>
<tr>
<th></th>
<th>Rhyme Detection</th>
<th>Phoneme ID</th>
<th>Letter Name</th>
<th>Phoneme ID w/ words</th>
<th>Phoneme Blending</th>
<th>Phoneme Segmentation</th>
<th>Letter ID</th>
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<tr>
<td>E-1</td>
<td>-10</td>
<td>-10</td>
<td>8</td>
<td>34</td>
<td>40</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>E-2</td>
<td>-40</td>
<td>37</td>
<td>42</td>
<td>17</td>
<td>60</td>
<td>0</td>
<td>34</td>
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<tr>
<td>C-1</td>
<td>30</td>
<td>30</td>
<td>0</td>
<td>8</td>
<td>-20</td>
<td>0</td>
<td>-34</td>
</tr>
<tr>
<td>C-2</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>-16</td>
<td>-40</td>
<td>0</td>
<td>12</td>
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</table>

Table 3- Continued

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<tbody>
<tr>
<td>Treatment</td>
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</tr>
<tr>
<td>Gain</td>
<td>9.2</td>
</tr>
<tr>
<td>Control</td>
<td>70 72.5 70</td>
</tr>
<tr>
<td>Gain</td>
<td>2.5</td>
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</table>
DISCUSSION

Case studies of children with speech sound disorder and/or language impairment involved in a larger project of explicit, intensive teacher-delivered phonological awareness instruction are provided. Identifying variables such as severity of speech sound disorder and/or language impairment in combination with method of instruction delivery, intensity, and content of the phonological awareness program may help determine whether classroom instruction may be beneficial for children with speech and/or language impairment. All of these factors may contribute to early literacy success in children who are typically developing and children with speech sound disorder and/or language impairment.

Variability in Improvement

The hypothesis stated that children with varying levels of speech sound disorder or language impairment would make gains in phonological awareness following the teacher-delivered instruction, but would vary in the amount of gain and how much they benefitted from instruction. This hypothesis was supported by the data.

The two identified cases from the experimental group (E-1 and E-2) were more variable in their gains as compared to their typically developing counterparts. Based on the data, the treatment group always made gains but the participants with speech or language impairment were less consistent, demonstrating how variable the growth of phonological awareness skills can be in children with speech sound disorder and/or language impairment. According to Gillon (2005), a wide performance range existed when comparing individual gains to group gains. In the present study, it is evident the
although the participants (E-1 and E-2) made gains, they are unlike the pattern of their typically developing peers. Justice et al. (2010) found that children with weaker language skills benefitted less from the phoneme awareness program and suggest that children with weak language demonstrate slower and more variable growth than typically developing children. Findings also showed, however, that skills such as rhyme were equal for children with language impairment and typically developing children, regardless of the variation in children’s language abilities. The findings from the current cases contrast with the findings of Justice et al. (2010), as participant E-1 demonstrated low language skills but made substantial gains with explicit treatment. E-1 made gains in all of the phonological awareness probes except for Rhyme Detection and Phoneme Identity; the gains made generally exceeded the mean gain made by typically developing children. This suggests that explicit phonological awareness instruction is necessary for children with language impairment to develop the skills needed for early literacy.

The same variability is evident in the control cases; although they were not exposed to the explicit, teacher-delivered instructional program, their gains were variable as well. A complication to consider in making comparisons is that the typically developing children of the control group also made gains without being given explicit instruction on these phonological awareness skills. The gains made by the control cases C-1 and C-2, however, are different from those made by their typically developing counterparts as well as those made by cases from the experimental group with speech sound disorder and/or language impairment. It is noteworthy that growth can occur without instruction, but children with speech sound disorder and/or language impairment are more likely to make gains when explicitly taught phonological awareness skills.
Comparison of Experimental vs. Control Participants

Case E-1 from the treatment group demonstrated a low core language score (25th percentile) on *Clinical Evaluation of Language Fundamentals – Preschool 2nd Edition* (CELF-P2; Semel, Wiig, & Secord, 2004) indicative of an expressive language impairment; however this participant demonstrated articulation that is within normal limits (71st percentile) on the *Goldman-Fristoe Test of Articulation-2nd Edition* (GFTA-2; Goldman & Fristoe, 2000). This participant made substantial gains in all of the phonological awareness tasks except for Rhyme Detection and Phoneme Identity without words, suggesting that this participant needed print cues in order to correctly identify phonemes (sounds). Rhyme Detection was not a trained phonological awareness skill and according to Callaghan and Madelaine (2012), rhyme has minimal benefit in facilitating early reading; therefore, it may not be a necessary part of a successful phonological awareness program.

Like Case E-1, Case C-2 also demonstrated a low core language score (5th percentile) on *Clinical Evaluation of Language Fundamentals – Preschool 2nd Edition* (CELF-P2; Semel, Wiig, & Secord, 2004) indicative of both an expressive and receptive language impairment; this participant also demonstrated articulation that is within normal limits, but below average (36th percentile) on the *Goldman-Fristoe Test of Articulation-2nd Edition* (GFTA-2; Goldman & Fristoe, 2000). Case C-2 did not receive the phonological awareness instruction and this case made gains on only two phonological awareness skills, Letter Name and Letter Identification. These skills do not involve phonemic awareness and are not the most important phonological awareness skills.
related to early reading success. Magnusson and Naucler (1990) found that children with expressive and receptive language difficulties are at greatest risk for impaired literacy skills as some of the problem relates to difficulty with syntax. The lack of response from this participant highlights the importance of explicit phonological awareness instruction for children with speech sound disorder and/or language impairment. It should be noted that C-2 had both low articulation skills and language impairment, whereas E-1 had high articulation skills but low language.

Case E-2 demonstrated articulation that fell at the low end of the normal range (21st percentile) on the Goldman-Fristoe Test of Articulation-2nd Edition (GFTA-2; Goldman & Fristoe, 2000), suggesting this participant has a mild speech sound disorder. Scores fell within the average/above average range on the Clinical Evaluation of Language Fundamentals – Preschool 2nd Edition (CELF-P2; Semel, Wiig, & Secord, 2004) with core vocabulary at the 61st percentile. This child made substantial gains on all phonological awareness tasks except for Rhyme Detection and Phoneme Segmentation. Bird, Bishop, and Freeman (1995) found that children with phonological impairment could not perform segmentation tasks, which have been shown to be important in the earliest stages of reading development. It was also determined that even though phonological awareness skills like segmentation are distinct from articulation, children with speech sound disorder often struggle with this phonological awareness skill. For this participant, explicit instruction appeared to be helpful for the development of most phonological awareness skills.

Case C-1 also demonstrated articulation that fell at the low end of the normal
range (20\textsuperscript{th} percentile) on the \textit{Goldman-Fristoe Test of Articulation-2\textsuperscript{nd} Edition} (GFTA-2; Goldman & Fristoe, 2000), also indicating a mild speech sound disorder. Scores fell within the average/above average range on the \textit{Clinical Evaluation of Language Fundamentals – Preschool 2\textsuperscript{nd} Edition} (CELF-P2; Semel, Wiig, & Secord, 2004); core language was at the 79\textsuperscript{th} percentile. Like E-2, C-1 also showed no gain in Phoneme Segmentation. Based on Bird and Bishop (1992), children with expressive phonological impairments experience difficulty with tasks involving segmentation even though segmentation involves no speech output. Cases E-2 and C-1 have comparable profiles and demonstrate a speech sound disorder with average language skills. Case C-1 made gains that were markedly lower than case E-2 on all phonological awareness skills. Of note, C-1 appeared to be close to ceiling on the pretest probe, meaning that on some phonological awareness tasks C-1 obtained perfect/near perfect scores and had no room for growth. Score for C-1, however, actually declined at post-test when compare to pretest performance. The gain scores of E-2 support the importance, relevance, and effects of treatment. Given two remarkably similar cases in articulation and language levels, the participant who was given explicit phonological awareness instruction was able to make substantial progress.

\textbf{Phoneme Blending and Segmentation}

Higher level skills such as phoneme blending and segmentation are found to be the most important skills for early literacy success. According to Callaghan and Madelaine (2012), interventions including both blending and segmentation are more readily transferred to reading skills, and may be sufficient on their own to help the
transfer to reading tasks. For the phonological awareness tasks of phoneme blending and segmentation together, cases (E-1, E-2) followed a pattern that was comparable to the treatment group’s typically developing children. In contrast, unlike their typically developing peers, cases (C-1, C-2) made no gains but instead declined on these phonological awareness skills over time. It does appear that the experimental cases benefited from the explicit, intensive teacher-delivered instruction, particularly for the higher level phonological awareness skills of phoneme blending and segmentation.

**Explicit Instruction**

The larger study involved explicit instruction in phonological awareness skills as it is known that children who are at-risk for reading difficulty benefit from more direct and structured instruction. According to Justice et al. (2003), children who have multiple risk factors for reading difficulty can benefit from explicit instruction. Four cases (E-1, E-2, C-1, and C-2) were identified as having mild speech sound disorder and/or language impairment and would thus be considered at risk for difficulty obtaining skills that are important for emergent literacy. Research by Hesketh et al. (2007) suggests that children with speech sound disorder and/or language impairment cannot learn phonological awareness skills at the same rate as typically developing children and need explicit instruction in order to gain the skills necessary for emergent literacy.

**Time-efficiency of Instruction**

Frequent and intensive sessions are the main components of time-efficiency. Based on research by Gillon (2005), 20 hours over a 10-week period is considered high-intensity and the optimal level of intensity for instruction focused at the phoneme level.
Cases reported here received phonological awareness sessions that were integrated over a 10-week period, 80 minutes per week, indicating that the recommended 20 hours of phonological awareness instruction was not achieved. According to Carson, Gillon, and Boustead (in press), “Under controlled research settings, 20 hours over 10 weeks of PA instruction have demonstrated significant benefits for reading outcomes in at-risk readers” (p. 28). If the suggested additional hours of instruction had been provided in the larger study, there may have been greater differentiation in the gains observed for cases with speech sound disorder and/or language impairment from treatment and control groups.

**Limitations and Clinical Implications**

The limitations of single case study methodology must be recognized. Descriptive case study analysis without experimental manipulation prohibits making conclusions about a cause and effect relationship between instruction and phonological awareness gains. Behaviors and gains made by the children with speech sound disorder and/or language impairment can only be described and their explanation can only be hypothesized. These descriptive case studies involved only four children and therefore, are likely not completely representative of the general population of at-risk children who have speech sound disorder and/or language impairment.

Additionally, the use of a quasi-experimental design in the larger study means that the children in the preschool classrooms were not randomly assigned at the individual level, but rather were assigned at the classroom/group level. This may also contribute to limitations concerning any cause and effect relationship. A quasi-
experimental design was utilized because the participants were identified as whole classroom groups. In an attempt to counteract the lack of random assignment at the individual level, the classrooms were selected out of 11 KC Ready 4s sites and then one classroom was randomly assigned as the control group and the other as the experimental group.

It must also be recognized that gains made by the control cases may in part be related to prior professional development or individual expertise of the control group teachers. Lastly, the limited number of children with speech sound disorder and/or language impairment suggests that further investigation should be conducted with larger sample sizes. Further studies should utilize the RTI approach with teacher-delivered instruction, as opposed to removing at-risk children from the general classroom, as these children are already at-risk for difficulty with reading as well as in other academic areas.

In summary, teaching preschool children with speech sound disorder and/or language impairment, as integrated members of their classrooms, to become successful readers is important for lifelong reading and academic success. The findings of these case studies contribute to the existing literature by suggesting that an intensive and explicit, teacher-delivered phonological awareness instruction during the preschool year has the ability to yield a noticeable effect on phonological awareness development of children with speech sound disorder and/or language impairment. For children with mild-moderate impairment, similar to the cases described here, explicit classroom instruction at a greater intensity should be further explored in experimental designs with larger samples.
REFERENCES


APPENDIX

WESTERN MICHIGAN UNIVERSITY

Date: August 14, 2012

To: Ann Tyler, Principal Investigator
    Heather Osterhouse, Student Investigator for thesis

From: Amy Naugle, Ph.D., Chair

Re: HSIRB Project Number 12-06-08

This letter will serve as confirmation that your research project titled "Classroom Phonemic Awareness Instruction: Early Literacy Outcomes" has been approved under the expedited category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note: This research may only be conducted exactly in the form it was approved. You must seek specific board approval for any changes in this project (e.g., you must request a post approval change to enroll subjects beyond the number stated in your application under "Number of subjects you want to complete the study"). Failure to obtain approval for changes will result in a protocol deviation. In addition, if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

Reapproval of the project is required if it extends beyond the termination date stated below.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: August 14, 2013


