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Effects of an iPad-Supported Phonics Intervention on Identifying and Generalizing Consonant Blends

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EFFECTS OF AN IPAD-SUPPORTED PHONICS INTERVENTION ON IDENTIFYING AND GENERALIZING CONSONANT BLENDS

by

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A THESIS

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EFFECTS OF AN IPAD-SUPPORTED PHONICS INTERVENTION ON
IDENTIFYING AND GENERALIZING CONSONANT BLENDS

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Phonemic awareness is the ability to hear and manipulate the individual sound within words and is a crucial predicator of reading skills. Students with reading and writing difficulties often struggle with phonemic awareness tasks. Technology contributes to early literacy skills through providing means of communication, phonemic awareness instruction and comprehension skills. This study is an extension upon a previous study that evaluated the effectiveness of an iPad supported phonics intervention on identifying and generalization of consonant blends. A multi-element single case research design was used to address the following two research questions: 1) Is there a functional relation between the iPad intervention and the participant’s ability to identify consonant blends within words? 2) Is there a functional relation between the iPad intervention and participant’s ability to generalize the consonant blends to match same-sounding blends in words? One third grade participant received instruction over three sets of consonant blends during intervention. Results indicated an increase in correct responses for identifying blends in words, however did not show a stable or consistent change in correct responses for generalizing consonant blends. Further research could evaluate the effectiveness of the iPad on other phonemic awareness tasks and different age groups of students, context and settings.
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CHAPTER 1: INTRODUCTION

Phonological awareness is a broad term referring to the skill of being able to hear and manipulate the sound structures in words (Shanahan, 2005). The ability to hear and manipulate the individual sounds within words, which are called phonemes, is known as phonemic awareness. Phonemic awareness contributes to rich and robust reading development, which includes phonological processing skills such as letter and word naming, phoneme segmentation and verbal memory. Additionally, phonemic awareness is a crucial predictor of reading skills (Bus & van IJzendoorn, 1999; Pirzadi, Ghabari-Bonab, Shokoohi-Yekta, Yaryari, Hasanzadeh & Sharifi, 2012).

During the first two years of school instruction, letter knowledge and phonemic awareness are two predictors that will determine children’s performance in reading. Detecting early phonemic awareness skills in children as young as preschoolers can influence future reading and writing skills (Lundberg, Olofsson, & Wall. 1980). A meta-analysis conducted by the National Reading Panel evaluated the effect of phonemic awareness instruction across multiple literacy areas. Word reading, reading comprehension and spelling were all improved by phonemic awareness instruction (Shanahan, 2005). This instruction yields better readers, because it equipped learners with tools and strategies to identify, manipulate and represent letter sounds (Pirzadi et al., 2012). It is beneficial when taught using specific letters or letter combinations (Ehri, Nunes, Willows, Schuster, Yaghoub-Zadeh & Shanahan, 2001). Prior researchers found that at-risk students, or those who require academic intervention to help succeed, benefit immensely from explicit training (Baker & Torgesen. 1995). Explicit training is a process...
where a teacher models the skill, teacher and student practice the skill, and then the student practices it independently.

Phonemic awareness instruction encompasses multiple reading and writing skills, as well as tools to practice these skills. One form that is found to be beneficial to early learners are sound boxes, also referred to as Elkonin boxes, which aid children in sequencing spoken words with letter sounds to then form written words (Maslanka & Joseph, 2002). Elkonin boxes consist of a rectangle that has been divided into sections corresponding to the number of phonemes present in the word. Children then move letters or counters into the empty boxes as they say each sound in the word. Elkonin boxes are a successful approach in helping children develop phonemic awareness skills which in turns helps improve reading and writing skills (Keesey, Konrad & Joseph, 2014). The positive effects of Elkonin boxes to teach phonemic awareness can be applied to teaching students consonant blends.

Consonant blends are two consonant letters that appear at the beginnings or ends of a word and make a specific sound. Consonant blends are an early literacy skill that typical students master by the end of second grade. Phonemic awareness skills are a component of normal oral language development as well as foundational in learning how to read and write (Anthony & Francis, 2005). These skills of being able to form, hear and manipulate consonant blends can be taught and practiced using a variety of different modes (e.g. traditional paper pencil activities, technology, and games).

Technology contributes to early literacy skills through providing a means of communication, phonemic awareness instruction and comprehension skills. With the use of technology, students can communicate via multiple formats and engage in active learning through interactive lessons, review and games. Often technology is used as medium of instruction. An instructor may present or enable a review application for students to study a specific topic in their independent work time. Technology in the use of phonemic awareness instruction is done best when it is explicit and systematic. (National Reading Panel, 2000). Through using devices that have applications, lessons, and programs students are readily given access to instruction over phonemic skills like rhyming, beginning sounds and blending.

The availability and integration of technology in the classroom has increased over the past fifteen years. Many school districts are going “paperless” in attempts to conserve resources (Maher, 2014). This requires an increase in the use of technology for students and teachers alike. To keep up with the demands for more use of technology, instructors need to integrate effective and beneficial ways to incorporate technology into daily learning. Through using technology, teachers can deliver personalized content to students, boost students’ technology skills, and empower students to engage in complex and creative thinking and work (Doran & Herold, 2016). A review conducted by MacArthur, Ferretti, Okolo & Cavalier (2001) addressed and evaluated the use of computer-assisted instruction in classrooms with phonemic awareness and decoding skills. The use of electronic texts to enhance reading comprehension was also evaluated. Electronics were found to enhance students phonemic awareness and decoding skills.
The current study is an extension of a previous study conducted by Larbee, Burns and McComas (2014) who evaluated the effect of an iPad-Supported phonics intervention compared to standard materials in decoding and time on task for three first grade participants who lacked decoding skills. During the time of the study, the students were attending school and receiving additional services at school for performing below level in the areas of reading and writing. The iPad application used for the study, called “Build A Word-Easy Spelling with Phonics” (developed by AtReks), functions as a standard Elkonin box delivered on an iPad. The use of the Elkonin box helps students identify sounds, match sounds to letters, and build words. Results from the study suggested the application had a positive, though be it small, effect on decoding performance when compared to standard materials.

Although the effects of the Larnee et al. (2014) study were small, the study had several limitations that may have contributed to the lack of effects. The study design for made use of minimal data points, which made it difficult to discern between the effectiveness of the iPad intervention when compared to the standard materials used. The word lists used in decoding during the intervention were pre-established and not adjustable or customized per participant. Thus, the participant may have already had exposure to a certain stimulus in the intervention and thus perform better on certain stimulus sets in data collection. Further research is needed to address these limitations so the approach can be evaluated without the limitations.

The purpose of the current study was to evaluate the effectiveness of an iPad supported phonics intervention on identifying and generalizing consonant blends. This study was designed to evaluate the effectiveness of an updated version of the iPad-
supported application in phonemic awareness intervention on the specific task of identifying and generalizing consonant blends.

The following research questions were addressed:

1) Is there a functional relation between the iPad intervention and the participant’s ability to identify consonant blends within words?

2) Is there a functional relation between the iPad intervention and participant’s ability to generalize the consonant blends to match same-sounding blends in words?
CHAPTER 2: METHOD

A multiple-probe design across stimulus sets was used to evaluate the effectiveness of the iPad intervention. This design is a variation of the multiple baseline design where data are collected across the study through probes instead of continuously collecting baseline assessment of the dependent variable. Multiple probe designs demonstrate experimental control within the participant’s performance across the consonant blends introduced. The study was designed with one participant, and three sets of words so that the replications for the multiple baseline tiers would demonstrated if the intervention had an effect on the students’ ability to learn the blends across sets. The participant did not receive instruction on the second and third consonant blends while the intervention was applied during the first set, making it unlikely that there would be changes in the baseline data during the extended baseline. The multiple probe design also allowed for fewer measurements, which reduced the chance of the student improving due to repeated testing. In other words, fewer measurements helped control for the student learning the blends through exposure and repetition. This design is beneficial to the study since only a finite number of words were included for each blend during the intervention.

Participant

A single 9-year old third grader named Joe (pseudonym) was the participant for this study. Joe attended school in rural Nebraska. At the time of testing, Joe received services at a university reading center for performing below grade level in both reading and writing. Prior to the start of the study, Joe’s mother consented to his participation based on the terms in the written informed consent form. Joe also provided verbal assent prior to the study.
Setting

The study took place at a local library in a private study room. The private study room was located in the back of the library along the south wall. The study room had a small window on the south wall, which faced a green space and a window and door on the north wall that opened up to table and chairs in a larger study area. The west wall had a small white board and the east wall had a built in table that extended along the entire wall with three chairs at the table. The participant completed all assessments and intervention sessions in this location.

Measures

This study included both screening measures and outcome measures. The university reading center personnel administered the screening measures, and the researcher administered the dependent measures.

Screening Measures. Prior to beginning the study, Joe completed screening measures to determine whether he was eligible for the study. The researcher examined Joe’s level of performance only on measures related to phonological awareness and phonics tasks involving reading and writing.

Woodcock Reading Mastery Test (WRMT) III. The reading center file contained results of five subtests of the WRMT-III: letter identification, phonological awareness, word identification, and word attack and passage comprehension. The letter identification subtest measured the student’s ability to recognize letters. Phonological awareness measured the participant’s ability to match first and last sounds, rhyme production, blending and deletion of sounds in words. The word identification subtest measured the ability of the participant to instantly recognize known words. The Word Attack subtest
measured the ability of the student to use phonemic awareness and phonics knowledge to decode nonsense words. The Passage Comprehension subtest measured the participant’s ability to make sense of sentences of short paragraphs by supplying a missing word when given a prompt. The results of the test were indicated that the student performed below grade level on reading and writing tasks. Reliability over the two scorers was 100%.

*Test of Silent Reading Efficiency and Comprehension (TOSREC).* The TOSREC was used to evaluate the reading compression of the participant. During this assessment, the student silently read statements and determined whether the statements were true or false. Joe answered as many questions as possible in 3-minutes. He scored in the 19th percentile when assessed, placing him below average. Reliability between the two scorers over the assessment was 100%.

*Words Their Way Spelling Inventory Primary Spelling List.* This test groups students in developmental appropriate stages based on their knowledge of key spelling features. A variety of spelling features includes, but is not limited to, consonants, short vowels, diagraphs, and blends. During this assessment, the tester read the spelling words to Joe orally, and he spelled it using paper and pencil. Joe’s score placed him in the Late Letter-Name Alphabetic stage. This stage indicated that Joe comprehends the relationship between letters and sounds, however has difficulty spelling words with blends as blends make a distinct sound. This places him two years below current grade level.

*Dependent Variables.* The researcher determined that the dependent variables would be evaluated based on Forming Blends within Words and Matching Same-Sounding Blends. Forming Blends Within Words was used to measure identifying blends. Matching Same-Sounding Blends was used to examine whether the student could
generalize what they learn about forming blends to a task involving sound matching and working memory. Both assessments were designed by the researcher. In both outcome measures, if the participant had not identified or generalized the blend the after five seconds, it was counted as an error and the experimenter moved on to the following questions.

*Forming Blends Within Words (Primary outcome measure and scoring).* This measure was used to determine whether the student could identify the correct blend and form it by using the correct letters. In this measure, the participant selected letter tiles to drag into an empty sound box to correspond with the sounds in the word and then say the blend out loud. If the correct letter tiles were selected to spell the blend correctly at the corresponding point in the word, and the participant said the correct blend, then it was counted correct. See Appendix A for an example of this in forming blends within words.

*Matching Same-Sounding Blends (Secondary outcome measure and scoring).* This measure was used to determine whether the student could generalize his knowledge of forming blends to a task requiring sound-matching of consonant blends to a task involving sound matching and working memory. In this measure, the participant listened to a word with a consonant blend (with a corresponding picture), then listened to three more words (also with corresponding pictures, and then selected the images that had same-sounding blend. The researcher pointed to each image and said the word that corresponded with the image, then asked the participant to circle the image that had the same blend as the prompt picture. See Appendix B for an example of this measure.

*Selecting Consonant Blends to Use in the Instruction and Measures*
Table 2.1

<table>
<thead>
<tr>
<th>Initial S</th>
<th>Initial L</th>
<th>Initial R</th>
<th>Odd</th>
<th>Final Consonant</th>
<th>Preconsonantal Nasal</th>
</tr>
</thead>
<tbody>
<tr>
<td>sk-</td>
<td>bl-</td>
<td>br-</td>
<td>qu-</td>
<td>-st</td>
<td>-mp</td>
</tr>
<tr>
<td>sl-</td>
<td>cl-</td>
<td>cr-</td>
<td>tw-</td>
<td>-sp</td>
<td>-nt</td>
</tr>
<tr>
<td>sm-</td>
<td>fl-</td>
<td>dr-</td>
<td>-</td>
<td>-sk</td>
<td>-nd</td>
</tr>
<tr>
<td>sn-</td>
<td>gl-</td>
<td>fr-</td>
<td>-</td>
<td>-ft</td>
<td>-nk</td>
</tr>
<tr>
<td>sp-</td>
<td>pl-</td>
<td>gr-</td>
<td>-</td>
<td>-pt</td>
<td></td>
</tr>
<tr>
<td>st-</td>
<td>pr-</td>
<td>-</td>
<td>-</td>
<td>-it</td>
<td></td>
</tr>
<tr>
<td>sw-</td>
<td>Tr-</td>
<td>-</td>
<td>-</td>
<td>-lf</td>
<td></td>
</tr>
<tr>
<td>Sc-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-lp</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Blends taken from *Words Their Way.*

The list of consonant blends used were found in *Words Their Way* (Bear, Invernizzi, & Templeton. 1996). The blends included initial s blends, initial r blends, initial l blends, final consonant blends, odd ‘qu’ and ‘tw’, and preconsonantal blends for a total of thirty-four blends (See Table 2.1 for list of blends assessed). The participant completed three tasks for this screening. First, the participant spelled the blends in a given word. Second, the participant formed the blends within a word. Third, the participant matched images with same-sounding blends. Three questions per blend were in each task. If the participant scored at thirty-three percent or lower on a blend, that blend was selected for intervention.

**General Procedures**

The researcher obtained Institutional Review Board approval prior to participant recruitment. An employee of the university reading center made the first contact via phone call to parents and guardians in order to notify parents of the potential study and determine their interest. The researcher then contacted a single parent about the eligibility of her child as a candidate for this study. After verbal consent was given over the phone by
Table 2.2  
Sets of Blends

<table>
<thead>
<tr>
<th>Blend</th>
<th>Examples of Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>sk-</td>
<td>skillet, ski</td>
</tr>
<tr>
<td>sw-</td>
<td>swan, switch</td>
</tr>
<tr>
<td>bl-</td>
<td>blizzard, blouse</td>
</tr>
<tr>
<td>gr-</td>
<td>groceries, grasshopper</td>
</tr>
<tr>
<td>-ct</td>
<td>infect, eject</td>
</tr>
<tr>
<td>sl-</td>
<td>slipper, sleigh</td>
</tr>
<tr>
<td>br-</td>
<td>bruise, bridge</td>
</tr>
<tr>
<td>-sk</td>
<td>whisk, kiosk</td>
</tr>
<tr>
<td>-ft</td>
<td>cleft, theft</td>
</tr>
<tr>
<td>-nk</td>
<td>embank, debunk</td>
</tr>
<tr>
<td>sm-</td>
<td>smoothie, smock</td>
</tr>
<tr>
<td>sp-</td>
<td>spear, spider</td>
</tr>
<tr>
<td>cl-</td>
<td>clamshell, class</td>
</tr>
<tr>
<td>-pt</td>
<td>attempt, bankrupt</td>
</tr>
<tr>
<td>-lp</td>
<td>pulp, scalp</td>
</tr>
</tbody>
</table>

the parent to the researcher, the researcher and parent met to sign a consent form and arrange a time for the participant to begin baseline data collection. At the first meeting with the potential participant, the researcher reviewed an assent form with the participant. The researcher explained to the participant that if he did not want to participate in the study, or stop at any point he could. The participant signed the assent form.

**Baseline.** The researcher collected and administered all baseline assessments. During baseline, the participant’s target behaviors were measured across 15 consonant blends. Prior to beginning baseline, the researcher divided the fifteen consonant blends into three sets labeled Set 1, Set 2, and Set 3, respectively (See Table 2.2). Each set included blends found at the beginnings and ends of words. The researcher separated similar-sounding blends into different sets as to not confuse the participant. Each assessment included three questions per blend, for a total of 15 questions per assessment.

Baseline consisted of two assessments: Matching Same-Sounding Blends and Forming Blends within Words. Although Forming Blends within Words was the primary
measure and Matching Same-Sounding Blends was the secondary measure, they were administered in reverse order during the study to avoid the influences of one measure on the other. Matching Same-Sounding Blends scored a correct response when the participant circled the image with the same-sounding blend as the prompt image. This assessment was administered via paper and pencil. The researcher photocopied the original for a second scorer to evaluate later.

In Forming Blends within Words, a correct response consisted of the participant correctly forming the blend using tiles and positioning them correctly in the word on the application. The researcher took a screenshot of the participants’ final assessment for a second scorer to review later.

**Intervention.** The intervention used an iPad application called Classroom Spelling (atReks, 2016). The researcher created three different words lists for each set of consonant blends. Intervention focused on three words per blend, each word list contained different words for each blend, pulling words from a word bank of 9-12 words per blend.

Each lesson had two parts: Teaching and Practice. In part one, teaching, the instructor lead the participant through learning letters that formed the target blends, the sound each letter in the blend made and it’s positioning in the word. The instructor said, “Today we will be learning five consonant blends. A consonant blend is two consonant letters put together to form a blend. Each letter in the blend says their own sound, but they are put together. An example of this might be ‘br’.”

Instructor opened the teach part on the iPad application and selected the word list for the consonant blends set that the student was working on. The iPad was positioned on
the table in front of the participant and the instructor, and the instructor modeled the first example. The instructor said, “The application is going to read a word and we are going to look at the word and listen.” Application said the first word as it appeared on the screen. Instructor said, “This is the word grill. At the beginning of the word grill, there is the consonant blend ‘gr’. The letter g and the letter r make up the blend gr. The sound that this blend makes is ‘gr’. I’m going to drag the g tile into the first blank and the r tile into the second blank to make this blend. Then, I’m going to fill in the rest of the blanks with the letters and sounds that I hear in the word. “ The instructor dragged the tiles into the blanks. Each letter being matched would be highlighted and the sound of the letter pronounced by the app. When the instructor touched the letter tile, the application said the letter sound. If the letter tile matched the letter sound heard in the word, the tile stayed in the blank boxes. If the letter tile did not match the letter sound heard in the word, the box shook and moved the tile below with all the other tiles.

Next, the instructor provided guided practice. A second word appeared on the screen after the first word was completed. The second word had a new consonant blend. The application said the word, ‘blanket’. The instructor said, “This is the word blanket. At the beginning of the word blanket, we have the consonant blend bl. What are the two letters that make up the consonant blend bl?” Participant responded, “b and l”. Instructor said, “Great, now drag those letters into the spaces up above in the order that you hear the letters and their sounds.” The participant dragged the letters into the blank spaces. The instructor said, “Now we are going to fill in the other letter tiles that we think we hear in the rest of the word.” The participant and the instructor worked together to fill in the rest of the word.
A third word appeared on the screen after the second word was completed. The third word had a new consonant blend. The application said the word, ‘infect’. The instructor said, “This is the word infect. At the end of the word infect we have a consonant blend ct. What letters two letters make up the blend ct?” The participant responded “c and t”. Instructor said, “Good. Now what sound do those letters make?” The participant made the sound for c and then t. The instructor said, “When we put those sounds together we have the sound for the blend ct. Drag the letter tiles into the spaces above to make the sounds for that blend. This blend comes at the end of the word, so let’s fill in the other letter tiles for the sounds we hear in the beginning of the word. Then, I want you to put in the letter tiles for the ct blend at the end of the word.” The instructor continued to guide the participant through the teaching phase for a total of 15 questions.

The instructor then began part two of intervention: Practice. The instructor said, “During practice, we will see blanks and question marks were the word was during teaching. We will hear the word, but we won’t be able to see how to spell it. We are listening for two things: one, what the blend is in the word and two, where the blend is in the word, at the beginning or the end. Next, we will select the letter tiles that make the sounds that we hear in the blend, and drag them into the blank spaces above. Let’s do an example.”

The instructor opened the practice screen on the iPad. The application said the word out loud, ‘groceries’. The instructor said, “The word that I heard was ‘groceries’. In the beginning of the word ‘groceries’ I hear the ‘gr’ sound. I know that the letter ‘g’ and the letter ‘r’ form the ‘gr’ blend. I am going to drag the ‘g’ tile into the first blank and the ‘r’ tile into the second blank.” When the instructor selected the tiles on the application,
the application said the sound of each letter. The instructor said, “Now I’m going to fill in the rest of the word with the letters that I hear.” After the instructor filled in the letter tiles, the questions marks on the screen disappeared and the word appeared. The instructor said, “I can see that I spelled the blend right. Now I can move on to the next word and blend.”

The application read the second word. The instructor said, “The word was ‘blizzard’ at the beginning of ‘blizzard’ I hear the blend ‘bl’. What letters make up the blend ‘bl’?” The participant said, “‘b’ and ‘l’”. The instructor said, “Great, now drag those tiles into the first two spaces.” The participant dragged the tiles into the first two blanks.

The instructor and the participant continued to answer a total of 15 questions. After the application had presented each of the five blends in words once, the instructor gradually increased the amount of work that the participant did. This meant the participant answered the blend heard, the positioning in the word and the letters that formed the blend. The participant had infinite number of attempts to form the blend on the application using the tiles during the practice phase.

The participant took breaks in-between parts of intervention as well as assessments. The participant engaged in a math motor cross computer game for his breaks. Breaks ranged in time of a minute and a half to two minutes.

**Interrater Reliability**

The researcher and a graduate research assistant independently scored the Forming Blends Within Words assessment. A screenshot of the list of words that the
participant formed on the iPad was taken after the assessment. The second scorer then viewed the words after the sessions were completed. Agreements in reliability were when the first author and graduate research assistant agreed upon the blend being formed correctly in the word and positioned correctly at the beginning or end of the word. Disagreements in reliability were when the researcher and graduate research assistant disagreed upon the spelling of the blend or where it was positioned in the word. Reliability score was 100% for Forming Blends Within Words assessment.

The researcher and a graduate research assistant independently scored the Matching Same-Sounding Blends assessment. The researcher calculated interobserver agreement by adding up the number of agreement, divided by the number of agreements plus the number of disagreements and multiplying by 100. Agreements in reliability were when the first author and graduate research assistant agreed upon the correctly circled image. Disagreements in reliability were when the first author and graduate research assistant disagreed upon a circled image. Reliability score was 100% for Matching Same-Sounding Blends assessment.

**Treatment Fidelity**

Researchers collected treatment fidelity data over the experimenter’s behaviors and operation of the iPad app with the participant over 33% of the lessons. The experimenter created a treatment fidelity checklist to be used. The researcher calculated treatment fidelity by adding together the number of correct tasks on the checklists, divided by the total number of tasks, and then multiplied by 100. Upon completion of
observation, feedback was given to the experimenter. Treatment fidelity was 96%. See Figure 2.1 for treatment fidelity checklist used.

<table>
<thead>
<tr>
<th>Session #:</th>
<th>Fidelity Checker</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fidelity Steps</strong></td>
<td>Yes</td>
</tr>
<tr>
<td>1. Greet participant</td>
<td></td>
</tr>
<tr>
<td>2. Open the app on the iPad. Hand student the iPad.</td>
<td></td>
</tr>
<tr>
<td>Teach Phase on iPad</td>
<td></td>
</tr>
<tr>
<td>Say: &quot;This is the teaching phase. During this phase you will learn what letters form a blend and what that blend sounds like. A word will be given and you will select letter tiles to form the sounds in the word. &quot;</td>
<td></td>
</tr>
<tr>
<td>Practice Phase on iPad</td>
<td></td>
</tr>
<tr>
<td>Say: This is the practice phase. During this phase you will hear a word has one of the blends that you have learned. You will select a letter tile to make the sounds in the word and the blend.&quot;</td>
<td></td>
</tr>
<tr>
<td>8. Test Phase on iPad</td>
<td></td>
</tr>
<tr>
<td>Say: &quot;You will hear a word that has one of the blends that you have learned in it. Below the empty box are tiles with letters in them. You will drag the tile into the empty box to form the sounds you hear in the word.&quot;</td>
<td></td>
</tr>
<tr>
<td>6. Spelling Assessment</td>
<td></td>
</tr>
<tr>
<td>Say: &quot;I am going to say a word and I want you to write down the word. If you need the word repeated, you may ask and I will repeat the word.&quot;</td>
<td></td>
</tr>
<tr>
<td>7. Match Assessment</td>
<td></td>
</tr>
<tr>
<td>Say: &quot;I am going to say a word and you will choose the word that has the same sound as the word that I said. Let’s do an example. (ie) This is an image of snow. What other picture has the same beginning sound as snow? *point to each image and say the word that goes with the image.&quot;</td>
<td></td>
</tr>
</tbody>
</table>

*Figure 2.1* Treatment Fidelity Checklist
CHAPTER 3: RESULTS

Forming Blends Within Words was the primary measure used to determine phase changes. The secondary measure used was Matching Same-Sound Blends. Means and standard deviations for baseline, intervention, and maintenance for both measures can be found in Table 3.1.

Forming Blends Within Words

The graphs for Forming Blends Within Words can be found in Figure 3.1. In Blends Set 1, a stable baseline was reached after five sessions. The correct number of responses ranged from seven to 10 during baseline. After establishing a stable baseline, the intervention phase began for Blends Set 1. Visual Analysis shows a clear and immediate change in level and trend. The participant’s score jumped from eight correct responses in the final baseline probe to 15 correct responses after the first session of intervention. Consistency was improved across assessment points during intervention and maintenance.

<table>
<thead>
<tr>
<th>Blend Set 1 (sk-, sw-, bl-, gr-, -ct)</th>
<th>Blend Set 2 (sl-, br-, -sk, -ft, -nk)</th>
<th>Blend Set 3 (sm-, sp-, cl-, -pt, -lp)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Forming Blends in Words</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>8.8 (1.3)</td>
<td>8.9 (2.0)</td>
</tr>
<tr>
<td>Intervention</td>
<td>15.0 (0.0)</td>
<td>14.7 (0.6)</td>
</tr>
<tr>
<td>Maintenance</td>
<td>14.8 (0.4)</td>
<td>14.3 (0.6)</td>
</tr>
<tr>
<td><strong>Matching Same-Sounding Blends</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>7.8 (3.7)</td>
<td>7.5 (2.1)</td>
</tr>
<tr>
<td>Intervention</td>
<td>8.6 (1.5)</td>
<td>13.3 (2.0)</td>
</tr>
<tr>
<td>Maintenance</td>
<td>7.0 (0.0)</td>
<td>11.5 (2.9)</td>
</tr>
</tbody>
</table>
into maintenance. The participant consistently scored at 15 correct responses in intervention and ranged from 15 to 14 correct responses in maintenance for Blends Set 1.

In Blends Set 2, a stable baseline was reached after eight sessions. Correct response ranged from five to 11 during baseline. Visual analysis shows an immediate change in level and trend upon introduction of the intervention. The participant increased from nine correct responses in the last baseline probe to 15 correct responses in the first session of intervention. Consistency was maintained across intervention ranging in 15 to
14 correct responses. This consistency was also found in maintenance, ranging in 15 to 14 correct responses.

In Blends Set 3, a stable baseline was reached after seven sessions. Correct responses ranged from six to 11 during baseline. Visual analysis shows an immediate change in level and trend upon introduction of the intervention. The participant increased from nine correct responses in the final baseline probe to 13 correct responses in the first session of intervention. In intervention for Blends Set 3, consistency ranged from 13 to 14 correct responses. Maintenance probes were consistently 13 correct responses.

Of all the sets, the participant was most inconsistent in correct responses in Set 2, correct answers ranging from five to 11. Visual analysis shows that across all three sets, an immediate increase in correct number of responses from baseline to the first session of intervention.

**Matching Same-Sounding Blends**

The graphs for Matching Same-Sounding Blends can be found in Figure 3.2. Matching Blend Sounds was not a primary measure for phase change due to the vast inconsistency in performance of the participant over baseline. In Set 1, correct responses
in baseline ranged from four to 13. After five probes, intervention for Set 1 Blends was introduced. Correct responses ranged from seven to 10 across intervention. In maintenance, the participant consistently scored seven correct responses.

In Set 2, baseline correct responses ranged from four to 11. After eight sessions, intervention for Set 2 was introduced. Visual analysis shows an immediate change in
level and trend upon the introduction of intervention. Correct responses ranged from 12 to 14 during intervention. During maintenance correct responses ranged from nine to 14.

In Set 3, correct responses ranged from five to seven in baseline. Intervention began after seven baseline probes. Visual analysis shows an immediate change in level and trend upon beginning intervention. During intervention, correct responses ranged from six to eight. Maintenance maintained the increase in level and trend from baseline with a correct response of eight.

Across all three sets, an increase in number of correct responses is seen from final baseline data point to the first session of intervention. A visual analysis of Set 3 shows the most consistency in correct responses compared to Set 1 and Set 2.
CHAPTER 4: DISCUSSION

This study examined the effectiveness of an iPad application on identifying and generalizing consonant blends in words for a participant who was below grade level in reading and writing. The research questions addressed were: 1) Is there a functional relation between the iPad intervention and the participant’s ability to identify consonant blends within words? 2) Is there a functional relation between the iPad intervention and participant’s ability to generalize the consonant blends to match same-sounding blends in words? The results of the current study were slightly different than the findings in the Larbee, Burns and McComas (2014) original study. Their study resulted in inconclusive findings of an iPad application when compared to standard materials in phonics identification skills. The current study resulted in an increase in correct responses for identifying blends in words during intervention and maintenance across all three sets of blends. Generalizing consonant blends data collection shows an inconsistency in correct responses across all three sets over baseline, intervention and maintenance.

These results led to the effectiveness of the intervention in the participant being able to identify consonant blends, however was not effective in generalizing consonant blends. The tasks the participant completed during intervention were similar to the tasks completed in the assessment of identifying blends. During the intervention, the participant heard the word, saw how the blend was spelled in the word, and where the blend appeared in the word. The participant then had guided practice on spelling the blend and placing it in the word using letter tiles. During the forming blends within word assessment, these tasks were similar, the difference being the participant had one opportunity to form the blend within the word and to form the blend correctly. Due to the
similarity in tasks, and exposure to words containing the blend, the participant readily increased correct responses when forming the blend in the word.

In the matching same-sounding blends assessment, the participant was exposed to four words with images, two of which had the same-sounding blend, and two of which had similar-sounding blends. The participant had no previous exposure to the images or two of the four words. The lack of exposure could be a reason why the participant struggled with consistency in correct responses on this assessment. Another potential reason this intervention was not effective for this task may have been an overload in audible information that the participant had to sift through to find same-sounding blends and differ those from words that had similar sounds.

Throughout the study, the participant struggled with motivation and consistency in responses on assessments and in intervention. At the beginning of the study, the participant was still receiving services at the university reading center twice a week, as well as attending school during the day. With sessions being held in the evening after school, the participant was often exhausted and expressed a desire to not be there. The participant’s mother was concerned with the amount of effort and motivation that was required on her part to bring him in to complete the assessments for baseline data. Due to her concerns, and the participant’s behavior, the sessions were reevaluated. Beginning after session 5, sessions were shortened from 30 to 40 minutes to 20 minutes and spelling using paper and pencil assessment were removed. Additionally, the researcher gave four to five breaks to the participant that lasted a minute and a half to two minutes. Shortening the sessions, additional breaks and removing of the paper/pencil spelling assessment
improved the participant’s engagement and effort on forming blends within words assessment and matching same-sounding blends assessment.

**Limitations**

Limitations that may have played a factor in the results of this study are the design of the study and confounding variables. The intervention focused on hearing the word, forming the word with an emphasis on the correct formation of the blend within the word. The intervention may have been more effective had there been more consistent explicit formal instruction and review over each blend. The experimenter informally prompted the participant what the target blend was in each word, and what letters formed that blend. However, the participant began to expect those prompting questions, and, in turn, would readily say the sound of the blend and the letters that it formed prior to being asked.

During the time of intervention, the participant was receiving services at the reading center and in school. The reading center provide additional support to students who struggle with reading and writing. It is a possibility that the transfer of skills learned in the reading center may have impacted the participant’s performance in the study. This is not a very likely probability, because the researcher controlled sets of blends in the study, but needs to be considered.

The participant struggled maintaining motivation throughout the study, which may have impacted the consistency in performance. As motivation is crucial in students complying and engaging in school work, the researcher addressed the lack of motivation following session 5 by shortening the session time, removing the paper and pencil assessment and more frequent breaks for the participant. While these adjustments did not
result in completely eliminating inconsistency in performance, the participant was more engaged and motivated during sessions following the changes. Therefore, these changes also may have impacted the study results. The participant was particularly motivated through playing a math motor cross video game as breaks in-between assessments. Assessing and incorporating interests of students may be beneficial in future use of this program.

**Implications and Recommendations**

The result of this study demonstrated that there is a positive effect in engaging the participant in similar tasks. The tasks completed in the intervention and during the forming blends assessment were very similar. The student may have felt confident and comfortable in these tasks, which could be a reason for the increase in correct responses during intervention. However, the Matching Same-Sounding Blends task was dissimilar to the intervention, which may explain why there was an inconsistency in results for that generalization measure. Further research might evaluate this intervention along with other proven tasks to potentially lead to impacts on generalizing phonic skills. In addition, building positive reinforcement into the intervention may provide additional incentive for students to succeed.

This study was conducted in a private tutoring room at a local library. Since the study was conducted one-on-one in a small area, it is unclear if the results could be replicated if the intervention was done in a typical classroom. Nevertheless, the use of iPad and easy to access interventions, such as this one, would be highly valuable in a classroom setting—especially with a paraeducator working one-to-one with struggling readers. In addition, iPads and other technology devices allow students to work
independently on tasks and at an individual pace. When working in a classroom environment, other factors may impact the effectiveness of the iPad intervention such as teacher fidelity, distractions occurring in the room (e.g., other students, activities and noises), and most importantly the access to technology. Further research could evaluate the effectiveness of this intervention in a classroom setting and with a younger group of students.

The participant and researcher engaged in informal conversations before, after and during breaks during the study. During one session, the participant was discussing the motor cross game with the researcher. The participant said, “Did you know that motor cross has the consonants ‘cr’ in it, and that’s a consonant blend too, right?” This informal conversation the participant and researcher had during the study demonstrates that the participant was able to generalize the content of consonant and consonant blends into something that he enjoyed. Working in a one-on-one setting enabled the participant and researcher to have informal conversations and ask questions. This interaction provoked an interesting and noteworthy response that the student, while not able to effectively generalize on the assessment, was able to use the knowledge learned in the intervention to discuss something else that he enjoyed. It is important for teachers in classroom settings to engage students in informal moments, such as this one, to help build connections and generalize skills learned.

Another noteworthy moment in the study occurred towards the end of the sessions when the participant began to create lists on a piece of paper of the blends that he knew. This spontaneous strategy is an example of something many students do to help remember certain things. By having the blends written down on a piece of paper, the
student was freeing some of his working memory to engage in a different task. Teachers in classroom settings should foster, encourage and engage students to use these spontaneous strategies. Further research could examine how students use strategies such as creating lists, and how that affects their performances on assessments.

The study used custom lists for the participant, specific to the consonant blends the student did not know. It is unclear what the results would be if the study was conducted using other phonics skills (i.e. long vowels, short vowels, diphthongs, diagraphs, etc.). In the original study conducted by Larbee, Burns and McComas (2014), the student did improve phonemic decoding. However, it is uncertain if results were due to the iPad application or standard materials, or a combination of both. Further research could examine the effect of the iPad intervention on phoneme decoding.

Conclusion

This study contributed further information to current research done of iPad applications used in identifying and generalizing consonant blends in words. The intervention was successful for increasing the number correctly identified blends in words in a task specific setting. With greater understanding and comprehension of blends comes greater understanding and comprehension in other literacy areas like reading and writing. The results of this study support the use of the iPad application intervention in specific phonetic skills such as forming consonant blends in words.
References


Psychology, 23, 271-288. doi: 10.1080/713775284


APPENDIX A
FORMING BLENDS WITHIN WORDS MEASURE EXAMPLE
APPENDIX B
MATCHING SAME-SOUNDING BLENDS MEASURE EXAMPLE