

California State University, Monterey Bay
Digital Commons @ CSUMB

Capstone Projects and Master's Theses

Capstone Projects and Master's Theses

Spring 2018

Implementing Multisensory Techniques when Teaching Letter Knowledge

Franciska Karpovich
California State University, Monterey Bay

Follow this and additional works at: https://digitalcommons.csUMB.edu/caps_thes_all

Recommended Citation

Karpovich, Franciska, "Implementing Multisensory Techniques when Teaching Letter Knowledge" (2018).
Capstone Projects and Master's Theses. 297.
https://digitalcommons.csUMB.edu/caps_thes_all/297

This Master's Thesis (Open Access) is brought to you for free and open access by the Capstone Projects and Master's Theses at Digital Commons @ CSUMB. It has been accepted for inclusion in Capstone Projects and Master's Theses by an authorized administrator of Digital Commons @ CSUMB. For more information, please contact digitalcommons@csUMB.edu.

Running head: IMPLEMENTING MULTISENSORY TECHNIQUES

Implementing Multisensory Techniques when Teaching Letter Knowledge

Franciska Karpovich

Thesis Submitted in Partial Fulfillment of the Requirements for the
Degree of Master of Arts in Education

California State University, Monterey Bay

May 2018

©2018 by Franciska Karpovich. All Rights Reserved

IMPLEMENTING MULTISENSORY TECHNIQUES

Implementing Multisensory Techniques when Teaching Letter Knowledge

Franciska Karpovich

APPROVED BY THE GRADUATE ADVISORY COMMITTEE

Kerrie Lemons Chitwood, Ph.D.
Advisor and Program Coordinator, Master of Arts in Education

Erin Ramirez, Ph.D.
Advisor, Master of Arts in Education

Kris Roney, Ph.D. Associate Vice President
Academic Programs and Dean of Undergraduate & Graduate Studies

IMPLEMENTING MULTISENSORY TECHNIQUES

Abstract

Small-group interventions involving multisensory techniques when teaching letter knowledge to Kindergarten students in the English language have not been researched. It is important to research the use of multisensory techniques in small-group instructional efforts when teaching letter knowledge because letter knowledge contributes to students' gaining reading abilities; and, reading abilities, in turn, contribute to students' academic success (Gellert & Elbro, 2017; Huang & Konold, 2014; Musti-Rao & Cartledge, 2007). The purpose of this quantitative quasi-experimental study was to determine whether small group instruction involving multisensory techniques had an impact on Kindergarten students' letter knowledge. The study divided 30 Kindergarten students into two groups: a treatment group, who received the small-group intervention using multimodal methods when teaching letter names, and a control group who received standard of care. Data were analyzed by conducting both independent and paired samples t-tests. The results indicated that the treatment group made a small gain in their mean score (i.e., an increase in the treatment group's mean score from 30.07 to 31.47), showing that the intervention had a positive impact; however, this impact was not statistically significant. Based on the results, teachers can see the potential impact that the small-group instruction involving multisensory techniques can have on their students' letter knowledge. Therefore, the small-group instruction can supplement the regular literacy instruction. Additionally, the intervention could lead to research into interventions using multisensory techniques for the other early reading skills (i.e., phonological awareness and phonemic awareness).

Keywords: Multisensory techniques, Kindergarten, letter knowledge, and small-group instruction

IMPLEMENTING MULTISENSORY TECHNIQUES

Acknowledgements

I would like to thank everyone at the elementary school for allowing me to conduct my research.

IMPLEMENTING MULTISENSORY TECHNIQUES

Table of Contents

Literature Review.....	1
Methods.....	11
Results.....	17
Discussion.....	19
References.....	24
Appendix A.....	27
Appendix B.....	28
Appendix C.....	29
Appendix D.....	31
Appendix E.....	32
Appendix F.....	33

Implementing Multisensory Techniques when Teaching Letter Knowledge

Literature Review

Numerous research studies indicate that reading difficulties are noticed as early as Kindergarten (Gellert & Elbro, 2017; Helf, Cooke, & Konrad, 2014; Huang & Konold, 2014; Musti-Rao & Cartledge, 2007; Noltemeyer, Joseph, & Kunesh, 2013). Difficulty with reading is a significant issue for many early elementary school students, which is problematic as struggling readers will likely encounter academic challenges later in their schooling (Gellert & Elbro, 2017; Helf et al., 2014; Huang & Konold, 2014; Musti-Rao & Cartledge, 2007; Noltemeyer et al., 2013). For example, Noltemeyer and colleagues (2013) found that young children starting Kindergarten without the necessary reading skills (i.e., phonemic awareness, phonological awareness, and letter knowledge) move on from kindergarten continuing to display continued challenges with these skills. Results indicated that students who did not demonstrate adequate skills in phonemic awareness, phonological awareness, and letter knowledge were at risk for later academic failure. Furthermore, these deficiencies in early reading skills may impact students in the upper grades, as difficulties in reading may lead to academic challenges in all content areas (Musti-Rao & Cartledge, 2007). To better understand how deficiencies in early reading skills may impact students in the upper grades, one must examine the components of early reading skills.

Reading Skills

Early reading skills (i.e., phonemic awareness, phonological awareness, and letter knowledge) are made up of multiple unique components that each contribute to learning how to read (Gellert & Elbro, 2017; Helf et al., 2014; Musti-Rao & Cartledge, 2007; Noltemeyer et al., 2013). Phonemic awareness is the ability to manipulate sounds into words and vice versa (Noltemeyer et al., 2013). For example, students can use the sounds /m/, short /o/, and /m/ to

create the word *mom* and break down the word *mom* into the individual sounds /m/, short /o/, and /m/. Phonological awareness is a broad set of skills that include phonemic awareness, syllable awareness (i.e., the understanding that words are composed of syllables), onset and rime identification (i.e., the ability to name the beginning and ending parts of words), and the connection between letter names and the sounds they represent (Anthony & Francis, 2005). Students who possess phonological awareness are capable of building words from sounds and breaking down words into sounds. Additionally, students can identify the onset blend /bl-/ and the rime /-ack/ to form the word *black*; and connect the letter, k, to the sound it represents, /k/. The third early reading skill is letter knowledge, which is the identification of letter names (Bara, Gentaz, Cole, & Sprenger-Charolles, 2004). For example, when students are presented with the letter, g, they can state that the letter is g (i.e., they know the name of the letter itself). These early reading skills are all essential in reading acquisition because they build upon one another (i.e., phonological awareness is built upon phonemic awareness which is built upon letter knowledge). Therefore, it is necessary that students gain the essential instruction needed to master each of these early reading skills if they are to be successful throughout the reading process.

Without phonemic awareness, phonological awareness, and letter knowledge, students will struggle with reading. In particular, phonemic awareness is important in predicting students' success with reading; even though it relies mainly on their ability to manipulate sounds into words and vice versa (Musti-Rao & Cartledge, 2007; Noltemeyer et al., 2013; Oslund et al., 2012). Students who can manipulate sounds into words and vice versa can say that the sounds /k/, short /a/, and /t/ form the word *cat* and the word *cat* has the sounds /k/, short /a/, and /t/. In fact, multiple studies reported that students who made gains from pretest to posttest on the

phonemic awareness subtest indicated future reading success (Helf et al., 2014; Musti-Rao & Cartledge, 2007; Oslund et al., 2012; Zoski & Erickson, 2017). Students who have a better grasp of breaking down words into their individual sounds (i.e., phonemes) are predicted to be more successful with reading because the students understand that words are created from sounds; and, the students can change the words by changing one of the sounds (e.g., cat can be changed to the word *bat* by changing the beginning sound from /k/ to /b/). Musti-Rao and Cartledge (2007) determined that awareness of phonemes must be established before students learn letter names because letter-sound correspondence does not occur solely with letter knowledge. For example, students cannot make the connection that the letter, b, represents the sound, /b/, without knowing that the name of the letter is b. Similarly, phonological awareness builds from phonemic awareness.

With phonemic awareness, phonological awareness can be achieved because phonological awareness and phonemic awareness are inextricably linked. Phonological awareness was defined as the “full awareness of the phonological structure of speech” (Nithart et al., 2011, p. 346). The phonological structure is comprised of the letter-sound correspondence of the entire English alphabet; thus, gaining phonological awareness emphasizes orthographic patterns (Zoski & Erickson, 2017). Students must know the names of letters in order to connect the letter names to the sounds they represent, because connecting letter names in the alphabet to the sounds they represent establishes speech. For example, students who recognize that the letter, m, represents the /m/ sound are gaining phonological awareness. Phonological awareness is noted as essential in reading acquisition (Gellert & Elbro, 2017; Nithart et al., 2011). Accordingly, school professionals track students’ mastery of phonological awareness due to its contribution to reading acquisition.

Nithart and colleagues (2011) pointed out explicitly that phonological awareness determines reading ability for students in upper elementary grades. Thus, assessments that measure phonological awareness are essential to help predict students' reading strengths and challenges (Gellert & Elbro, 2017). Furthermore, appropriate assessment is important to predict success and difficulties with reading, which can aid school personnel in developing interventions for reading acquisition (Gellert & Elbro, 2017; Huang & Konold, 2014; Musti-Rao & Cartledge, 2007; Noltemeyer et al., 2013; Oslund et al., 2012). These interventions can seek to address students' issues with early reading skills and provide them more opportunities to gain reading acquisition. Moreover, reading acquisition will help students succeed academically (Musti-Rao & Cartledge, 2007). It becomes important to determine each component that impacts reading acquisition; therefore, letter knowledge must also be considered as it contributes to reading acquisition.

Another important reading skill that Kindergarten students require is letter knowledge. Huang and Konold (2014) defined letter knowledge as knowing the letter names. Letter knowledge has been cited as vital to building letter-sound correspondence for the entire English alphabet (Musti-Rao & Cartledge, 2007). For example, students recognize that the letter, d, represents the /d/ sound; thus, they have developed letter-sound correspondence between the letter, d, and the /d/ sound. Once letter knowledge and letter-sound correspondence have been established, students are predicted to gain reading abilities as they progress academically (Bara et al., 2004; Bara, Gentaz, & Cole, 2007; Huang & Konold, 2014). Students who are predicted to gain reading abilities are more likely to acquire reading skills; thus, they are more likely to succeed academically (Gellert & Elbro, 2017; Huang & Konold, 2014; Musti-Rao & Cartledge, 2007; Noltemeyer et al., 2013; Oslund et al., 2012). Therefore, phonemic awareness,

phonological awareness, and letter knowledge are required for students to develop reading abilities; which will help students to succeed academically (Musti-Rao & Cartledge, 2007). Other studies have argued that phonemic awareness has more predictive ability, but letter knowledge remains important. For instance, Bara and colleagues (2004) concluded that letter knowledge is necessary, but not essential for decoding words. Further, Gellert and Elbro (2017) explained that letter knowledge may not contribute to indicating later reading abilities. Notably, letter knowledge remains a significant reading skill, despite the argument that letter knowledge is less important than phonemic and phonological awareness. Letter knowledge can predict reading acquisition, which will help students succeed academically (Gellert & Elbro, 2017; Huang & Konold, 2014; Musti-Rao & Cartledge, 2007). As research has demonstrated early reading skills acquisition as a predictor of later academic success, it becomes important to accurately assess said skills to ensure remediation occurs for struggling students.

Assessments of reading skills. As students progress through school, they are assessed in a multitude of ways to ensure that adequate progress is made for grade promotion. However, assessments do not need to only occur at the end of units and school years, but rather should be used formatively to help ascertain a student's ability level. In relation to reading ability, assessments can also be used to determine which students are at risk for becoming struggling readers (Gellert & Elbro, 2017; Huang & Konold, 2014; Oslund, et al., 2012). Dynamic Indicators of Basic Early Literacy Skills (DIBELS) is a widely-used series of assessments in the evaluation of literacy skills (Helf et al., 2014; Musti-Rao & Cartledge, 2007; Oslund et al., 2012). The DIBELS assesses all areas of early literacy, but specifically, the Nonsense Word Fluency (NWF) and Phoneme Segmentation Fluency (PSF) subtests of the DIBELS have been used in several studies (Helf et al., 2014; Musti-Rao & Cartledge, 2007; Oslund et al., 2012).

These subtests were used to measure the dependent variables detailed in the studies (e.g., student progress, students' ability to break down words into sounds, and differences in reading gains). Furthermore, the NWF and PSF subtests accurately measure students' progress in phonemic awareness, phonological awareness, and letter knowledge (Helf et al., 2014; Musti-Rao & Cartledge, 2007; Oslund et al., 2012).

Additionally, the NWF and PSF may assist educators in determining which students are more likely to acquire reading abilities; therefore, the educators can ascertain which students will succeed academically (Helf et al., 2014; Musti-Rao & Cartledge, 2007; Oslund et al., 2012). These subtests are often indicative of students' later reading abilities and difficulties. The gains students make from these subtests strongly correlate with later reading acquisition (Helf et al., 2014; Musti-Rao & Cartledge, 2007; Oslund et al., 2012). For instance, the PSF subtest of the DIBELS assessment is frequently used to measure students' phonemic awareness (Helf et al., 2014; Musti-Rao & Cartledge, 2007; Oslund et al., 2012; Zoski & Erickson, 2017). Other assessments, such as Phonological Awareness Literacy Screening for Kindergarten (PALS-K) and curriculum-embedded mastery checks, are used concurrently with DIBELS in order to better predict students' later reading abilities and difficulties (Huang & Konold, 2014; Oslund et al., 2012). Thus, assessments serve to identify future struggling readers and the reading skills they lack as well as evaluate students' preparedness for grade promotion. By identifying future struggling readers and students who are prepared and unprepared for grade promotion, school personnel can provide interventions to students in order to help them with reading acquisition, which will contribute to their academic success (Gellert & Elbro, 2017; Huang & Konold, 2014; Musti-Rao & Cartledge, 2007; Noltemeyer et al., 2013; Oslund et al., 2012).

Educators, paraprofessionals, and other personnel who are concerned about students' reading acquisition can determine and track which reading skills students lack using assessments, determine the interventions students require, plan small-group instructional efforts, and address the students' gaps in reading skills. Often, educators and other personnel focus on improving the students' letter knowledge due to its importance in reading acquisition (Gellert & Elbro, 2017; Helf et al., 2014; Musti-Rao & Cartledge, 2007). It is necessary for students to read because they cannot be successful academically if they are unable to read (Musti-Rao & Cartledge, 2007). Ultimately, interventions are planned and implemented for students in order to help them learn to read by improving students' early reading skills.

Interventions

After assessments have determined future struggling readers, school professionals plan interventions in order to close the gaps in reading skills. An intervention is defined as an instructional effort that focuses intensely on at least one of the reading skills (e.g., phonemic awareness, phonological awareness, and letter knowledge), occurs in a small group or one-on-one setting, and includes special education services as well as other services (Zoski & Erickson, 2017). Interventions are highly recommended for students at risk of becoming struggling readers, and teachers are strongly encouraged to begin these efforts as early as Kindergarten (Noltemeyer et al., 2013).

When teachers start reading intervention efforts, they focus on different reading skills; such as alphabet knowledge, phonemic awareness, fluency, vocabulary, and reading comprehension (Helf et al., 2014). Several studies have demonstrated that students benefit from interventions (Helf et al., 2014; Musti-Rao & Cartledge, 2007; Zoski & Erickson, 2017). Musti-Rao and Cartledge (2007) evaluated the effectiveness of including a supplemental reading

program to literacy instruction and found that the program had significant positive results in terms of improving Kindergarten students' phonological knowledge and letter knowledge. Further, Kindergarten students acquiring reading abilities can benefit from a morphological-awareness-focused intervention when added to an intervention targeting letter knowledge and phonological awareness (Zoski & Erickson, 2017). Interventions do not only improve students' reading skills, but the interventions contribute to their future reading abilities, which also help students succeed academically (Musti-Rao & Cartledge, 2007). Small-group instruction can also contribute to reading acquisition and academic success because it is another type of intervention.

Small-group instruction. Interventions in the primary grades often include small-group instructional efforts. Small-group instruction works because each student in the small group receives individual attention from the school professional. Furthermore, small-group instruction can be beneficial for students at risk of becoming struggling readers (Musti-Rao & Cartledge, 2007; Noltemeyer et al., 2013). Several research studies working with small groups of students showed significant gains for students in phonological awareness, phonemic awareness, and letter knowledge (Bara et al., 2004; Bara et al., 2007; Helf et al., 2014; Musti-Rao & Cartledge, 2007; Noltemeyer et al., 2013; Zoski & Erickson, 2017).

Also, small-group instructional efforts can focus solely on phonological awareness, which is often the case because, like alphabet knowledge, phonological awareness is another reading skill that must be gained in Kindergarten in order to develop reading skills (Nithart et al., 2011). Small-group instructional efforts can focus on either one or more than one reading skill; thus, the efforts can focus on improving letter knowledge for Kindergarten students. By improving at least one of the reading skills, students will more likely gain reading abilities, which will contribute to students' academic success (Gellert & Elbro, 2017; Musti-Rao &

Cartledge, 2007; Noltemeyer et al., 2013). The third type of intervention that can contribute to reading acquisition and academic success is an intervention using multisensory techniques.

Before the intervention can be explained, the term *multisensory* must be defined for clarification.

Interventions using multisensory techniques. Multisensory, which is also known as multimodal, is defined as using more than one sense (e.g., smell, touch, sight, and hearing) (Joshi, Dahlgren, & Boulware-Gooden, 2002). Four studies document the effectiveness of interventions using multisensory techniques (Bara et al., 2004; Bara et al., 2007; Flood, Lapp, & Fisher, 2005; Preece & Zhao, 2015). Two of these studies focus on determining the effectiveness of interventions using multimodal methods when teaching letter knowledge (Bara et al., 2004; Bara et al., 2007). The remaining two studies were conducted to determine the effectiveness of interventions using multisensory techniques when teaching fluency, comprehension, and content areas, such as English (Flood et al., 2005; Preece & Zhao, 2015). Students with disabilities, especially those with learning disabilities and dyslexia benefit from interventions using multimodal methods (Joshi et al., 2002; Magpuri-Lavell, Paige, Williams, Akins, & Cameron, 2014; Preece & Zhao, 2015; What Works Clearinghouse, 2010). It is important that educators explore using interventions involving multisensory techniques because the interventions can help students gain reading abilities, which will help them succeed academically (Flood et al., 2005; Joshi et al., 2002; Magpuri-Lavell et al., 2014; Musti-Rao & Cartledge, 2007; Walet, 2011). Specifically, interventions involving multimodal methods when teaching letter knowledge should be explored.

Letter knowledge's significance is apparent in the fact that researchers have started to explore the use of multisensory techniques in small-group instructional efforts when teaching the early reading skill. Two studies have examined the effects of small-group instructional efforts on

letter knowledge in the French language using multimodal methods (Bara et al., 2004; Bara et al., 2007). Bara and colleagues (2004) examined the use of multisensory techniques in a small-group setting in Kindergarten. This study measured students' grasp of letter knowledge using three different approaches (i.e., a visual-auditory approach, a tactile-kinesthetic-visual-auditory approach, and a visual-auditory approach done in a sequential manner; Bara et al., 2004). Bara and colleagues followed up on the 2004 study and determined that Kindergarten students' grasp of the letter knowledge improved significantly with haptic-auditory-visual-metaphonological (HVAM) training (2007). In addition, Bara and colleagues (2007) noted that the improvements were larger with the HVAM training than with the visual-auditory-metaphonological (VAM) training.

Studies that replicate Bara and colleagues' 2004 and 2007 studies in the English language have not been done. It is important to research the use of multisensory techniques in small-group instructional efforts when teaching letter knowledge because letter knowledge contributes to students' gaining reading abilities; and, reading abilities, in turn, contribute to students' academic success (Gellert & Elbro, 2017; Huang & Konold, 2014; Musti-Rao & Cartledge, 2007). After research into using small-group instructional efforts involving multimodal methods has been completed, the intervention can be used when teaching the other early reading skills (e.g., phonemic awareness and phonological awareness) in order to combat against reading difficulty. The purpose of the study was to determine the impact that small-group instruction involving multisensory techniques has on students' understanding of letter knowledge.

Methods

Research Question

In line with the purpose of this study, the research question was: Does small-group instruction involving multisensory techniques (i.e., a visual-auditory approach and a tactile-kinesthetic-visual-auditory approach) have an impact on Kindergarten students' understanding of letter knowledge?

Hypothesis

Based on the results of Bara and colleagues (2007), my hypothesis for the research question was that small-group instruction involving multisensory techniques would have a positive impact on students' understanding of letter knowledge.

Research Design

This study used a quantitative nonequivalent-groups pretest-posttest quasi-experimental design. There were two groups: a treatment group who participated in an intervention, and a control group who received standard of care (i.e., no intervention). The study examined the scores on the Letter Naming Fluency (LNF) assessment of the DIBELS (*"Taking a Reading" a teacher's guide to reading assessment*, 2002) for Kindergarten students who participated in the small-group instruction involving multisensory techniques (i.e., treatment group) and a group of Kindergarten students who did not participate in the intervention (i.e., control group). The scores from the pretest and posttest underwent independent samples and paired t-tests to determine if small-group instruction involving multisensory techniques (i.e., a visual-auditory approach and a tactile-kinesthetic-visual-auditory approach) had an impact on Kindergarten students' understanding of letter knowledge (Bara et al., 2004).

Independent variable. The independent variable in this study was small-group instruction involving multisensory techniques. Small-group instruction was defined as instruction where students could be assigned in groups with peers based on reading level (Balu, Zhu, Doolittle, Schiller, Jenkins, & Gersten, 2015). Multisensory techniques involved students tracing an orthographic image with their fingers while looking at and saying the image and students just looking at and saying the image (Bara et al., 2004).

Dependent variable. The intervention in this study affected letter knowledge, which was the dependent variable. Huang and Konold (2014) defined alphabet knowledge as knowing the letters' names and the sounds they represent. Letter knowledge was strictly the knowledge of the letter names. Letter knowledge was operationally defined as the number of letters named in one minute in the LNF assessment of the DIBELS (*"Taking a Reading" a teacher's guide to reading assessment*, 2002).

Setting & Participants

The study occurred at an elementary school on the Central Coast of California. The elementary school had approximately 795 students and served K-6 students (California Department of Education [CDE], 2016-2017). The school was 96% Latino, 2% White, 1% African American, and 1% two or more races, and 91% of students were socioeconomically disadvantaged (CDE, 2017-2018). Participants consisted of 30 elementary school students, aged 5-6, all of whom were enrolled in Kindergarten classes. In one Kindergarten class, 15 of the 30 students were assigned to the treatment group. The remaining 15 students were enrolled in another Kindergarten class and were assigned to the control group. Purposeful convenience sampling was used for this study. The sampling was purposeful because the classes had the

matching characteristic of the target population: Kindergarten students, and was convenient because the participants were available to the researcher.

Treatment group. The treatment group consisted of 15 students, nine boys and six girls. There were 14 English Learners (ELs) and one English-only (EO) student.

Control group. The control group consisted of 15 students, 10 boys and five girls. There were 13 ELs and two EO students.

Measures

This study used Probes 1 and 2 of the LNF assessment of the DIBELS (“Taking a Reading,” 2002; see Appendices A and B). The assessment was administered to individual students and required students to name as many letters as possible within a specific time limit; thus, it measured students’ understanding of the letter knowledge (“Taking a Reading,” 2002). The researcher administered the assessment as the pretest and posttest to the treatment group in the treatment group’s classroom and to the control group in the control group’s classroom. While the assessment was administered to individual students, the rest of the students took part in the regular literacy instruction. During the assessment, the researcher showed students letters one-by-one and the students responded with the letter name.

Validity. Oslund and colleagues (2012) indicated that DIBELS possessed predictive validity; thus, the LNF assessment also possessed predictive validity because it was part of the DIBELS. Smolkowski and Cummings (2016) found that the predictive validity was .70. The LNF assessment of the DIBELS could accurately predict what score a student would receive. The LNF assessment of the DIBELS possessed concurrent validity ($r = .88$) when used in Kindergarten (Smolkowski & Cummings, 2016).

Reliability. Smolkowski and Cummings (2016) recorded that alternate-form reliability for the LNF assessment of the DIBELS was .88 when used in Kindergarten. The LNF assessment of the DIBELS was demonstrated to provide accurate scores when any form of the assessment was administered to Kindergarten students. Reliability was ensured by following the directions for administration of the assessment, which is located in the book “*Taking a Reading a teacher’s guide to reading assessment* (2002). The teacher for the treatment group who was unaware of the purpose of the study and the research hypothesis scored 20% of the measure with the researcher and compared the scores they received in order to achieve at least 80% reliability.

Intervention

Small-group instruction involving multisensory techniques was the intervention. Small-group instruction occurred in order to assist students with developing their knowledge of the letter names. Multisensory instruction techniques were categorized into two of the three approaches described in the study by Bara and colleagues (2004). The two approaches were a visual-auditory approach and a tactile-kinesthetic-visual-auditory approach (Bara et al., 2004).

The visual-auditory approach was defined as an approach where a student learned by sight and sound (i.e., the student looked at an image and listened to the audio description of the image). The tactile-kinesthetic-visual-auditory approach was defined as an approach where a student learned by touch, movement, sight, and sound (i.e., a student looked at an image, touched the image to feel its texture, moved the image in an image sorting activity, and listened to the audio description of the image). For the visual-auditory approach, laminated upper- and lowercase alphabet letter cards were procured and used during one part of the instruction. During this approach, students learned the upper- and lowercase letters by examining and saying the upper- and lowercase letters from the letter cards. For the tactile-kinesthetic-visual-auditory

approach, sand and paper plates were procured and used during another part of the instruction. During this approach, students learned the upper- and lowercase letters by tracing the letters in the sand on the paper plates while examining and saying the letters. Both approaches were done in a small-group setting for a period of three weeks. There were 15 intervention sessions with each intervention session lasting 20 minutes for each small group of students.

Procedures

Starting on the first day of the study, students in the treatment group were administered the pretest—the LNF assessment of the DIBELS. On the second day, the control group was administered the pretest. The pretesting phase of the study required two days because the researcher administered the DIBELS to one student at a time. On the third day, the researcher began the intervention for the treatment group. Each intervention session occurred for 20 minutes for each small group of students, totaling one hour in the morning each day for three weeks. After three weeks of daily intervention sessions, the researcher administered the posttest to the students in the treatment and control groups for two days. Thus, the study took place for four weeks, which consisted of one week of pretest and posttest administration, and three weeks of intervention sessions (see Appendices C & D). In this study, data were collected before and after the intervention for the treatment and control groups (see Appendix E). The data consisted of the pretest and posttest scores from the Letter Naming Fluency assessment of the DIBELS.

Fidelity. The researcher ensured fidelity by having a Kindergarten teacher observe 20% of the intervention and control sessions in order to ensure the intervention was only occurring with the treatment group (see Appendix F). Further, to ensure fidelity in scoring, a second teacher assessed 20% of participants to ensure that the researcher was scoring the measure correctly.

Ethical Considerations

The researcher ensured that no names were used in the research in order to ensure confidentiality. No students were harmed during the intervention sessions. Intervention sessions were done in small groups rather than large groups because Kindergarten students possessed short attention spans. Intervention sessions were done during English Language Arts instruction because it did not interfere with instructional time for other academic areas. Intervention sessions were 20 minutes for each small group of students because Kindergarten students possessed short attention spans.

Validity threats. During the pretest, posttest, and intervention sessions, potential extraneous variables that affected the sessions were the researcher bias, scoring errors, pretesting, and participant effects. The classroom teacher scored 20% of the measure and compared the scores with the researcher's scores during the pretest and posttest administration in order to address researcher bias and scoring errors. The researcher was new to the students and sometimes students acted differently when there was an outside observer; therefore, the researcher visited the classroom frequently in order for the students to become comfortable with the researcher. The researcher and the teacher for the control group had an agreement that the teacher would not provide intervention on the alphabet letters for the students in the control group in order to address pretesting; however, if the intervention was effective, the classroom teacher could use the intervention with the control group.

Data Analyses

All data were entered into the Statistical Package for the Social Sciences® (SPSS®) for Windows, version 24.0.0 (SPSS, 2016). No names or identifying information were included in the data analysis. Before analyses were conducted, all data were cleaned to ensure no outliers

were present (Dimitrov, 2012). After cleaning the data, independent and paired sample t-tests were conducted to determine the significant difference in the understanding of letter knowledge between the two means of the pretest and posttest scores on the LNF assessment of the DIBELS. Further, before interpreting the analytical output, Levene's Homogeneity of Variance was examined to see if the assumption of equivalence had been violated (Levene, 1960). If Levene's Homogeneity of Variance was not violated (i.e., the variances were equal across groups), data would be interpreted for the assumption of equivalence; however, if the variances were not equal across groups, the corrected output would be used for interpretation.

Results

Two independent samples t-tests were conducted on the whole sample ($n = 30$) for both pre and post assessment scores. Results for the pretest showed that Levene's Homogeneity of Variance was not violated ($p > .05$), meaning the variance between groups was not statistically different and no correction was needed, and the t-test showed non-significant differences between the mean scores on the pretests between the two groups $t(28) = -.13, p > .05$. Therefore, the treatment and control groups had similar pretest score averages and there was no statistically significant difference between the mean scores. Results for the posttest indicated that Levene's Homogeneity of Variance was not violated ($p > .05$), meaning the variance between groups was not statistically different and no correction was needed, and the t-test showed non-significant differences between the mean scores on the posttests between the two groups $t(28) = .31, p > .05$. Meaning that the mean scores between the treatment and control groups did not increase from pre to post assessment in a statistically significant way (see Table 1). Overall, the treatment and control groups had similar pretest score averages and there was no statistically significant difference between the mean scores. The posttest scores were not statistically different between

groups, and they demonstrated that the treatment and control groups' scores did not increase statistically significantly from pre to post assessment.

Table 1

Results of Independent Samples T-Tests

	Mean	SD
Pre Test		
Treatment	30.07	10.51
Control	29.47	14.57
Post Test		
Treatment	31.47	10.89
Control	33.13	17.41

Note. SD = Standard Deviation.

After determining the differences between pre and post assessment scores between groups, two paired t-tests were run for both groups (i.e., treatment and control) to determine if participants' mean scores from pre to post were significantly different within each group (see Table 2). Results for each group were as follows: treatment group, $t(14) = -1.20, p > .05$; control group, $t(14) = -1.63, p > .05$. Therefore, neither group made statistically significant gains from pre to post. In particular, the treatment group's scores did not grow significantly, but they showed consistency in scoring (i.e., their standard deviation was similar pre to post; whereas the control group's standard deviation increased by almost three full points). After examining individual pretest and posttest scores, each score increased in a similar manner from pre to post assessment, indicating the consistency in their scores. The control group's scores, on the other hand, grew, but the scores were variable. Specifically, the scores that increased from pre to post assessment increased more than the average scores of the whole class; whereas the scores that regressed from pre to post assessment regressed more than the average scores. Additionally, the

negative t-value for each group indicates an increase in scores from pre to post assessment. Meaning that, overall, both groups learned; however, the control group demonstrated more learning than the treatment group, but not in a statistically significant way.

Table 2

Results of Paired T-Tests

	Mean	SD
Treatment Group		
Pre	30.07	10.51
Post	31.47	10.89
Control Group		
Pre	29.47	14.57
Post	33.13	17.41

Note. SD = Standard Deviation.

Discussion

The purpose of the study was to determine the impact that small-group instruction involving multisensory techniques had on students' understanding of letter knowledge. The small-group instruction was used to increase students' grasp of letter knowledge, one of the early reading skills essential to reading acquisition, which would positively affect students' academic achievement (Gellert & Elbro, 2017; Huang & Konold, 2014; Musti-Rao & Cartledge, 2007). The expectation was that the small-group instruction involving multisensory techniques would have a positive impact on students' understanding of letter knowledge. While the results indicated gains for the treatment and control groups, the control group showed greater gains than the treatment group. Therefore, the small-group instruction involving multisensory techniques had a positive impact on the treatment group's grasp of letter knowledge, demonstrating that the results are acceptable and consistent when relating them to the expectation. The study's findings

are mostly consistent with Bara and colleagues' studies (2004, 2007). This study showed that students benefited from tactile (i.e., touch) exploration, which is consistent with the 2004 study. In addition, the treatment group's positive gains from this study is consistent with the treatment group's increases in scores from the 2007 study.

The results of this study are acceptable and consistent when relating to Bara and colleagues' 2007 study as the results show positive gains in students' letter knowledge after the small-group instruction using multimodal methods (see Table 2). Bara and colleagues (2004) found that interventions involving tactile exploration were beneficial for students when learning about letter knowledge; thus, the fact that the treatment group's scores grew after participating in interventions that included a tactile-kinesthetic-visual-auditory approach demonstrated the benefits of interventions using tactile exploration. After data analyses were completed, two major findings were discovered.

First, the results show small gains in the treatment group's scores, as shown in Table 1. This aligns with Bara and colleagues (2004) findings because they found small gains in students' knowledge of letters. Similar to Bara and colleagues' (2007) findings, the treatment group in this study had gains from pre to post assessment (i.e., the treatment group's mean score of 30.07 increased to 31.47). The treatment group's gains demonstrated that the small-group instruction involving multisensory techniques had a positive impact on students' grasp of letter knowledge. The possibility of students learning from the regular literacy instruction that included teaching letter knowledge could have resulted in the treatment group's gains, despite the implementation of a small-group instruction involving multisensory techniques.

Second, the control group made bigger gains in letter knowledge than the treatment group (i.e., the control group's mean score of 29.47 increased to 33.13), but the control group was only

receiving standard of care. The control group's gains showed that the gains could have occurred from receiving regular literacy instruction that included teaching letter knowledge. With this in mind, the control group's increase in their mean score conflicts with Bara and colleagues' (2007) findings because they did not report bigger gains with participants of the VAM trainings (i.e., the control group) than with participants of the HVAM trainings (i.e., the treatment group). The increase, however, is consistent with results from Bara and colleagues' 2004 study because they reported bigger gains with participants of the VAM trainings than with the HVAM and VAM-sequential trainings.

After demonstrating how this study's results are consistent with Bara and colleagues' (2004, 2007) studies, an examination of how the study affected the sample and how it could affect the target population is necessary. Starting with the sample, this study increased the number of letter names the students in the sample could identify; thus, they would be able to identify more letter names after the study than before the study. On a larger scale, the intervention used in this study could be beneficial for the target population when teaching letter knowledge because of the small gains the treatment group received from the intervention. There are several limitations that could have contributed to the findings of this study.

Limitations & Future Studies

One of the limitations for this study was that the sample was not random. A recommendation for future studies could be to use proportional stratified random sampling because the Kindergarten classes had more boys than girls and more ELs than EO students. The proportional stratified random sampling would create homogeneous groups and reduce potential biases (e.g., the boys benefited more from the intervention than the girls and EO students benefited more from the intervention than the ELs). Further, the length of the intervention phase

of the study was short, so future studies should lengthen the phase to five-six weeks. The change in the length of the intervention phase would show clearly the impact that the intervention has on Kindergarten students' letter knowledge.

Another limitation was the small sample size; therefore, future studies should have a larger sample size because a larger sample size would better represent the target population. In addition to the limitations, there were potential bias and threats to internal validity. The researcher could have biased the study's results by intentionally increasing posttest scores in order to show that the intervention had a positive impact on students' grasp of letter knowledge. To prevent researcher bias, a Kindergarten teacher assessed 20% of participants to ensure that the researcher was scoring the measure correctly. In terms of the threats to internal validity, this study could have been affected by pretesting and participant effects. The researcher was new to the students and sometimes students acted differently when there was an outside observer; therefore, the researcher visited the classroom frequently in order for the students to become comfortable with the researcher. The researcher and the teacher for the control group had an agreement that the teacher would not provide intervention on the alphabet letters for the students in the control group in order to address pretesting.

Implications & Recommendations

Teachers can see the potential impact that the small-group instruction involving multisensory techniques can have on their students' grasp of letter knowledge. Therefore, the small-group instruction can supplement the regular literacy instruction. Additionally, the intervention could lead to research into interventions using multisensory techniques for the other early reading skills (i.e., phonological awareness and phonemic awareness) because the treatment group in this study had small gains in letter knowledge. Lastly, this study can inform others that

small-group instruction involving multisensory techniques can potentially impact students' grasp of letter knowledge.

A recommendation for future studies would be to include another assessment that measures letter knowledge in order to better predict students' reading success with letter knowledge. Another recommendation would be to conduct this study with first graders in order to determine whether small group instruction involving multisensory techniques helps first graders with an insufficient knowledge of letter names. The results and conclusions of this study will help educators determine whether this intervention would be useful for their Kindergarten students. Also, school and district administrators can determine whether this intervention would be beneficial to add to the regular literacy instruction in schools. Finally, the results and conclusions of this study add to the knowledge about small-group instruction involving multisensory techniques.

By improving letter knowledge with the intervention, interventions using multimodal methods can be created in order to strengthen students' grasp of the other early reading skills (i.e., phonological awareness and phonemic awareness); thus, interventions can help prevent students from developing difficulties in reading as early as Kindergarten. Overall, the small-group instructional efforts involving multisensory techniques shows promise for educators and curriculum specialists when it comes to developing and implementing interventions for struggling students, despite the non-significant gains that the treatment group obtained from the intervention. As a result, this study can influence other researchers to research this topic further for the English language.

References

- Anthony, J. L., & Francis, D. J. (2005). Development of phonological awareness. *American Psychological Society, 14*, 255-259. doi: 10.1111/j.0963-7214.2005.00376.x
- Balu, R., Zhu, P., Doolittle, F., Schiller, E., Jenkins, J., & Gersten, R. (2015). Evaluation of response to intervention practices for elementary school reading (NCEE 2016-4000). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education.
- Bara, F., Gentaz, E., & Cole, P. (2007). Haptics in learning to read with children from low socio-economic status families. *British Journal of Developmental Psychology, 25*, 643-663. doi: 10.1348/026151007X186643
- Bara, F., Gentaz, E., Cole, P., & Sprenger-Charolles, L. (2004). The visuo-haptic and haptic exploration of letters increases the kindergarten-children's understanding of the alphabetic principle. *Cognitive Development, 19*, 433-449. doi:10.1016/j.cogdev.2004.05.003
- California Department of Education. (2016-2017). *California Longitudinal Pupil Achievement Data System (CALPADS)* [Data files].
- California Department of Education. (2017-2018). *California Longitudinal Pupil Achievement Data System (CALPADS)* [Data files].
- Flood, J., Lapp, D., & Fisher, D. (2005). Neurological impress method plus. *Reading Psychology, 26*, 147-160. doi: 10.1080/02702710590930500
- Gellert, A. S. & Elbro, C. (2017). Does a dynamic test of phonological awareness predict early reading difficulties? a longitudinal study from kindergarten through grade 1. *Journal of Learning Disabilities, 50*, 227-237. doi: 10.1177/0022219415609185

- Helf, S., Cooke, N. L., & Konrad, M. (2014). Advantages of providing structured supplemental reading instruction to kindergartners at risk for failure in reading. *Preventing School Failure, 58*, 214-222. doi: 10.1080/1045988x.2013.798773
- Huang, F. L. & Konold, T. R. (2014). A latent variable investigation of the phonological awareness literacy screening-kindergarten assessment: Construct identification and multigroup comparisons between Spanish-speaking English-language learners (ELLs) and non-ELL students. *Language Testing, 31*, 205-221. doi: 10.1177/0265532213496773
- Joshi, R. M., Dahlgren, M., & Boulware-Gooden, R. (2002). Teaching reading in an inner city school through a multisensory teaching approach. *Annals of Dyslexia, 52*, 229-242. <https://doi.org/10.1007/s11881-002-0014-9>
- Magpuri-Lavell, T., Paige, D., Williams, R., Akins, K., & Cameron, M. (2014). The effects of a summer reading program using simultaneous multisensory instruction of language arts on reading proficiency. *Reading Improvement, 51*(4), 361-372.
- Musti-Rao, S. & Cartledge, G. (2007). Effects of a supplemental early reading intervention with at-risk urban learners. *Topics in Early Childhood Special Education, 27*(2), 70-85. <https://doi.org/10.1177/02711214070270020301>
- Nithart, C., Demont, E., Metz-Lutz, M., Majerus, S., Poncelet, M., & Leybaert, J. (2011). Early contribution of phonological awareness and later influence of phonological memory throughout reading acquisition. *Journal of Research in Reading, 34*, 346-363. doi: 10.1111/j.1467-9817.2009.01427.x
- Noltemeyer, A. L., Joseph, L. M., & Kunesh C. E. (2013). Effects of supplemental small group phonics instruction on kindergartners' word recognition performance. *Reading Improvement, 50*(3), 121-131.

Oslund, E. L., Hagan-Burke, S., Taylor, A. B., Simmons, D. C., Kwok, O., Johnson, C...Coyne,

M. D. (2012). Predicting kindergartners' response to early reading intervention: An examination of progress-monitoring measures. *Reading Psychology, 33*, 78-103.

doi: 10.1080/02702711.2012.630611

Preece, D. & Zhao, Y. (2015). Multi-sensory storytelling: a tool for teaching or an intervention

technique. *British Journal of Special Education, 42*, 429-443. doi: 10.1111/1467-

8578.12116

Smolkowski, K. & Cummings, K., D. (2016). Evaluation of the DIBELS (6th Edition) diagnostic

system for the selection of native and proficient English speakers at risk of reading difficulties. *Journal of Psychoeducational Assessment, 34*, 103-118.

doi:10.1177/0734282915589017

“Taking a Reading.” (2002). *“Taking a Reading” a teacher’s guide to reading assessment.*

Imperial, CA: Southern California Comprehensive Assistance Center.

U.S. Department of Education, Institute of Education Sciences, What Works Clearinghouse.

(2010). *Orton-gillingham-based strategies (unbranded)* (WWC Intervention Report)

Retrieved from https://ies.ed.gov/ncee/wwc/Docs/.../wwc_ortongill_070110.pdf

Walet, J. (2011). *Differentiating for struggling readers and writers: Improving motivation and*

metacognition through multisensory methods & explicit strategy instruction (Master’s

thesis). Retrieved from Education Resources Information Center database. (EJ1137150)

Zoski, J. L. & Erickson, K. A. (2017). Multicomponent linguistic awareness intervention for at-

risk kindergartners. *Communication Disorders Quarterly, 38*, 161-171.

doi: 10.1177/1525740116660817

Appendix A

Probe 1 of LNF Assessment



Assessment Tool No. 2
Letter Naming Fluency
DIBELS - Dynamic Indicators of Basic Early Literacy Skills
Student Copy

Probe 1

c	c	N	u	Q	M	u	h	S	i
n	b	e	N	F	f	o	a	K	k
g	p	k	p	a	H	C	e	G	D
b	w	F	i	h	O	x	j	I	K
x	t	Y	q	L	d	f	T	g	v
T	V	Q	o	w	P	J	t	B	X
Z	v	U	P	R	I	V	C	I	w
R	J	m	O	z	D	G	y	U	Y
Z	y	A	m	X	z	H	S	M	E
q	n	j	s	W	r	d	s	B	I
r	A	E	L	c	c	N	u	Q	M

Appendix B

Probe 2 of LNF Assessment



Assessment Tool No. 2
Letter Naming Fluency
DIBELS - Dynamic Indicators of Basic Early Literacy Skills
Student Copy

Probe 2

i	N	P	C	a	g	U	W	Z	q
N	w	p	t	O	Y	A	f	n	g
v	G	c	D	r	x	X	n	b	k
q	T	i	S	J	I	A	E	j	
b	V	c	d	f	l	F	W	z	V
y	d	t	m	o	y	Z	x	K	k
M	F	r	P	I	E	R	e	s	D
Y	H	B	o	e	G	v	l	J	L
u	L	K	H	B	h	s	j	M	p
Q	S	O	C	X	Q	W	h	U	u
z	m	R	a	i	N	P	C	a	g

Appendix C

Fidelity Checklist for Intervention Sessions

First intervention session

1. Is the researcher using cards with capital letters and lowercase letters for the first part of the intervention session? Yes ___ No ___
2. Is the researcher asking students to tell her what the letters' names are? Yes ___ No ___
3. Is the researcher using sand on paper plates for the second part of the intervention session? Yes ___ No ___
4. Is the researcher telling the students what they will write in the sand? Yes ___ No ___
5. Is the researcher showing an example of what the students will write in the sand?
Yes ___ No ___
6. Is the researcher showing the students that they will look at the letter after they write the letter? Yes ___ No ___
7. Is the researcher showing the students that they will say the letter's name aloud after they write the letter? Yes ___ No ___
8. Is the researcher telling the students that they will look at the letter after they write the letter? Yes ___ No ___
9. Is the researcher telling the students that they will say the letter's name aloud while they look at the letter? Yes ___ No ___
10. Is the researcher allowing students a chance to practice? Yes ___ No ___
11. Is the researcher having students write many letters? Yes ___ No ___
12. Is the researcher having students look at the letters after they write them? Yes ___
No ___

13. Is the researcher having students look at the letters while they look at them? Yes _____

No _____

Appendix D**Checklist for Measures**

1. Is the researcher preparing the student for the assessment by showing the first letter the student will start on? Yes ___ No ___
2. Is the researcher preparing the student for the assessment by showing them to move to the next letter after saying the letter name aloud in a left-to-right, downward manner?
Yes ___ No ___
3. Is the researcher timing the student for one minute? Yes ___ No ___
4. Is the researcher tracking with a pencil? Yes ___ No ___
5. Is the researcher putting a check next to the letter the student named correctly? Yes ___
No ___
6. Is the researcher putting a slash through the letter the student named incorrectly?
Yes ___ No ___
7. Is the researcher writing the number of letters the student named aloud correctly on the measure? Yes ___ No ___
8. Is the researcher writing the number of letters the student named aloud correctly next to the student's initials on the data collection sheet? Yes ___ No ___

Appendix E

Data Collection Sheet for Treatment Group

Student Initials	Date of Pretest	Pretest scores	Date of Posttest	Posttest scores
<i>Treatment group</i>				
LA				
BA				
KAC				
EB				
JC				
JG				
JJ				
CL				
JM				
EM				
BM				
IN				
DO				
JO				
JS				

Appendix F

Fidelity Checklist

Date	Treatment/Control	Signature
Tuesday, February 27, 2018	Treatment	
Monday, March 5, 2018	Control	
Thursday, March 15, 2018	Treatment	