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Developing pre-literacy skills in preschool children: The utilization of parents as a vital resource

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Developing Pre-Literacy Skills In Preschool Children:

The Utilization Of Parents As A Vital Resource

by

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A thesis submitted in partial fulfillment
of the requirements for the degree of
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DEVELOPING PRE-LITERACY SKILLS IN PRESCHOOL CHILDREN: THE UTILIZATION OF PARENTS AS A VITAL RESOURCE

Ashley N. Sundman

ABSTRACT

This study examined the effects of a parent-implemented intervention on preschool children's development of letter-naming and phonological awareness skills. Six parent-child dyads with children enrolled in a Head Start Program in West Central Florida were selected to participate in the study. A multiple baseline across participants design was used to evaluate the impact of an intervention package that included activities focusing on: (1) using mnemonics to learn letter names and (2) developing phonological awareness of the onsets of words through parent questioning and feedback. Phonological awareness development was measured using the Dynamic Indicators of Basic Early Literacy Skills First Sound Fluency (DIBELS-FSF) and letter-naming ability was measured using the DIBELS Letter Knowledge (DIBELS-LK) probes. Results showed that five of the six students responded favorably to the intervention, increasing their growth rate on at least one of the two measures. The final child showed little change in trends across the phases. Additionally, data was collected regarding intervention integrity of intervention implementation as well as social validity, or the acceptance and usefulness, of the intervention. Intervention integrity data revealed that the majority of parents completed the intervention with high levels of fidelity, although variability across parents was noted. Social validity data indicated that the parents found the program helpful and effective. Implications for research and practice are discussed.

CHAPTER ONE

INTRODUCTION

Statement of the Problem

The matter of literacy has become a national concern. A study commissioned by the U.S. government revealed that 14% of American adults possess below basic literacy skills, indicating that these adults would have difficulty using a television guide to determine a show time or comparing ticket prices for two events (NCES, 2006). Illiteracy correlates strongly with extensive increases in health care costs, higher likelihood of imprisonment, and higher likelihood of receiving government assistance (Arkansas Literacy Council, 2005). Due to these concerns, literacy has come to the forefront of issues for the U.S. government.

Recent legislation addresses the literacy problem with both expectations for achievement (e.g., No Child Left Behind Act, NCLB) and parent involvement (e.g., Section 1118). The NCLB mandates that schools monitor basic skill development in reading and math. It also sets a goal of having all students reach state standards in reading and math by 2013-2014. Section 1118 of NCLB focuses on parent involvement and states that schools should encourage parents to: (1) assist in their child's learning, (2) be actively involved in their child's education, and (3) be included in making decisions about their child's education. Parent involvement is no longer an optional activity as schools are now required to encourage parent participation.

A multitude of research indicates that family involvement directly relates to student academic achievement (Epstein, 2002; Fantuzzo, McWayne, Perry, & Childs, 2004). Specifically, parental involvement in reading activities has been found to

overcome limitations due to economic, ethnic, racial, and educational backgrounds to improve children's reading abilities (Arnold, Zeljo, Doctoroff & Ortiz, 2008; Epstein, 1996). While research has been conducted focusing on parent involvement once children enter formal schooling, there is a paucity of research at the preschool level. With greater emphasis on the prevention of problems, the early school years become an important focus. Therefore, it is crucial to investigate ways in which caregivers can become involved in and effectively improve their children's early academic abilities.

Prevention and Early Intervention in Literacy Skills

Both research and legislation are focusing on prevention and early intervention to help lessen the problems with illiteracy in the United States. A good foundation of pre-literacy skills can help prevent the "Matthew Effect," where students who struggle with initial reading skills fall further and further behind their peers as time passes (Stanovich, 1986). The National Reading Panel (NRP; 2000) has summarized reading research and found that phonemic awareness and letter knowledge predict future school success. In addition, the National Early Literacy Panel (NELP; 2008) confirmed the importance of these skills along with several other predictors of early literacy success. These skills typically develop during preschool. Parent involvement at this stage of development has proven to be effective and parents can be successfully taught to help their children if given the correct tools (Gang & Poeche, 1982).

Parent Involvement in Preschool

Very few studies have examined parental involvement at the preschool level. Arnold and colleagues (2008) explored the existing literature base and found only four studies that investigated parent involvement and preschool children's emerging academic

skills. Three of the four studies focused primarily on teacher ratings of parent involvement and only reported correlations between teacher perceptions, ratings of parent involvement, and children's performance on early academic skill tasks (Mantzicopoulos, 1997; Marcon, 1999; Taylor & Machida, 1994). A fourth study directly measured parent involvement behaviors in Head Start classrooms and at home (Fantuzzo et al., 2004). Results of this study indicated a strong positive relationship between home-based involvement and development of receptive vocabulary.

Research has found that there is less parent involvement in households that fall below the poverty threshold (Rush, 1999). These parents often have lower-levels of education, resulting in restricted resources to provide for their children, a problem that becomes even more significant when parents do not speak English (Zill et al., 2003). The literature clearly delineates that children who grow up in poverty are at higher risks for a variety of negative outcomes. Living in poverty during preschool negatively impacts children's cognitive development, academic achievement, and socio-emotional well-being in the long-term (Allhusen et al., 2005; Brooks-Gunn & Duncan, 1997). These children are also exposed to more violence, live in more chaos, have more separation from their parents, have less structure and routine, and are less socially supported (Evans, 2004). The multiple stressors that result from living in poverty provide a strong rationale for implementing interventions with at risk populations.

Intervention

Many interventions have been found to be effective for improving children's early literacy skills. Interventions at the preschool level typically target a specific area (e.g.,

phonemic awareness, letter-name and letter-sound correspondences) and incorporate varied activities to develop the skill (Sindelar, Lane, Pullen, & Hudson, 2002).

The early literacy intervention package of this study was intended to address the issues associated with a disadvantaged early environment. The package is a combination of two evidence-based practices. The first part of the package focuses on teaching the names of letters through the use of a mnemonic strategy (Raschke, Alper, & Eggers, 1999). The second part of the package focuses on developing phonological awareness in a sequence proposed by Sindelar and colleagues (2002). A detailed explanation of the intervention procedure appears within the methods section of this document.

Intervention Integrity & Social Validity

A well designed empirical study of the impact of caregiver involvement on children's early literacy skills must go beyond simply teaching caregivers an intervention strategy. Ensuring the integrity of an intervention conducted at home is vital to affirming the effectiveness of the intervention. A review of the literature has found a significant moderate correlation between intervention integrity and intervention outcomes (Gresham, Gansle, Noell, Cohen, & Rosenblum, 1993), providing evidence that intervention integrity data collection should be an important component of any intervention research. To illustrate this, Bates (2005) examined fifteen studies that implemented family-school interventions with preschool and kindergarten children. Interventions primarily targeted early academic skills and compliance with adult requests. Results of the analysis displayed that in comparison to studies that did not have adequate intervention integrity, those that did have adequate intervention integrity (rated as 2 or greater on a 0-3 scale) produced slightly larger effect sizes (Bates, 2005).

While intervention integrity is an important part of any intervention, it can be impacted by the perceptions of those directly involved in implementation. Social validity refers to the appraisal of the intervention by consumers (Wolf, 1978). Social validity can be broken up into three components: (1) goals, (2) procedures, and (3) outcomes (Witt & Elliott, 1985). Questions such as, “Were the goals appropriate for this child?”, “Was any part of the procedure for implementation aversive to you?”, and “What were the intended and unintended outcomes of the intervention?” can assess these components. Prior to and after implementing an intervention, the opinions of the consumers should be explored on all three components (Witt & Elliott, 1985).

Purpose

This study has added to the limited literature base on how caregivers can be involved in enhancing their children’s academic skills. With legislation advocating for greater parent involvement in a child’s education, it is important to investigate ways in which caregiver involvement will result in high levels of success for children. This study has examined the impact of a parent-led intervention on preschool children’s early literacy development. The degree to which intervention integrity and ease of implementation influence early literacy outcomes has also be explored. The results of this project have contributed to the literature on parent-based interventions for early literacy skill development and provide a method for improving kindergarten readiness for underprivileged children.

Research Questions

The following research questions have been examined in this study:

1. Is the parent-led intervention an effective method for improving a child's early literacy skills (phonological awareness and letter naming)?
2. Given the evidence-based practices used to increase intervention integrity (i.e., videotaped demonstrations, lesson plan packets), was the intervention implemented with integrity?
3. What is the strength and direction of the relationship between intervention integrity and outcomes on phonological awareness and letter naming assessments?
4. What is the level of intervention acceptability of the early literacy intervention as rated by the Intervention Rating Profile (Witt & Elliot, 1985)?
5. What qualities of the early literacy intervention (e.g., lesson plans, training session, follow-up support) do parents perceive to be the most helpful?
6. What is the strength and direction of the relationship between the level of intervention acceptability as rated by the Intervention Rating Profile and the outcomes on phonological awareness and letter naming assessments?

Significance of the Study

Difficulties in reading are common among children in early elementary school. Research has shown that the two most significant predictors of kindergarten success upon entry into school are phonological awareness and letter-naming ability (Blachman, 1994; Daly, Wright, Kelly, & Martens, 1997; Ehri & Roberts, 2006; NRP, 2000; Share, Jorm, MacLean, & Matthews, 1984). A prevention perspective aims to intervene prior to

problems occurring. This would point to beginning interventions at the preschool level. Programs such as Head Start provide a step in the right direction, but increasing parent involvement can provide further support to establish a solid foundation in early literacy skills. Effective interventions can increase parent involvement and children's skills to better prepare children for kindergarten (NELP, 2008). It is essential that strategies, such as the early literacy intervention package that has been implemented in this study, be evaluated for effectiveness.

CHAPTER TWO

REVIEW OF THE RELATED LITERATURE

Overview

Literacy is a growing national concern. In a recent report by the National Assessment of Educational Progress (NAEP), only 32% of students in the U.S. were at or above a proficient level in reading (NAEP, 2007). Even more troubling was that only two-thirds (66%) of students attained a basic level of reading achievement (NAEP, 2007). The NRP (2000) indicated that over 17.5% of children will have reading problems within their first three years of school. Students who initially struggle with acquiring reading skills are less likely to become literate later (Torgesen & Burgess, 1998). In fact, of children who experience reading problems in third grade, 75% will continue to demonstrate deficits in reading skill (Lyon, 1995). The remainder of the chapter that follows critically reviews research regarding the impact of socioeconomic status on pre-literacy skills, early literacy, and the role parents play in their child's path to literacy. The review concludes with a summary of the existing literature and a description of the purpose of the study.

Socioeconomic Status and Early Literacy

Socioeconomic status has been shown to have multiple impacts or correlates to early literacy experiences. Evans (2004) reviewed the relevant literature and found that when separating parents into classes by either income or profession/education, the findings are consistent. Children in lower socioeconomic classes have fewer words addressed to them, go to the library less frequently, are engaged in conversation less often, are read to less often, and are more likely to be ordered to do something (Federal

Interagency Forum on Child and Family Statistics, 2000; Kagan & Tulkin, 1971; Hart & Risley, 1995; Hoff, Laursen, Tardiff, 2002). Many of these factors directly impact early literacy due to exposure to language and print.

Metsala (1996) investigated the effects of income on home literacy activities of families within the Baltimore region. Families were included if they had a child in prekindergarten in the 1992-1993 school year. The sample came from four neighborhoods in Baltimore that had diverse populations. The four separate neighborhoods were composed of: (1) low-income African American families, (2) low-income European Americans, (3) a mix of low-income African-Americans and European Americans, and (4) a mix of middle-income African-Americans and European Americans. Parents were instructed to keep diaries of their child's home activities for one week and were interviewed regarding their child's engagement in many activities thought to promote the development of early literacy skills. An anecdotal inspection of the language used within the low-income homes provided multiple examples of the language children in this study were exposed to during their early literacy development. The improper grammar and misuse of words were hypothesized to contribute to difficulties in learning to read proper English. Results showed greater differences when participants were grouped by socioeconomic status than when grouped by race. Also, middle-income families engaged in reading and literacy related activities as a source of entertainment for their children. In contrast, low-income families often engaged in very structured activities such as reciting the alphabet or using flashcards, viewing these activities more as tasks than as enjoyable pursuits.

Rush (1999) examined the activities within the homes of children enrolled in Head Start. She surveyed and observed a total of thirty-nine families. Information on child skills was obtained through the Peabody Picture Vocabulary Test- Revised (PPVT-R; Dunn & Dunn, 1981), the Expressive One-Word Picture Vocabulary Test (EOWPVT-R; Gardner, 1990), letters named within one minute, initial sounds of words generated within one minute, and phoneme blending. Children in this study were found to score on average about two-thirds to one standard deviation below the mean on the standardized vocabulary measures (PPVT-R and EOWPVT-R).

The literacy activities that each Head Start family engaged in were measured through the Stony Brook Family Reading Survey (SFRS; Whitehurst, 1992). This nine-item multiple choice questionnaire assesses how frequently parents read to their children, the number of books in the home, child's interest in reading or being read to, and other literacy activities that take place within the home. The home learning environment was recorded using the Code for Interactive Recording of Caregiving and Learning Environments-2 (CIRCLE-2; Atwater, Montagna, Creighton, Williams & Hou, 1993). The CIRCLE-2 assesses the home environment within three domains: (1) the ecology of the caregiving environment, (2) the caregivers' behavior, and (3) the child's engagement with people and objects within the caregiving setting. Analysis revealed that despite the Head Start preschools offering multiple literacy enhancing activities, no parents surveyed utilized the materials or services. The home observation found that a majority of children were rarely engaged in structured activities and spent most of their time wandering from activity to activity, watching television, or engaging in non-interactive play. For at least half of the observation periods the caregiver was present while the child continued in

unstructured activities around the home. The amount of time in structured and unstructured activities is important to note because children who were more often engaged in structured activities and play with a caregiver tended to score higher on literacy and vocabulary skills (Rush, 1999).

Research conducted with Head Start students found that children coming from these low-income homes performed considerably below the national norms in vocabulary, writing ability, emergent reading, and letter identification. The performance scores on average were two-thirds to one full standard deviation below national norms (Zill et al., 2001, 2003).

Legislation Supporting Literacy

The research that has examined the effects of poverty on academic skill acquisition and the research delineating the difficulties young readers face after falling behind academic expectancies has prompted the creation of a system to ensure that all children receive quality education. The No Child Left Behind Act (NCLB; 2001) endorses reforms that are based on the belief that setting high expectations and establishing measurable goals can improve individual outcomes in education. The law states that schools must create a system that assesses and monitors basic skill development. The goal according to the law is to have 100% of students reach state standards in math and reading by 2013-2014. To support literacy development directly, Reading First and Early Reading First were established.

Reading First is a program mandated under NCLB that provides funding to Title I schools in order to improve reading outcomes. The program focuses on kindergarten through third grade. Funds are to be used to implement 'scientifically based reading

research' (SBRR) and to hire coaches to assist teachers with improving classroom reading instruction. A recent review of the data found that the Reading First initiative was effective in improving children's basic early literacy skills, such as phonics, phonemic awareness, and fluency (Manzo, 2008).

Early Reading First, the companion of Reading First, focuses on pre-kindergarten materials and coaches to increase reading readiness. The money is allocated for implementing evidence based reading research in areas with high concentrations of low-income families. Examples of the types of programs supported include Head Start and other school-based and family literacy settings.

While there is research indicating that students are making gains in literacy skills, many students still do not meet grade level expectations in reading (NAEP, 2007). Legislation is encouraging the use of early intervention with the use of evidence-based practices to increase children's literacy skills.

Evidence-based interventions (EBI; Forman & Burke, 2008) have been shown to be effective through well-controlled research. Implementing EBIs when initial deficits in skills appear is critical due to what has been termed the "Matthew Effect". The "Matthew Effect" refers to a phenomena in which children who have difficulty with initial reading skills tend to master subsequent reading skills more slowly than peers, often resulting in more stress and fear of failure (Stanovich, 1986). These consequences become associated with reading making it a negative experience, and struggling readers begin to avoid engaging in reading activities, therefore decreasing their opportunities to practice reading skills (Stanovich, 1986; Topping & Lindsay, 1992).

Path to Literacy

Early literacy skills are critical to progress in school. Research has shown that the two biggest predictors of kindergarten success upon entry into school are phonological awareness and letter-naming ability (Blachman, 1994; Daly et al., 1997; Ehri & Roberts, 2006; NELP, 2008; NRP, 2000; Share et al., 1984). Children who have adequate skills in these areas when entering kindergarten are less likely to have difficulties in later school years (Stevenson & Newman, 1986). In fact, ratings on reading skills taken prior to kindergarten correlated with comprehension ($r=.60$) and decoding ($r=.61$) scores in fifth grade, and comprehension scores in tenth grade ($r=.60$; Stevenson & Newman, 1986). Establishing these early literacy skills prior to kindergarten provides children with a strong foundation and springboard for their future education.

Emergent literacy and early literacy are two terms that are often used to describe what takes place in the development of a child's literacy skills. However, these two terms are not the same. Emergent literacy, as defined by Gunn, Simmons, and Kame'enui (1995), describes the broad concept of knowledge learned prior to formal instruction that leads to an awareness of print. Examples of this awareness are knowledge of the how to hold and turn pages of a book, and recognizing a phrase such as "and they lived happily ever after" as a close to a story. Early literacy typically refers to skills children are expected to master during the first few years of formal schooling such as phonological awareness and the alphabetic principle, or the knowledge that letters and sounds correspond to one another in specific ways (Daly, Chafouleas, & Skinner, 2005). The focus of this study is on interventions of early literacy abilities, in that the skills of letter-

naming and phonological awareness are expected to be mastered within the first years of school.

Another important concept to understand when examining the early literacy research is the difference between phonological and phonemic awareness. Phonological awareness consists of four levels of awareness: word, syllable, onset/rime, and phoneme (Sindelar et al., 2002). The word level of phonological awareness develops very young as children segment spoken language into words. Typically, by the age of three most children can detect the “beat” of language by clapping or walking to the “beat” of words—showing a mastery of syllable awareness (Sindelar et al., 2002). The onset/rime level of awareness develops a little later, and children often enjoy playing games practicing these skills by rhyming words (mouse and house) and stating words that start with the same sound (sat and sip, phone and fun; Sindelar et al., 2002). Phonemic awareness is the highest level of phonological awareness, and consists of the ability to break words or syllables into individual phonemes and then manipulate them (Daly et al., 2005). This includes blending individual phonemes, segmenting phonemes, and deleting or reversing individual phonemes in words. This level of skill emerges throughout kindergarten and by the end of that year most children who become successful readers will show some success on tasks assessing this level of phonological awareness (Sindelar et al., 2002).

Research by the National Reading Panel (NRP; 2000) found that phonemic awareness led to improvements in not only phonemic awareness but also positively impacted reading and spelling skills. Also, phonemic awareness and letter knowledge are the two best school-entry predictors of how well children will learn to read during the kindergarten and first grade years. The NRP (2000) extensively reviewed the existing

scientific literature on reading skills and how these skills should be taught. The panel found that alphabetic skills, fluency, and comprehension are critical areas of reading to be taught to students within a curriculum. Alphabetic skills consists of two subskills: phonemic awareness and phonics. Adams (1990) stated that the development of phonological awareness requires experiences with language activities, such as engagement in spoken language and language play with caregivers.

Phonics consists of understanding the letter-sound correspondences, or the links between phonemes and the letters that represent them in written language. The National Reading Panel (2000) reported that systematic phonics instruction produced significant benefits in reading and spelling for children in kindergarten through sixth grade. It is important to note that the NRP did find that phonics instruction did not significantly improve children's ability to comprehend text. After children develop a solid understanding of phonics, other skills such as fluency and comprehension should become a focus of the reading curriculum. An important precursor to developing this skill is knowledge of the letters themselves.

Developing Phonological Awareness Skills

Phonological awareness can be improved through a variety of evidence-based procedures. One similarity between all activities is that children must be engaged with someone else in communication. These skills cannot be improved with written work (Sindelar, et al., 2002). Daly and colleagues (2005) adapted six criteria to be met for good early literacy instruction from Stahl, Duffy-Hester and Stahl (1998). Early literacy instruction should provide (a) development of the alphabetic principle, (b) development of phonological awareness, (c) a thorough grounding in letters, (d) stimulating and

engaging activities, (e) sufficient practice in reading words, and (f) development of automatic word recognition (Daly et al., 2002). The best activities to utilize depend on which subset of phonological awareness is being addressed and the age and skill of the child.

The order of instruction for teaching phonological awareness begins broadly by teaching children to recognize separate words in a sentence and then moving to segmenting those words into syllables. Further development in phonological awareness breaks down syllables into phonemes. Sindelar and colleagues (2002) provide a comprehensive outline of activities that can be used to teach phonological awareness at the various levels. For developing awareness at the word level, students can be instructed to identify separate words by tapping each word in a sentence, or connecting blocks/sliding beads for each word in a sentence. If a child has mastered these tasks, moving on to tasks that further segment spoken language and focus on the syllables of a word is appropriate. Children can do activities similar to those for developing awareness at the word level, but use syllables for each counting unit or they can play games such as rocking their hips for each syllable in a word, moving the same number of steps as there are syllables in a word, or clapping out syllables in other children's names or in words for familiar objects (Sindelar et al., 2002). After developing an awareness of syllables within a word, children can be instructed to focus on either the onset or rhyme of a word. Tasks teaching this level can range in difficulty from having a child recognize a match in onset or rhyme (i.e., "Do fish and wish rhyme?") to asking the child to generate a response (i.e., "What is another word that starts with the same sound as moon?") (Sindelar et al., 2002). Children can be taught word families such as the -at or -um families. Learning nursery

rhymes can also be incorporated at this level. The final level of phonological awareness narrows down to the individual phonemes within a word, or phonemic awareness. Students should achieve this level of skill in the middle to end of their kindergarten year. Activities that work to improve this skill include adapting the activities previously discussed as well as having students imagine that there is a “robot” (puppet) who only understands words if each sound is spoken separately or having students listen for a particular sound (i.e., /t/) in a list of words (Sindelar et al., 2002). It is important to keep in mind that these are not the only interventions that will work. The most important thing is that the intervention meets the six criteria set forth by Daly et al. (2005).

The teaching procedure outlined at the onset-rime level will serve as part of the current study’s intervention package to improve children’s phonological awareness. The onset/rime level was chosen as a focus since it is an excellent building block for phonemic awareness by helping children to narrow down the onset, or first sound, of a word. Rhyming was not included in the intervention because there is little support for focusing on the rhyme of a word. In fact, Nation and Hulme (1997) found no support for being able to identify the rhyme of a word as a major predictor of future reading or spelling abilities, after controlling for age and memory. Nation and Hulme (1997) studied first grade students and as such these students may have already had practice or instruction working on phonemic awareness. Onset was chosen for this study as the participants will be about two years younger and may need instruction at a more basic level to prevent frustration. In the current study, lesson plans increased in difficulty according to the following process: (1) comparing the onsets of two words, (2) orally producing a word that begins with the same onset as a stimulus word, and (3) producing

only the initial sound(s) of an orally presented word. This intervention served as one of the two components of the early literacy intervention package.

Developing Letter Naming Skills

There is some debate as to whether to teach letter names, letter-sound correspondence, or both. Adams (1990) and Stahl et al., (1998) recommend teaching both skills since letter knowledge is a predictor of future success with reading, and knowing the letter-sound correspondences helps develop phonics skills and spelling. While teaching both concepts would be ideal, the prerequisite skill is knowledge of the names of the letters (Adams, 1990; Ehri & Roberts, 2006). Teaching letter recognition prior to letter-sound relationships has several benefits. First, letter names provide separate labels so children can categorize effectively, including placing both lower and uppercase letters in a correct category. Second, labels allow students to talk about letter referents when using them to read or spell. Third, labels are much clearer than using sounds, as letters can represent several sounds. Fourth, children who already know the names of letters can learn the sounds of letters more quickly (Share, 2004). Finally, letter names are easier to hear than sounds (Treiman & Kessler, 2003) making them easier to recreate accurately.

Roberts (2003) assessed whether learning letter names translates into learning letter sounds and assists with progress into reading. Thirty-three preschoolers (ages 3-4) participated in the study. Twenty children primarily spoke Hmong, nine spoke Spanish and the remaining four spoke English in their home. All children were enrolled in a half-day preschool provided for low-income families. Preschoolers were trained for sixteen weeks on either learning letter names for letters *A* through *P* and working on identifying rhymes or working on comprehension through storybook readings. Each week, three 20-

25 minute lessons took place. Children in the comprehension condition first viewed a videotape that matched a storybook and then “read” the storybook. In the next two sessions, children engaged in a variety of activities working on vocabulary for the story, using cards with pictures from the story to create a sequence of events, and acting out scenes from the story. As the weeks passed, the complexity and length of the stories grew. The first day of the letter-rhyme treatment consisted of teaching children the alphabet song, having them look at an alphabet book, and then instructing them on rhyming words (i.e., “Cake and lake rhyme”). During the next two days children wrote letters and reviewed letters taught during previous intervention days. After the intervention, children were assessed for their accuracy on three lists of “words”: (a) phonetic letter name spellings (e.g., KND for candy) with letters *A-P*, (b) phonetic letter name spellings with letters *Q-Z*, and (3) visually distinctive spellings containing no correlating letters (e.g., Hf for candy). Children trained in letter names performed more accurately on lists with phonetic spellings of letters they were taught than on the other two lists. In contrast, children who received training in comprehension performed significantly better on the lists of visually distinct words. The ability to begin to apply letter names to “read” words was interpreted as indicating development in pre-literacy skills.

While the results of Roberts (2003) are interesting in the use of the knowledge of letter-names to “read” words, several aspects of this study are problematic. The first concern is whether the ability to examine a combination of letters and say the names in successive order actually equates to early literacy skill development. A second concern regarding this study was the use of experimenter generated measurement tools, with little

data provided to support psychometric properties, and few details explicitly stated about how measures were developed, or what the final form was. One final criticism is the lack of discussion regarding why students who received no instruction in letter names performed better on lists of words that possessed no correlating letters to the word students were supposed to answer (i.e., cN for ball).

The literature offers a few effective methods for how to teach letter names. One method that has been shown to be effective in a case study is incremental rehearsal (Bunn, Burns, Hoffman, Newman, 2005). In incremental rehearsal, the child names letters that are on flashcards presented to him or her. The flashcards are presented in a particular order so that a known letter follows an unknown letter and then the unknown letter is presented again. It is then followed by two known letters and then the unknown letter again. This process repeats with the number of known letters in between the unknown letter increasing up to four. This process is repeated with two unknown letters for each session.

Another process that has been proven effective in research is the use of mnemonics to teach letter names (Raschke et al., 1999). Raschke and colleagues worked with 10 five and six year old children with varying exceptionalities who were in a self-contained classroom. Prior to the intervention, children knew an average of six letters. For this intervention, children were taught a short sentence that was paired with two letters and an image. One example is a picture of an eye paired with the upper and lowercase versions of “i” and the sentence “This is my eye.” The children then had to repeat the sentence and the name of the letter. As children began to master the letter names, the sentence was whispered and the image was gradually removed until no

prompt was needed for the child to name the letter. To finish each session, children were instructed to go through flashcards with letters on them and practice using the cues silently. A child was considered to achieve mastery when he or she was able to recall all twenty-six letters correctly, three days in a row. It took children in this sample ten to seventeen sessions to be able to name all the letters accurately (Raschke et al., 1999).

A thorough literature review produced only these two strategies that solely focused on teaching letter names to young children. While both intervention studies reported acceptable outcomes, the use of the mnemonic intervention was chosen as it was determined by the PI to be more parent-friendly and lent itself more easily to the creation of a lesson plan and parent training.

Parents as a Resource

Parents are an excellent resource to utilize to advance children's early literacy skills. A multitude of research indicates that family involvement directly relates to student achievement academically (Epstein, 2002; Fantuzzo et al., 2004; Henderson & Mapp, 2002). The findings within this area of research are compelling enough that the U.S. government included a parental involvement section within the No Child Left Behind Act (NCLB). Parental involvement in reading activities has been found to overcome economic, ethnic, racial, and educational backgrounds to improve children's reading activities (Arnold et al., 2008; Epstein, 1996).

Very few studies have examined parental involvement at the preschool level. Arnold and colleagues (2008) explored the existing literature base and found only four studies that investigated parent involvement and preschool children's emerging academic skills. Three of the four studies focused primarily on teacher ratings of parent

involvement and only reported correlations between teacher perceptions, ratings of parent involvement, and children's performance on early academic skill tasks (Mantzicopoulos, 1997; Marcon, 1999; Taylor & Machida, 1994).

Mantzicopoulos (1997) examined the contribution of multiple family variables (i.e., maternal expectations, home literacy activities, maternal school involvement, and parenting style) on children's preacademic competence. Participants were 93 children enrolled in Head Start along with their mothers. Children's preacademic competence was assessed through four separate measures. All assessment measures were given during the spring semester of the school year. Students were given the Kaufman Assessment Battery for Children-Achievement Battery (K-ABC Achievement; Kaufman & Kaufman, 1983). An additional measure of preacademic competence was the Pictorial Scale of Perceived Competence and Social Acceptance for Young Children (Harter & Pike, 1984). This scale can be administered to both children (grades primer to 2) and teachers. This provided two additional data collection sources. The final method of data collection for preacademic competence was Children's School Adjustment rating form (Stipek, 1991), which was completed by the mothers of the participants. Parent involvement was quantified using the Parent/Family Involvement Index (PFII; Cone, Delawyer, & Wolfe, 1985) which was completed by the classroom teacher.

Results found that teacher ratings of maternal school involvement predicted children's school adjustment ratings, but maternal involvement was not found to help predict preacademic achievement, teacher-rated or self-rated competence (Mantzicopoulos, 1997). The lack of significant results could be due to problems with having the teacher rate parental involvement.

A second study also examined teacher ratings of parent involvement (Marcon, 1999). Sixty-two teachers rated the parent involvement of 708 predominantly low-income families. The ratings took place over two years, resulting in two cohorts of preschoolers. These two cohorts were not found to differ significantly on any study characteristics and therefore data were combined. A simple four question, yes-no rating scale of parent involvement was used, that assessed contact with the school in the following forms: (1) attendance of a parent-teacher conference, (2) home visit by the teacher, (3) extended class visit by the parent, and (4) helping with class activities. The answers to the four questions were then classified into low, median, or high involvement. Involvement was also classified into active (visiting the class) and passive (receiving a home visit) categories. Data on academic skills were collected via the child's report cards.

Results showed that teacher ratings of parent involvement were significantly related to teacher ratings of children's language development and emergent academic skills. No differences were found when analyzing the data by gender. The children whose parents were more involved (actively or passively) were more likely to display greater mastery of basic school skills in all subject areas (i.e., higher grades).

A third study examined parent involvement in preschool by having teachers rate specific behaviors of involvement. Teachers completed a five-item questionnaire rating parent involvement in specific activities (i.e., volunteers in classroom, attends parent meetings, works in classroom, responds to requests for information, and follows through with activities suggested by the teacher). These questionnaires were completed on a total of 63 Head Start students throughout the year. Child outcomes were assessed via the Teachable Pupil Survey (Kornblau, 1982)- a rating scale of classroom behavior and the

Developmental Indicators for the Assessment of Learning- Revised (DIAL-R; Mardell-Czudnowski & Goldenberg, 1983). The DIAL-R assesses language, motor, social, self-help and conceptual development through various tasks. Both measures, along with the teacher rating scales were given at the beginning and end of the school year. Results indicated that parent involvement was significantly correlated with gains in learning skills and classroom behaviors.

A fourth study directly measured parent involvement behaviors in Head Start classrooms and at home (Fantuzzo, et al., 2004). The level of parental involvement in 144 families of children between the ages of four and six was surveyed using the Family Involvement Questionnaire (FIQ; Fantuzzo & Tighe, 2000) and information on a child's vocabulary skills was measured using the Peabody Picture Vocabulary Test- Third Version (PPVT-III; Dunn & Dunn, 1997). The FIQ has primary care providers indicate the extent of their involvement in three broad areas: (1) school-based involvement, (2) home-based involvement, and (3) home-school conferencing. School-based involvement encompasses behaviors such as volunteering in the classroom or chaperoning field trips. Home-based involvement includes behaviors where the parent actively promotes learning in the home, for example creating space for learning activities or going to the library. Finally, home-school conferencing describes frequency of communication with the child's teacher about progress or how to enrich the home environment. Correlations of receptive vocabulary and school involvement found that a strong relationship exists between home-based involvement and receptive vocabulary. School-based involvement and home-school conferencing yielded moderate correlations, indicating a moderate relationship between these factors and school involvement.

Arnold and colleagues (2008) examined the involvement of 163 families in their preschool child's academic development. The children were between the ages of three and five years and a majority came from low-income homes (74.8%). Parent involvement was gathered from the preschool teacher via the Parent-Teacher Involvement Questionnaire. Each child's preliteracy development was determined by the PPVT-R (Dunn & Dunn, 1981), the EOWPVT-R (Gardner, 1990), and the Auditory Skills and Print Concepts subtests of the Developing Skills Checklist (DSC; McGraw-Hill, 1990). Results showed that parent involvement was positively correlated with levels of preliteracy skills and this relationship remained significant when socioeconomic status was controlled. These findings support that parent involvement in preschool is related to preliteracy development (Arnold et al., 2008).

In examining the implications of these findings, a scarcely examined topic within the field is how to improve caregivers' involvement with their children during the preschool years to increase these benefits. Arnold and colleagues (2008) suggest that future research should focus on getting caregivers involved in home-based activities for literacy and other types of development. Therefore, the purpose of the current study is to examine an early literacy intervention that is carried out by the caregiver for efficacy in increasing their preschool child's academic skills.

Benefits

There are many benefits to utilizing caregivers over other resources since caregivers are major stakeholders in their children's education (Christenson & Buerkle, 1999). Cost-effectiveness, potential for benefiting other children in the family, convenience of in-home intervention, ability to note needed changes in the intervention

immediately, and the avoidance of removing a child from the classroom to implement the intervention all fall into the benefits of parent-implemented interventions (Gang & Poeche, 1982). While these benefits were written with the elementary child in mind, these same gains apply to teaching caregivers to work with their preschool-aged children.

Barriers

There are some barriers to utilizing caregivers, such as caregivers not having knowledge on how to deliver instruction, not having knowledge of how to assist their child's learning at home, or low caregiver self-efficacy in helping their child in specific subjects (Fiala & Sheridan, 2003; Persampieri, Gortmaker, Daly, Sheridan, & McCurdy, 2006). Another barrier that can arise is if parents do not feel it is part of their role to help with early literacy (Anderson, Cronin, & Fagan, 1998).

With adequate support and training parents can overcome possible barriers and implement effective interventions (Duvall & Ward, 1997; Gang & Poeche, 1982; Weiner, Sheridan & Jenson, 1998). Duvall and Ward (1997) examined the differences in learning rates, performance on standardized academic tests, and level of academic engaged time between elementary students who were home-schooled and those in public schools. Four students with learning disabilities who were home-schooled were matched on multiple variables (i.e., gender, age, SES, disability type, Woodcock Johnson- Tests of Academic Achievement- Revised scores) with students found in the elementary public school. With parents receiving only the basic support of materials from the home-school coalition in the area, students who were home-schooled outperformed those in public school in reading, writing and math. In examining the rates of growth, students who were home-schooled showed greater increases in learning, most likely due to higher levels of

academic engaged time. Overall, students who were home-schooled by a parent had rates of academic engagement two and a half times their matched peers.

Weiner and colleagues (1998) investigated a parent-implemented intervention to assist junior high students with completing their math homework with accuracy. Five parent-child dyads participated in the intervention that took place for seven to ten days. Training the parents involved conducting three interviews with each parent to: (1) discuss the problem and identify what the parent would like to see, (2) develop an intervention, and (3) evaluate the intervention. Parents were found to implement the treatment correctly about 93% of the time. The researchers supported parents by providing intervention checklists to assess completion of activities and checking in with them by phone once a week.

Intervention Integrity

Ensuring the integrity of an intervention conducted at home is vital to affirming the effectiveness of the intervention. Intervention integrity refers to how well the original intervention protocol is followed when implemented (Roach & Elliott, 2008). A review of the literature has found a significant moderate correlation ($r = .51 - .58$) between intervention integrity and treatment outcomes (Gresham et al., 1993), providing support that intervention integrity data collection should be an important component of any intervention research.

Intervention integrity has often been referred to as the degree to which an intervention is implemented as planned (Gresham et al., 1993; Roach & Elliott, 2008). However, some researchers have expanded this definition so that the question, “Was the intervention implemented with integrity?” cannot be answered in a dichotomous way.

After reviewing the research literature, Perepletchikova and Kazdin (2005) suggested that there are three important aspects of integrity: (1) treatment adherence, (2) interventionist competence, and (3) treatment differentiation. Adherence refers to much of the original definition, covering how closely the specific steps of an intervention were followed. Interventionist competence is characterized by the implementer's skills, decisions, timing, and judgment during implementation. Treatment differentiation refers to the degree to which the intervention is different from and kept distinct of other practices. This last component may be the most important in determining whether an intervention is effective.

Intervention integrity can be enhanced in the home through two main components. One component involves monitoring the procedures. This has been proven effective with parents by using procedural checklists, videotaping, and phone calls (Hook & DuPaul, 1999; Powell-Smith, Stoner, Shinn, & Good, 2000). The second important component is proper training of the parents (Persampieri et al., 2006). The more direct training models, such as immediate feedback or modeling, tend to improve intervention integrity with parents (Sterling-Turner, Watson, Wildmon, Watkins, & Little, 2001).

Parents have been effectively taught to implement a reading intervention for third grade students (Gang & Poeche, 1982). Gang and Poeche (1982) trained the mothers of three boys who were below grade level in reading to implement a phonics-based reading intervention, four times a week for seven weeks. Parents were trained through modeling and instruction in how students learn and what is an appropriate environment to tutor in. An observer was present at initial sessions to monitor integrity. After sessions were completed the observer would provide corrective feedback. As parents maintained 90%

accuracy in implementation, the observer was gradually removed from sessions. Over the course of the intervention period, parents averaged 97% correct tutoring behaviors. As far as development of reading skills, two of the students showed rates of growth that were greater than the mainstream students. The third student showed gains that would be expected in the mainstream environment. This could have been due to the fact that he did not take his medication for hyperactivity the morning of the posttest. Overall, the results support that parents can implement an effective reading intervention with high levels of integrity when specific strategies are in place.

Summary

Both research and legislation are moving toward the use of early interventions to help lessen the problems with illiteracy in the United States. A good foundation of pre-literacy skills can help prevent the “Matthew Effect,” where students who struggle with initial reading skills fall further and further behind their peers as time passes. The National Early Literacy Panel (2008) has summarized early literacy research and found that phonological awareness, letter knowledge, as well as the ability to rapidly name letters and objects, and the ability to write one’s name predict future school success. The National Reading Panel (2000) also found that phonemic awareness and letter knowledge were predictive of future literacy success. As such, children not possessing these skills at the beginning of kindergarten are at greater risk for academic difficulties and problems with reading. These skills typically develop during preschool. Caregiver involvement at this stage of development has proven to be effective and caregivers can be successfully taught in helping their children if given the correct tools. It is important to effectively train and monitor caregivers who may be conducting interventions outside of school as

intervention integrity is vital to validating that outcomes result from the intervention that was put into place.

Purpose of the Present Study

This study begins to address the limitations and gaps in the literature on how caregivers can be involved in their preschool children's academic lives. Currently, there are only four articles in peer-reviewed journals that address parent involvement and its relation to preschooler's academic development (Arnold et al., 2008). With legislation advocating for greater caregiver involvement in a child's education, it is important to know the ways in which a caregiver can become involved with high levels of success for the child. This study examined how a caregiver-led intervention impacts preschool children's early literacy development. Caregivers implemented an intervention package in their home that focused on developing phonological awareness and learning the names of letters. Intervention integrity was monitored to determine how well the intervention was implemented and social validity data was gathered to address any barriers to future implementation.

CHAPTER THREE

RESEARCH METHODS

This chapter focuses on the methods employed in conducting the present study. First, participants and delimitations, settings, and measures are described. Next, the research design will be discussed, followed by a description of the procedures. The discussion of procedures includes ethical considerations, participant selection, baseline period, caregiver training, intervention phase, intervention integrity and social validity, and the follow-up phase. This chapter concludes with a presentation of the data analyses used for the purposes of addressing the research questions.

Participants

Seven caregiver-child dyads were selected from a pool of ten possible dyads enrolled in a Head Start center in Hillsborough County. All participants met the following criteria: (1) both caregiver and child are fluent in English, (2) child is enrolled in the Hillsborough County Head Start program, (3) child is eligible to enroll in kindergarten in Fall 2009, (4) the child scores below 10 first sounds and 10 letters on DIBELS First Sound Fluency and DIBELS Letter Knowledge assessments, respectively, and (5) the caregiver has a consistent phone number. Additionally, the caregiver must have consented to participate in the study and agreed to implement the intervention package.

To enroll in Head Start, the child's support system (parent(s)/guardian(s)) must have an income that falls below the federal poverty line. No comparison higher socioeconomic status group will be used as research has already well-established the deficits in skills of both students from low socioeconomic backgrounds and students who qualify for the Head Start program (Zill et al., 2003)

The Hillsborough County Head Start program offers several options for families to enroll their children. Working families can apply to have their children in the full-day/full-year program. An additional program offers services part-day for the academic school year. Combined, these two programs provide services to over 3,000 children ages 0-5 (Hillsborough County Head Start, 2008). All participants in this study were enrolled in the full-day/full-year program.

Participant Attrition

Seven caregiver-child dyads were initially recruited and data were gathered on all seven children through the baseline phase. All seven caregivers were trained and began the intervention shortly after the training. One participant declined continued participation in the study five weeks into the intervention phase and returned the intervention package to the PI with no lessons completed. Despite repeated attempts made by the PI and the classroom teacher, the caregiver could not be reached for follow-up. Due to the fact that this dyad withdrew from study participation, data from the dyad were not included in analysis. Demographic information pertaining to the remaining six parent-child dyads can be found in Table 1. Anecdotal comparisons of the participants to the typical population served by Head Start revealed that the sample within this study appears to represent the broader population with regard to race/ethnicity, single-parent homes, and socioeconomic status.

Table 1

Participant Demographic Information

<i>Child</i>	<i>Parent</i>	<i>Age</i>	<i>Race/Ethnicity</i>	<i>Siblings</i>
Rachel	Rhonda	4-8	African-American	2 younger girls
Wesley	Wendy	5-0	Hispanic	2 older girls, 1 older boy
Jennifer	Janet	4-6	Caucasian	1 younger boy
Tanner	Tina	5-3	African-American	2 older girls
Melanie	Mary	5-1	Bi-Racial (Hispanic & Caucasian)	1 older girl, 1 younger girl and boy
Brenna	Bethany	4-9	Bi-Racial (African-American & Caucasian)	1 older boy and 1 younger girl

Note. All names are pseudonyms. Ages represent age at beginning of intervention

Settings

Data collection with the DIBELS LK and FSF measures during all phases took place in the child’s Head Start classroom two times each week, once during Monday or Tuesday and once during Thursday or Friday. The Principal Investigator (PI) or the project assistant took each child out into the hallway to conduct each assessment.

Caregiver training was offered in three locations: a conference room at USF, at the Head Start Center, or in a common area of the home (i.e., kitchen, living room). These training sessions were scheduled at a time that was convenient for the caregiver and the PI.

Measures

Independent Variable

Caregivers were taught to implement a pre-literacy intervention package focusing on increasing letter-naming abilities and phonological awareness performance in their children. Caregiver-child dyads involved in the intervention engaged in twenty-seven, fifteen-minute sessions (three a week for nine weeks). During these sessions, caregivers followed a specific lesson plan that details a mnemonic device used to teach letter names (Raschke et al., 1999) and completed an onset identification activity where the child attempts to generate words that begin with the same sound (i.e., mouse and moon). Caregivers began the session by recording how many letters the child could correctly identify on flashcards. Caregivers then taught the name of a new letter to their child. Caregivers corrected any inaccurate responses from the child using a script given to them. The sessions concluded with caregivers engaging in a phonological awareness activity that required the child to answer questions and produce words that begin with a specific sound.

Dependent Variables

Dynamic Indicator of Basic Early Literacy Skills

The Dynamic Indicators of Basic Early Literacy Skills (DIBELS; Kaminski, Cummings, Powell-Smith, & Good, 2008) are characterized by being sensitive to small changes in student performance over short periods of time (i.e., dynamic). This brief measure is well suited to frequently monitor progress toward a benchmark or goal. The DIBELS assessments are considered indicators as they measure key behaviors to indicate overall performance in early literacy skills (Kaminski et al., 2008). Two new measures

will be used in this study: (1) DIBELS First Sound Fluency, and (2) DIBELS Letter Knowledge. There are two measures that predated these new measures and these deserve a brief discussion as the development of the new measures was heavily influenced by the established measures.

DIBELS Initial Sound Fluency

The precursor to First Sound Fluency is Initial Sound Fluency (ISF; Kaminski & Good, 1998). Initial Sound Fluency assesses a child's phonemic awareness skills by examining his or her ability to recognize and produce the initial sound or group of sounds of an orally presented word. This probe is scored by timing the duration it takes for a child to respond to questions by identifying or producing the correct sound. The time is then converted to a score of correct initial sounds per minute.

An assessment of the reliability and validity of this measure was conducted using a sample of 86 kindergarten students (Hintze, Ryan, & Stoner, 2003). All assessments were completed within three days for each participant, with participants taking breaks in between assessments. Reliability was assessed via the administration of an alternate form of the ISF. Results showed that ISF had an alternate form reliability of .86 (Hintze et al., 2003). Concurrent validity was examined by comparing performance on the ISF to scores of the Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgesen, & Rashotte, 1999) Phonological Awareness and Phonological Memory Composites. A correlation of .60 was found between ISF and the CTOPP Phonological Awareness Composite score and a .46 correlation was found between ISF and the CTOPP Phonological Memory Composite score. Discriminant validity for ISF was determined by comparing scores to the CTOPP Rapid Naming Composite. Correlations between these

measures were low (.20) providing support that ISF measures a specific skill and does not appear to overlap with other skills. While ISF has demonstrated adequate alternate-form reliability, and concurrent validity, practitioners have reported that it is difficult to administer and other research has shown that it is one of the least reliable DIBELS measures (Cummings, Good, Kaminski, & O'Neil, 2008). These reasons have prompted the creation of a new test (DIBELS FSF) to assess the ability to identify and produce the initial sound of a word.

DIBELS First Sound Fluency

The DIBELS FSF was designed to measure a level of phonological awareness known as onset-rime awareness (Cummings, Good, Kaminski, & O'Neil, 2007). This skill is a precursor to phonemic awareness (Sindelar, Lane, Pullen & Hudson, 2002). The measure was created to overcome some of the problems that have been found with the DIBELS Initial Sound Fluency (ISF) administration and scoring. The measure has been compared with other measures that attempt to gauge a student's progression toward literacy (Cummings et al., 2007). In comparison to DIBELS ISF, and the Picture Naming, Alliteration and Rhyming tasks of the Individual Growth and Development Indicators for Early Literacy (EL-IGDIs; Missal et al., 2007), DIBELS FSF showed the greatest sensitivity of growth during pre-kindergarten, predicting an average growth of 0.50 first sounds identified per minute each week (Cummings et al., 2007).

Technical adequacy of DIBELS FSF. Cummings and colleagues (2007) found adequate test-retest reliability for DIBELS FSF in their sample of 73 pre-kindergarten students. Each assessment period consisted of administering one FSF probe. One month alternate-form reliability was found to be .86. In examining the validity of DIBELS FSF,

it was found to correlate highly with other DIBELS measures as well as with the Alliteration and Rhyming tasks of the EL-IGDI. DIBELS FSF was also found to predict later DIBELS scores on higher-level phonemic awareness tasks very well (Nonsense Word Fluency $r=.53$, Phoneme Segmentation Fluency $r=.71$).

Administration and Scoring of DIBELS FSF. DIBELS FSF was designed to be administered during the pre-kindergarten year through the fall and winter of kindergarten. Students are asked to identify the first sound in a word presented orally by the examiner. Students get two points for providing only the first phoneme of the word, and one point for providing the first two or three phonemes. The student does not receive credit for repeating the word, or providing more than three phonemes. The responses that occur within one minute receive scores.

DIBELS Letter Naming Fluency

The Letter Knowledge assessment was created to closely resemble the DIBELS LNF probes. Therefore, an understanding of LNF provides a solid understanding of the concepts and scoring of the new LK measure. Letter Naming Fluency provides a measure of risk for problems in future literacy development. It was designed to be given throughout the kindergarten year, and for the Fall assessment period in first grade. Students are presented with a page that has upper- and lower-case letters arranged in a random order in rows across the page. Students are given one minute to produce as many letter names as they can, and correct responses within the minute are added to come up with the score (Good et al., 2004).

Hintze and colleagues (2003) also examined the reliability and validity of LNF by using alternate forms and comparing results to the CTOPP. Alternate form reliability was

very good (.94) and correlations measuring concurrent validity with the Rapid Naming, Phonological Awareness and Phonological Memory Composites were .58, .53, and .52, respectively. Another study examined the predictive validity of LNF in a sample of 60 kindergarten students at two schools (Good et al., 2004). The LNF probe was administered at the Winter and Spring benchmarks at both schools and scores were compared to scores on Nonsense Word Fluency at the Winter assessment period of first grade. Results showed correlations of $r=.61$ - $.77$ with a median correlation of $r=.72$. With the strong psychometric properties of DIBELS LNF, only minor changes were made to begin the creation of the Letter Knowledge (LK) assessment for pre-Kindergarteners.

DIBELS Letter Knowledge

DIBELS Letter Knowledge is an adaptation of the LNF probes to be more suitable for administration at the pre-K level. These probes consist of four pages with 13 random letters on each page that are printed in a slightly larger font than the LNF probes. Given that the LK probe is administered and scored in the same manner as the LNF probe, the data on LNF can be generalized to the LK measure with a few precautions. It is important to remember that when the number of options to respond is decreased, the reliability of the measure will be lowered. Also, the performance of younger children (i.e., preschoolers) is less stable than older children, leading to more variation and less reliability.

Intervention Integrity

Documentation of intervention integrity was also included in the study. Lesson plan completeness (i.e., fully filled out sheets) was examined along with the number of sessions completed each week. An example lesson plan can be found in Appendix C.

Each of the four sections of the lesson (letter check, new letter, letter review, and sound practice) has steps to be completed (i.e., checked off, filled out, circle yes or no). The number of steps for each lesson varies between 58 and 64. To compensate for this difference, percentages were calculated to quantify the level of intervention integrity. The formula that was used for calculating intervention integrity for each session was:

$$\frac{\text{Number of Completed Steps}}{\text{Number of Total Steps Possible}} \times 100$$

Social Validity

Social validity refers to the implementer's judgment or affinity toward the intervention and carrying it out (Witt & Elliott, 1985). One measure that has been used to quantify this construct is the Intervention Rating Profile (IRP; Witt & Martens, 1983). The form has a Likert-scale response format from 1 (Strongly disagree) to 6 (Strongly agree). The form was originally created to assess the acceptability of interventions that were to be implemented by classroom teachers.

An altered form of the IRP-15 was used to collect data regarding intervention acceptability. The original form consisted of fifteen questions. However, two questions were not easily altered to become a question to ask a caregiver, and these items were removed. Therefore the form used in this study has thirteen questions that provide a thorough assessment of how the implementer rates the intervention. The fully adapted form can be examined in Appendix D.

Further information regarding social validity was gathered via a semi-structured interview with each parent. The form used for all interviews can be found in Appendix E. The interview consisted of nine questions that gathered information on parent perceptions

of the intervention as well as recommended changes to make the intervention package easier to implement or more fun to carry out with their child.

Design

A multiple baseline across participants design was used in this study to analyze the data and test hypotheses. The design included three phases for each child: baseline, intervention for nine weeks, and follow-up. Caregiver-child dyads began the baseline phase at the same time. This study had six participants who began the intervention at four different points, leading to four separate baselines. A minimum of three baselines is recommended for this type of design (Kazdin, 1982). Data collection throughout all phases consisted of progress monitoring with both DIBELS measures. For the purposes of this study, visual analyses and trendlines were used to determine stability or decreasing trend, characterized by the absence of slope in the data points, or decreasing slope (Kazdin, 1978). Participants were randomly assigned to begin the intervention phase. Participants entered the intervention phase at four different points, with one participant entering initially, followed by two pairs of participants, and finally the last participant. While waiting to begin the intervention phase, those participants remaining in baseline were still assessed twice weekly. The purpose of the baseline phase was to reduce threats to internal validity, such as history, maturation, testing, and instrumentation threats (Barlow, Hayes, & Nelson, 1984). Changes in behavior of students who are in the intervention phase that did not occur with students who remained in baseline phases provides confidence that any observed changes would be due to effects of the intervention (Cooper, Heron, & Heward, 1987). The intervention phase lasted for nine weeks for each caregiver-child dyad, with follow-up occurring approximately two weeks

after completion of the intervention. The follow-up phase can support maintenance of the intervention package's effects. No intervention was in place during this phase but data were still collected twice per week. This design allowed for initial demonstration of early literacy skills prior to the intervention, demonstration of intervention effects during the intervention, and an assessment of intervention effects at follow-up.

Procedure

Ethical Considerations

The study was submitted to the University of South Florida Division of Research Integrity and Compliance Institutional Review Board (IRB) for approval and consent for participation was sought from the Hillsborough County Head Start Division of Children's Services. The study began once approval is received from both agencies. The researcher made every effort to ensure that participants were treated ethically and that confidentiality was maintained. Informed consent was obtained from the caregiver participants. Students were identified by number for data entry purposes. Data was kept in a locked file cabinet in the possession of the PI, and names will be changed in any future verbal or written presentation of the research.

Training in DIBELS Administration

Both the PI and the project assistant received basic training in administering multiple forms of DIBELS probes during their graduate studies. In addition to this training the PI has received training with regards to the new DIBELS measures. Training of the PI was conducted by a person from the Dynamic Measurement Group who is knowledgeable of both measures. The Project Assistant was trained by the PI using the Dynamic Measurement Group's training materials. Training consisted of one 60-minute

session where the assistant demonstrated 98% and 100% accuracy on the DIBELS FSF and LK measures, respectively, before being allowed to collect data for this study.

Participant Selection

After gaining acceptance from the administration of Hillsborough County Head Start, social workers at a local Head Start center were contacted and given information about the study in the form of a handout. This handout also detailed how to get into contact with the PI. The social workers then distributed these handouts to parents who they knew met the following criteria: (1) both caregiver and child are fluent in English, (2) child is enrolled in the Hillsborough County Head Start program, (3) child is eligible to enroll in kindergarten in Fall 2009, and (4) the caregiver had a consistent phone number. The social workers informed the caregivers that the research would involve the caregiver providing a literacy intervention package that could improve their child's skills in preparation for kindergarten. A general description of what would be required of caregivers was provided (i.e., time, activities) in the content of the handout. Caregivers or social workers (with a signed caregiver form) contacted the PI to let her know they would like their child to be assessed. The child of any caregiver who was interested was assessed by the PI with the DIBELS FSF and LK probes to see if the child met the inclusion criteria. If the child's scores fell below the designated cut points (FSF and LK less than 10), the caregiver and the examiner met to describe the program in detail and obtain informed consent. An example of the informed consent for caregivers is in Appendix A. The first seven dyads that met inclusion criteria were included in the study.

Baseline Period

The baseline period of data collection involved the child receiving typical classroom and home activities for his or her early literacy skill instruction. Students were assessed with both DIBELS FSF and LK probes twice a week during the baseline period. Data will be collected twice a week with at least one day in between assessment during all phases of the study.

All caregiver-child dyads began baseline at the same time. The change to intervention from baseline occurred after six weeks since no stable trend was evident for all participants. For this study, stability was defined as having the last three data points be within ± 1 unit (first sound or letter) of the cumulative mean of the baseline period. After the six-week baseline phase, participants were selected randomly to enter the intervention phase. At first, one caregiver-child dyad began the intervention phase and then four participants entered in two pairs, and then finally the last participant began the intervention. The intervention was implemented for each dyad sequentially: baseline data collection continued until another two dyads enter the intervention phase, and these dyads participated in the intervention training and began the intervention, while the remaining participants continued at baseline. This process continued until all participants were in the intervention phase or for the first six weeks, whichever comes first. One important note is that academic performance data are not typically completely stable, making trends difficult to decipher. While this may make data analysis more difficult, Kazdin (1982) suggests that these trends rarely impede the ability to determine intervention effects in a multiple baseline design if the effects are strong.

Caregiver Training

After it was determined that a child would move from baseline to intervention, the PI trained that child's caregiver to implement the early literacy intervention package with his or her participating child. The training was scripted to ensure equivalent content across each caregiver training. A copy of the caregiver training session can be found in Appendix B. The training consisted of one 60-90 minute session in a place of the caregiver's choosing (either USF, Head Start, or the caregiver's home). The training consisted of instruction, modeling, role play and feedback. These methods have been shown to increase intervention integrity (Sterling-Turner, Watson, Wildmon, Watkins, & Little, 2001). Caregivers were trained on providing corrective and specific feedback, keeping track of correctly named letters, teaching letter names using a mnemonic strategy, and facilitating activities that focus on the onset/rime level of phonological awareness. During the first nine sessions, phonological awareness activities had the child compare whether two words have the same onset. During the middle nine sessions, the child was asked to produce full words that start with the same sound. The activity during the final nine sessions had the child produce only the onset of a word (Sindelar et al., 2002). Caregivers were given the opportunity and encouraged to ask questions and received feedback on a mock session they conducted with the primary investigator. Caregiver participants also received a calendar to schedule intervention sessions and follow-up phone calls (to check for implementation integrity) twice a week.

Intervention Procedure

The materials needed for the intervention package were compiled into a three-ring binder for ease of use. They include lesson plans for each session, letter flashcards, and

picture flashcards for the mnemonic strategy. These materials were provided to each caregiver by the PI.

For each intervention session, the caregiver was instructed to sit with their child in a quiet location in their home with minimal distractions (e.g., away from television, radio, windows). Sessions should have occurred three times per week for brief amounts of time, lasting approximately 15-20 minutes. During the first two activities that focus on letter naming, caregivers were instructed to place materials where it is easy for the child to see.

The sessions were identical for each dyad and followed the same sequence of letter introduction and sound practice. Caregivers first individually held up the 26 letter flashcards, recording which letters were accurately identified and which were not. Caregivers then taught a new letter name using a mnemonic strategy (Raschke et al., 1999). The letter to be taught depended on which session of the intervention the caregiver was conducting. This process required caregivers to present a flashcard with letters on it alongside a flashcard with a picture representing a mnemonic. For example, for the letter “B”, one flashcard would have the capital (B) and lower case (b) and the other would have a picture of a bee. The caregiver would say, “A bee goes buzz.” The child would then repeat the phrase, and the caregiver and child would identify the name of the letter. This would be repeated several times while the caregiver fades the prompt (i.e., whispering the prompt, then saying none at all). After this, up to three letters were reviewed that had been previously learned (i.e., the letters taught in the three previous sessions).

The second half of the intervention package involved caregivers helping their children to identify differences and similarities in onsets of words. The initial stage had

parents present two words and had the child compare whether these begin with the same sound (i.e., Do mat and mouse start with the same sound?). These activities increased in difficulty through the intervention phase by having the children produce words that start with the same sound as a given word (i.e., Name all the words you can think of that start the same as turtle), and finally produce the single sound that is the onset (i.e., Tell me the first sound in sit).

Caregivers recorded their child's answers at each step and reported any difficulties with distinguishing letters and sounds. Caregivers were also instructed to provide specific feedback to their child for trying hard and doing good work (i.e., "I like how you came up with so many words that start the same as zoo.", "I like how you worked hard to learn that letter name.")

Intervention Phase

The intervention phase for each participant lasted nine weeks. The intervention occurred three times per week in 15-20 minute sessions. The interventions were planned to take place in an area in the participants' home where there are few distractions, but the caregiver participant of each dyad determined the location. Progress monitoring data were collected twice weekly by the primary investigator and trained project assistant at the child's Head Start classroom using both DIBELS FSF and LK probes. The child received no error correction during these sessions, other than that scripted by the DIBELS probe directions. Participating children received reinforcement in the form of verbal praise for complying with the examiners requests.

Procedural Integrity

Intervention integrity was monitored throughout the intervention phase. The lesson plans served as a checklist to determine whether the all the components of each session were carried out. Caregivers recorded the date of the intervention, the beginning and ending time, the activities completed with the information for each activity to be filled in, an evaluation of the session (i.e., indication of how the session went), and any questions the caregiver had while conducting the session. A sample lesson plan can be found in Appendix C. The PI collected these lesson plans from the child when they met for the first progress monitoring session each week. If the child did not have the checklists, the PI called the caregiver to remind them to send the checklists on the next assessment day. If the lesson plans were consistently not being returned, the PI visited the child's caregiver when they came to pick up their child from Head Start. Additionally, the PI called the caregivers twice a week during the intervention phase to assess implementation and answer any questions the caregiver wrote on the lesson plan sheets or had during the conversation. Also, any inconsistencies on the lesson plans were addressed during these phone calls.

Follow-Up Phase

In the weeks after the end of the intervention phase, maintenance of intervention effects were evaluated with the collection of data using the two DIBELS assessments (FSF and LK). These assessments continued to be administered twice a week until the PI collected two weeks (4 data points) of assessment data from last participant to completing the intervention phase.

To gather data regarding the social acceptance and caregiver perceptions of the intervention package, a semi-structured interview was conducted by the PI with the caregivers. The interviews took place in the caregiver's home, at a time agreed upon by the caregiver and the PI. The questions for the interview can be found in Appendix E. These interviews gathered information regarding the components of the intervention package that were perceived to be the most helpful or effective, as well as barriers and difficulties with implementing the intervention package. Just prior to the interview being conducted, the modified version of the IRP-15 was filled out (Appendix D). At the end of the interview, the caregivers received books for their child, a small toy for their child and a \$100 Wal-mart gift card to thank them for their participation.

Data Analysis

Data were analyzed from the DIBELS FSF and LK assessment information. The assessment data are displayed graphically with five days per week (no weekends) to indicate performance during baseline, intervention and follow-up phases of the study. Data were compared across phases, and trendlines were constructed to determine differences in rate of growth in each phase. The change in level across phases also were examined, as described by Kazdin (1982). However, because sudden changes in level of performance in academic data are rare, an alternative definition of level was used in this study. The mean performance on each DIBELS measure during the last 2 weeks (4 data points) of each phase were compared. This results in a comparison between the last two weeks of baseline and the last two weeks of the intervention phase, and a comparison between the last two weeks of intervention and the last two weeks of the follow-up period.

Data were also examined through the use of non-overlapping data points. The following formula was used:

$$\frac{\text{Number of data points above the highest baseline point}}{\text{Total number of data points in the intervention phase}} \times 100$$

A higher percentage of non-overlapping data points indicates a stronger effect for the intervention whereas a lower percentage indicates more overlapping data points and weaker intervention effects (Stape, 2000).

Further analyses included the use of hierarchical linear modeling to gather evidence regarding the effectiveness of the intervention (Van den Noortgate & Onghena, 2003). Effect sizes for the intervention package were calculated along with tests of significance. Specifically, at level 1 the DIBELS FSF and LK scores were modeled as a function of the phases. This was represented as:

$$\text{Early Literacy Skill } (Y_{ij}) = \beta_{0j} + \beta_{1\text{phase}j} + \beta_{2\text{time}j} + \beta_{3\text{phase}*\text{time}j} + e_{ij}$$

Level 2 was represented by the following equations:

$$\beta_{0j} = \gamma_0 + u_{0j}$$

$$\beta_{1j} = \gamma_1 + u_{1j}$$

$$\beta_{2j} = \gamma_2 + u_{2j}$$

$$\beta_{3j} = \gamma_3 + u_{3j}$$

To examine the level of intervention integrity, each lesson plan sheet was examined for completeness to indicate whether the procedure was followed for each component. The total number of steps for each lesson completed was divided by the total possible steps to generate a percentage of intervention integrity. These percentages were averaged across the 27 sessions to generate an overall level of intervention integrity.

Also, the individual session percentages each week were averaged and were correlated with the slope of the trendline for scores on each of the DIBELS measures using the Pearson Product Moment correlation. This gave an indication of whether the level of integrity varied with the level of performance on pre-literacy tasks.

The IRP rating scale yields total scores ranging from 13 to 78. These scores were correlated with the slope of the DIBELS scores on both measures during the intervention phase. Data were analyzed using the Pearson Product Moment correlation.

The information gathered from the caregiver semi-structured interviews was examined for themes regarding benefits and barriers to implementation as well as what components of the intervention package the caregivers found most helpful. This information can help inform future efforts to include caregivers in implementing home-based interventions.

CHAPTER FOUR

RESULTS

This chapter includes a discussion of multiple baseline early literacy data for the six child participants along with analyses of data gathered on intervention integrity and social validity. Consistent with single case design studies, the data presented in this chapter will first be discussed through visual analysis, and descriptive statistics.

Additionally, the results of hierarchical linear modeling analysis will be discussed. The chapter also reviews data gathered on the intervention integrity and social validity of the study as well as themes gathered from the interviews with the parents.

Visual Analysis and Descriptive Statistics

In order to examine the impact the parent-implemented early literacy skills intervention package had on students' early literacy skills, results were visually analyzed to determine the change in levels of performance, trendlines, and variability across phases. A graphical representation of the data on the First Sound Fluency Measures (FSF) for each child is provided in Appendix F. The data gathered from the Letter Knowledge (LK) measure for each child are provided in Appendix G. Examination of the graphs of the FSF and LK data revealed considerable variability across participants in all three phases. For this reason, data for each child will be discussed individually. To facilitate this discussion, each child was given a pseudonym.

Child 1- "Rachel"

FSF Results

Descriptive statistics summarizing the variability of data points and the mean level of performance in FSF for each phase (i.e., baseline, intervention, and follow-up)

for Rachel are presented in Table 2. An increase is observed in mean level of FSF from the baseline phase ($M= 0.18$) to the intervention phase ($M= 3.06$). This is an increase in mean data of 2.88 FS from baseline to intervention phase. Because sudden gains in academic skills are unlikely to result at the beginning of the intervention phase, the means from the end of each phase were compared (last two points in each phase). From the end of the baseline phase ($M= 0.00$) to the end of the intervention phase ($M= 7.50$), there was an increase in level of 7.50 in first sounds per minute.

A comparison of differences between intervention and follow-up phases also was conducted. Rachel’s mean FSF score continued to increase from the intervention phase ($M= 3.06$) to the follow-up phase ($M= 5.56$), resulting in a total mean increase of 2.50 first sounds per minute. When comparing the means of the last two data points from the intervention and follow-up phases, the mean final scores increased from the intervention phase ($M= 7.50$) to the follow-up phase ($M= 9.50$), an increase of 2.00 first sounds produced in one minute. Overall, the Rachel’s data demonstrate increases in the means level of performance from each phase and increases in the variability of scores, with the intervention and follow-up phases having larger standard deviations.

Table 2

Descriptive Statistics for First Sound Fluency (FSF) Skills for Rachel

<i>Phase</i>	<i>M</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
Baseline	0.18	0.41	0	1
Intervention	3.06	3.19	0	12
Follow-up	5.56	3.40	0	10

Additional analyses were conducted to aid in interpreting the FSF data for Rachel. A calculation of percentage of non-overlapping data points showed that 61.11% of the data points during the intervention phase did not overlap with points in the baseline phase. Linear trendlines were created for each phase of data to examine any changes in rates of growth across phases. The slope of the trendline for each phase is reported in Table 3. A comparison across phases reveals that Rachel’s rate of growth increased across each phase, providing further support for the increase in scores across phases.

Table 3

Rates of FSF Growth for Rachel Across Phases

<i>Phase</i>	<i>Slope</i>
Baseline	-0.03
Intervention	0.15
Follow-up	0.26

LK Results

Descriptive statistics summarizing the variability of data points and the mean level of performance on letter knowledge tasks for each phase for Rachel are presented in Table 4. Similar trends were noted within Rachel’s data between performance on the LK and FSF assessments. When comparing baseline to intervention, the mean level of letters named in one minute for Rachel increased from the baseline phase ($M= 0.27$) to the intervention phase ($M= 2.33$). This is an increase in mean data of 2.06 in letters named per minute. In comparing the end of the baseline phase ($M= 0.00$) to the end of the intervention phase ($M= 5.00$), there was a change in level of 5.00 in letters correctly named in one minute.

In examining differences between the intervention and follow-up phases, Rachel's mean score on letter knowledge assessments increased from the intervention phase ($M=2.33$) to the follow-up phase ($M=4.56$), a mean increase of 2.23 letters per minute over the intervention phase. The mean data from the last two points of the intervention ($M=5.00$) and follow-up ($M=6.00$) phases revealed a small average increase of 1.00 in letters named per minute.

Table 4

Descriptive Statistics for Letter Knowledge (LK) Skills for Rachel

<i>Phase</i>	<i>M</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
Baseline	0.27	0.47	0	1
Intervention	2.33	2.17	0	6
Follow-up	4.56	2.60	0	8

Percentage of non-overlapping data points and trendlines also were calculated on the letter knowledge assessment data. A calculation of percentage of non-overlapping data points showed that 61.11% of the data points during the intervention phase did not overlap with points in the baseline phase. Linear trendlines were created for each phase of data to examine any changes in rates of growth across phases. The slope of the trendline for each phase is reported in Table 5. Changes in rates of growth in LK were very similar to changes in rates of growth of FSF, with an increase in growth occurring at every phase.

Table 5

Rates of LK Growth for Rachel Across Phases

<i>Phase</i>	<i>Slope</i>
Baseline	-0.01
Intervention	0.06
Follow-up	0.26

Child 2- “Wesley”

FSF Results

Descriptive statistics summarizing the variability of data points and the mean level of performance in FSF for each phase are presented in Table 6. The intervention phase had the greatest level of variability with regards to FSF scores, while the mean scores increased across all phases. An increase of 16.12 first sounds per minute was observed between the baseline ($M= 16.75$) and intervention ($M= 32.87$) phases. The increase is even greater when comparing the final two data points from each phase. An increase of 22.00 first sounds produced in one minute occurred between the baseline phase ($M= 21.50$) and the intervention phase ($M= 43.50$).

Data also were compared between the intervention and follow-up phases. Wesley’s mean FSF score increased another 9.70 first sounds per minute from the intervention phase ($M= 32.87$) to the follow-up phase ($M= 42.57$). While phase means show an increase, data comparing the average of the last two assessments in each phase show a slight decrease (-2.50) between the intervention ($M= 33.50$) and follow-up ($M= 41.00$) phases. Overall, comparisons of Wesley’s data across phases exhibit changes in

variability across each phase, increases in average first sound fluency scores, and a large increase then small decrease when comparing final data points of a phase.

Table 6

Descriptive Statistics for First Sound Fluency (FSF) Skills for Wesley

<i>Phase</i>	<i>M</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
Baseline	16.75	6.03	4	23
Intervention	32.87	7.98	22	47
Follow-up	42.57	3.69	38	49

Data were also subjected to the analyses of non-overlapping data points and the construction of trendlines. A calculation of percentage of non-overlapping data points revealed that 86.67% of the data points during the intervention phase did not overlap with points in the baseline phase. Linear trendlines were created for each phase of data to examine any changes in rates of growth across phases. The slope of the trendline for each phase is reported in Table 7. A comparison across phases evidences a small increase from baseline to the intervention phase (0.09) with regards to slope, and a large decrease in growth between the intervention and follow-up phases (-0.88).

Table 7

Rates of FSF Growth for Wesley Across Phases

<i>Phase</i>	<i>Slope</i>
Baseline	0.42
Intervention	0.51
Follow-up	-0.37

LK Results

Descriptive statistics summarizing the variability of data points and the mean level of performance in Letter Knowledge for each phase for Wesley are presented in Table 8. Wesley's knowledge of letters increased throughout all three phases. An increase in mean score of 6.43 correct letters per minute was found between the baseline phase ($M= 5.17$) and the intervention phase ($M= 11.60$). The mean of the final points of the baseline phase and intervention phase were also compared, with an increase of 11.50 letters per minute being found (baseline $M= 6.50$; intervention $M=18.00$).

An evaluation of the intervention and follow-up phases found increases in all mean comparisons. The increase of the overall means between the intervention and follow-up phases was 9.97 letters named correctly per minute (intervention $M= 11.60$; follow-up $M=21.57$). The level of change in the means of the last two data points from each phase was not as large, revealing an increase of only 5.00 letters named per minute (intervention $M= 18.00$; follow-up $M=23.00$).

Table 8

Descriptive Statistics for Letter Knowledge (LK) Skills for Wesley

<i>Phase</i>	<i>M</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
Baseline	5.17	2.62	2	10
Intervention	11.60	4.70	5	20
Follow-up	21.57	3.16	18	28

The percentage of data points that did not overlap between the baseline and intervention phases for Wesley's Letter Knowledge scores was 60%. The slope of the trendlines for each phase is reported in Table 9. In contrast to the significant drop in rate

of growth found in the FSF trendlines, Wesley’s rate of growth within the Letter Knowledge scores shows an increase between baseline and intervention phases and only a small decrease between the interventions and follow-up phases.

Table 9

Rates of FSF Growth for Wesley Across Phases

<i>Phase</i>	<i>Slope</i>
Baseline	0.11
Intervention	0.29
Follow-up	0.21

Child 3- “Jennifer”

FSF Results

Descriptive statistics summarizing mean levels of performance and the variability of data points for FSF within each phase for Jennifer are presented in Table 10. The follow-up phase had the greatest level of variability with regards to FSF scores, while the mean scores increased across all phases. A small increase of 3.08 first sounds produced in one minute was noted between baseline ($M= 1.25$) and intervention ($M= 4.33$) phases. A slightly larger increase of 6.00 first sounds was noted when comparing the last two data points from the baseline ($M= 0.00$) and intervention ($M= 6.00$) phases.

When the intervention and follow-up phases were compared, Jennifer’s mean FSF score increased by 12.30 first sounds produced per minute ($M= 4.33$ intervention; $M= 16.43$ follow-up). In addition, when comparing the mean of the last two data points from each phase, an increase of 25.00 first sounds per minute was found between the intervention ($M= 6.00$) and follow-up ($M= 31.00$) phases. Overall, little difference was

observed in Jennifer’s data gathered during the baseline and intervention phase, with a change in mean performance and variability occurring during the follow-up phase.

Table 10

Descriptive Statistics for First Sound Fluency (FSF) Skills for Jennifer

<i>Phase</i>	<i>M</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
Baseline	1.25	2.14	0	6
Intervention	4.33	2.74	0	10
Follow-up	16.43	10.85	4	33

Percentage of non-overlapping data points and trendlines were also calculated on the FSF data for Jennifer. A calculation of percentage of non-overlapping data points revealed that 33.33% of the data points during the intervention phase did not overlap with points in the baseline phase. Linear trendlines were created for each phase of data to examine any changes in rates of growth across phases. The slope of the trendline for each phase is reported in Table 11. A comparison across phases evidences a small increase from baseline to intervention phases (0.06), but a large increase in rate of growth between the intervention and follow-up phases (1.33).

Table 11

Rates of FSF Growth for Jennifer Across Phases

<i>Phase</i>	<i>Slope</i>
Baseline	0.09
Intervention	0.15
Follow-up	1.48

LK Results

Descriptive statistics summarizing the variability of data points and the mean level of performance in correct letters named per minute for each phase for Jennifer are presented in Table 12. Jennifer's early literacy skills in the area of correctly naming letters increased through all three phases, with variability in the data remaining fairly consistent. When comparing mean baseline performance ($M= 9.83$) to mean intervention performance ($M= 22.33$), an increase of 12.50 letter names per minute was found. When comparing the mean performance during the last weeks of the baseline ($M= 14.00$) and intervention ($M= 35.50$) phases, a larger increase of 21.50 in LK was found.

Differences between the intervention and follow-up phases in the Letter Knowledge data were also examined. Comparisons of mean level of performance evidenced smaller gains than differences found between baseline and intervention. The increase of the overall means between the intervention and follow-up phases was 15.53 correct letter names per minute (intervention $M= 22.33$; follow-up $M= 37.86$). However, when comparing the mean of the last data points within each phase, a small difference of 8.00 letters per minute was found (intervention $M= 35.50$; follow-up $M= 43.50$)

Table 12

Descriptive Statistics for Letter Knowledge (LK) Skills for Jennifer

<i>Phase</i>	<i>M</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
Baseline	9.83	4.75	1	16
Intervention	22.33	6.36	11	37
Follow-up	37.86	4.63	31	45

A high percentage (88.89%) of the data points in the intervention phase did not overlap with the baseline phase. Data for the slope of the trendlines for each phase of LK scores are presented in Table 13. Of note, the rate of Jennifer’s growth across the baseline and intervention phases does not differ significantly. The largest change was noted in the follow-up phase, where the rate of growth is double what was observed during baseline and intervention phases.

Table 13

Rates of LK Growth for Jennifer Across Phases

<i>Phase</i>	<i>Slope</i>
Baseline	0.33
Intervention	0.32
Follow-up	0.66

Child 4- “Tanner”

FSF Results

Descriptive statistics summarizing the variability within Tanner’s data and the mean level of his performance in FSF for each phase are presented in Table 14. The intervention phase had the greatest level of variability with regards to FSF scores, while the mean scores increased across all phases. An increase of 9.53 first sounds per minute was observed between the baseline ($M= 0.00$) and intervention ($M= 9.53$) phases. The increase is even greater when comparing the mean of the final two data points from each phase. An increase of 29.50 first sound produced per minute occurred in change in level between the baseline phase ($M= 0.00$) and the intervention phase ($M= 29.50$).

Tanner's data from the intervention and follow-up phases were compared to examine differences. Tanner's mean FSF score increased another 6.72 first sounds per minute from the intervention phase ($M= 9.53$) to the follow-up phase ($M= 16.25$). While phase means show an increase, data comparing the average of the last two assessments in each phase show a large decrease (-10.50) between the intervention ($M= 29.50$) and follow-up ($M= 19.00$) phases. In general, comparisons of Tanner's data across phases evidence changes in variability, increases in mean FSF scores, and a large increase then small decrease when comparing the means of final data points of each phase.

Table 14

Descriptive Statistics for First Sound Fluency (FSF) Skills for Tanner

<i>Phase</i>	<i>M</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
Baseline	0.00	0.00	0	0
Intervention	9.53	10.94	0	32
Follow-up	16.25	6.67	6	25

To further clarify differences found in the data, Tanner's performance scores were analyzed using percentage of non-overlapping data points and creation of trendlines. A calculation of percentage of non-overlapping data points revealed that 70.59% of the data points during the intervention phase did not overlap with points in the baseline phase. Linear trendlines were created for each phase of data to examine any changes in rates of growth across phases. The slope of the trendline for each phase is reported in Table 15. A comparison across phases evidences a large increase from the baseline phase (where no growth was evident) to the intervention phase (0.78), but then a lack of growth during the follow-up phase, where the growth rate was similar to baseline levels.

Table 15

Rates of FSF Growth for Tanner Across Phases

<i>Phase</i>	<i>Slope</i>
Baseline	0.00
Intervention	0.78
Follow-up	0.05

LK Results

Descriptive statistics summarizing the variability of data points and the mean level of performance in LK for each phase for Tanner are presented in Table 16. Similar trends were noted within Tanner’s data between the LK and FSF performance. When comparing baseline to intervention, the mean level of letters named in one minute for Tanner increased from the baseline phase ($M= 9.29$) to the intervention phase ($M= 24.35$). This is an increase in mean data of 15.06 in knowledge of letter names. In comparing the means from the end of the baseline phase ($M= 15.00$) to the end of the intervention phase ($M= 41.00$), there was a sizeable increase in level of 26.00 letter names produced per minute.

In examining differences between the intervention and follow-up phases, Tanner’s mean score in LK increased from the intervention phase ($M= 24.35$) to the follow-up phase ($M= 44.75$), a mean increase of 20.40 letters per minute over the intervention phase. The mean data from the last two points of the intervention ($M= 41.00$) and follow-up ($M= 47.00$) phases revealed a small mean increase of 6.00 in LK performance. Overall, Tanner evidenced large gains in letter naming ability across all three phases.

Table 16

Descriptive Statistics for Letter Knowledge (LK) Skills for Tanner

<i>Phase</i>	<i>M</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
Baseline	9.29	3.41	3	16
Intervention	24.35	10.92	11	43
Follow-up	44.75	4.13	37	50

Percentage of non-overlapping data points and trendlines were calculated on the LK assessment data as well. A calculation of percentage of non-overlapping data points showed that 82.35% of the data points during the intervention phase did not overlap with points in the baseline phase. Linear trendlines were created for each phase of data to examine any changes in rates of growth across phases. The slope of the trendline for each phase is reported in Table 17. Changes in rates of growth in producing letter names were very similar to changes in rates of growth of FSF assessment scores, with an increase in growth between baseline and intervention phases and a decrease in growth during the follow-up period.

Table 17

Rates of LK Growth for Tanner Across Phases

<i>Phase</i>	<i>Slope</i>
Baseline	0.13
Intervention	0.79
Follow-up	0.38

Child 5- "Melanie"

FSF Results

Melanie's data are described regarding mean level of performance of FSF and variability within the data in Table 18. Increases were noted in mean scores through each phase, with only a slight increase in variability during the intervention phase. When comparing Melanie's mean performance during the baseline phase ($M= 4.36$) and the intervention phase ($M= 13.43$), a gain of 9.07 first sounds per minute was demonstrated. However, when comparing the average of the last two data points from each phase, Melanie's mean baseline ($M= 9.50$) was 1.50 first sounds per minute higher than the mean from the end of the intervention phase ($M= 8.00$).

Comparisons of the data points in the intervention and follow-up phases evidenced increases when examining both overall means of phases and when comparing average final data points. Melanie's mean follow-up score ($M= 18.60$) was 5.17 first sounds per minute higher than her mean intervention score ($M= 13.43$). A higher increase was noted when comparing the mean of the final two data points from each phase. Melanie's mean score at the end of the intervention phase was 8.00 first sounds per minute, and her mean follow-up score was 17.50 first sounds per minute, yielding an increase of 9.50 in skills producing first sounds. Overall, Melanie's data are characterized by increases across the phases with similar variability in each phase. The single exception is the finding of decreasing mean final scores between the baseline and intervention phases.

Table 18

Descriptive Statistics for First Sound Fluency (FSF) Skills for Melanie

<i>Phase</i>	<i>M</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
Baseline	4.36	3.86	0	11
Intervention	13.43	5.46	7	24
Follow-up	18.60	2.89	14	21

To further clarify differences found in the data, Melanie's performance scores were analyzed using percentage of non-overlapping data points and creation of trendlines. A calculation of percentage of non-overlapping data points revealed that a little over half (57.14%) of the data points during the intervention phase did not overlap with points in the baseline phase. Linear trendlines were created for each phase of data to examine any changes in rates of growth across phases. The slope of the trendline for each phase is reported in Table 19. A comparison across phases demonstrates that Melanie's growth decreases during the intervention phase, and then increases slightly during the follow-up phase.

Table 19

Rates of FSF Growth for Melanie Across Phases

<i>Phase</i>	<i>Slope</i>
Baseline	0.22
Intervention	-0.12
Follow-up	-0.06

LK Results

Descriptive statistics summarizing the variability of data points and the mean level of performance on LK assessments for each phase are presented in Table 20. In comparing baseline and intervention phases, Melanie's mean level of performance increased. Mean performance during the baseline phase ($M= 7.93$) and intervention phase ($M= 16.57$) showed an increase in the intervention phase of 8.64 letters named per minute. This increase was magnified when the means of the last two data points from each phase were used. When examining the means of the last two data points, an increase of 15.00 letters named per minute was found between the baseline phase ($M= 8.00$) and the intervention phase ($M= 23.00$).

Differences between the intervention and follow-up phases were also examined. Melanie's mean score increased 10.43 units in letter knowledge from the intervention phase ($M= 16.57$) to the follow-up phase ($M= 27.00$). This large gain is not reflected when the mean of the last two data points from the intervention and follow-up phases are compared. Using this analysis, a gain of only 2.50 letters names per minute was found between the intervention phase ($M= 23.00$) and the follow-up phase ($M= 25.50$).

Table 20

Descriptive Statistics for Letter Knowledge (LK) Skills for Melanie

<i>Phase</i>	<i>M</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
Baseline	7.93	3.20	1	13
Intervention	16.57	5.06	7	25
Follow-up	27.00	5.66	18	33

The percentage of data points that did not overlap between the baseline and intervention phases for Melanie’s LK scores was 78.57%. Linear trendlines were created for each phase of data to examine any changes in rates of growth across phases. The slope of the trendline for each phase is reported in Table 21. Melanie’s rate of growth was very small initially, increased by 0.34 during the intervention phase, and then returned to levels resembling baseline during the follow-up period.

Table 21

Rates of LK Growth for Melanie Across Phases

<i>Phase</i>	<i>Slope</i>
Baseline	0.03
Intervention	0.37
Follow-up	0.02

Child 6- “Brenna”

FSF Results

Descriptive statistics summarizing mean levels of performance and the variability of data points for FSF assessments within each phase are presented in Table 22. Matching a pattern of many other children within the study, Brenna’s data show an increase in mean scores of FSF through all three phases, with an increased variability in scores during the intervention phase. In comparing mean baseline performance ($M= 0.00$) to mean intervention performance ($M= 9.21$), a gain of 9.21 first sounds per minute was noted. When comparing the means of the last data points in each phase, a gain of 20.00 first sounds produced in one minute was noted between baseline ($M= 0.00$) and the intervention phase ($M= 20.00$).

Data were also compared between the intervention and follow-up phases. Brenna's mean FSF score increased another 6.79 first sounds per minute from the intervention phase ($M= 9.21$) to the follow-up phase ($M= 16.00$). While phase means show an increase, data comparing the average of the last two assessments in each phase show a slight decrease (-2.50) between the intervention ($M= 20.00$) and follow-up ($M= 17.50$) phases.

Table 22

Descriptive Statistics for First Sound Fluency (FSF) Skills for Brenna

<i>Phase</i>	<i>M</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
Baseline	0	0	0	0
Intervention	9.21	9.48	0	26
Follow-up	16.00	2.24	13	19

Additional analyses were conducted to aid in interpreting the FSF assessment data. A calculation of percentage of non-overlapping data points showed that 78.57% of the data points during the intervention phase did not overlap with points in the baseline phase. Linear trendlines were created for each phase of data to examine any changes in rates of growth across phases. The slope of the trendline for each phase is reported in Table 23. A comparison across phases reveals that Brenna's rate of growth increased from the baseline phase (showing on average, no growth) to the intervention phase. A moderate decrease is noted for rate of growth during the follow-up phase.

Table 23

Rates of FSF Growth for Brenna Across Phases

<i>Phase</i>	<i>Slope</i>
Baseline	0.00
Intervention	0.63
Follow-up	0.25

LK Results

Descriptive statistics summarizing the variability of data points and the mean level of performance on the LK assessment for each phase for Brenna are presented in Table 24. Brenna’s mean performance in knowledge of letters increased throughout all three phases. An increase in mean score of 2.64 letters named in one minute was found between the baseline phase ($M= 5.00$) and the intervention phase ($M= 7.64$). The mean of the final points of the baseline phase and intervention phase also were compared, with an increase of 9.50 letters per minute being found (baseline $M= 5.50$ LK; intervention $M=15.00$).

In examining differences between the intervention and follow-up phases, Brenna’s mean score in LK increased from the intervention phase ($M= 7.64$) to the follow-up phase ($M= 23.20$), a mean increase of 15.56 letters per minute over the intervention phase. The mean data from the last two points of the intervention ($M= 15.00$) and follow-up ($M= 25.00$) phases revealed a slightly smaller mean increase of 10.00 in LK performance.

Table 24

Descriptive Statistics for Letter Knowledge (LK) Skills for Brenna

<i>Phase</i>	<i>M</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
Baseline	5.00	2.25	0	9
Intervention	7.64	5.18	0	18
Follow-up	23.20	3.03	19	27

Percentage of non-overlapping data points and trendlines were calculated on the LK data as well. A calculation of percentage of non-overlapping data points showed that 35.71% of the data points during the intervention phase did not overlap with points in the baseline phase, indicating a majority of points did overlap between the two phases.

Linear trendlines were created for each phase of data to examine any changes in rates of growth across phases. The slope of the trendline for each phase is reported in Table 25.

Table 25

Rates of LK Growth for Brenna Across Phases

<i>Phase</i>	<i>Slope</i>
Baseline	0.08
Intervention	0.29
Follow-up	0.57

Changes in rates of growth in LK increased considerably in each phase, with the largest change in rate of growth occurring between the intervention and follow-up phases (0.28 rate of growth increase).

Hierarchical Linear Modeling

A previous limitation of multiple-baseline across subject designs was the absolute reliance on descriptive statistics and graphs in order to present and analyze data. This drawback led to reliance on inferences from the data to determine effectiveness instead of calculating a measure of effect (Van den Noortgate & Onghena, 2003). To determine if the effects noted in the graphs and descriptive statistics were significant, the data were analyzed using multiple baseline hierarchical linear modeling (HLM). Originally, HLM was designed to be applied to data sets with a greater number of participants, but research supports its application to single-case designs to provide a method for synthesizing results across cases. Thus, estimates of single effect magnitudes in individual case studies can be increased when the strength from multiple cases are shared by utilizing HLM (Van den Noortgate & Onghena, 2003). Consequently, this method of data analysis was chosen to strengthen the conclusions resulting from this single-case design study. By uniting that results found from each individual through the use of HLM, group parameters could be estimated and individual parameters could be tested more efficiently.

Within this study, the hierarchical model was employed to determine the average change in level between baseline and intervention phases, the average change between baseline and follow-up phases, the variance in baseline levels, the variance in treatment effects (changes from baseline to intervention and changes from baseline to follow-up), and variance in rates of growth within each phase. Data for FSF and LK were analyzed in identical models (described below), but as entirely separate, never including data from one early literacy skill in the model for the other early literacy skill. At level one, early literacy scores were modeled as a function of the specific phase of the study the student

was in. Two models were used, one to index changes between the baseline and intervention phases, and the other to examine changes between the baseline and follow-up phases. The first model (Model 1 below), represents the analysis comparing the baseline and intervention phases. For each child at Level 1:

$$\text{Early Literacy Skill } (Y_{ij}) = \beta_{0j} + \beta_{1\text{intervention}j} + \beta_{2\text{time}j} + \beta_{3\text{phase*time}j} + e_{ij}$$

where β_0 is the literacy skill during baseline for case j , β_1 is the shift in early literacy skill level from baseline to intervention, β_2 is the shift in rate of growth of the early literacy skill from baseline to intervention, and β_3 represents the interaction between phases and time.

At Level 2, each of the coefficients from the Level 1 model was allowed to vary across participants:

$$\beta_{0j} = \gamma_0 + u_{0j}$$

$$\beta_{1j} = \gamma_1 + u_{1j}$$

$$\beta_{2j} = \gamma_2 + u_{2j}$$

$$\beta_{3j} = \gamma_3 + u_{3j}$$

where γ_0 is the average baseline level of the early literacy skill and u_{0j} is the deviation of a particular participant (j) from the average value. In the second equation, γ_1 is the average shift from baseline to intervention and u_{1j} is the deviation of a particular participant from the average value. Within the third equation, γ_2 is the average slope during baseline and u_{2j} is the deviation of a particular participant from the average value. Finally, γ_3 is the change in slope and u_{3j} is the deviation of a particular participant from the average value.

To examine changes between the baseline and follow-up phases, Model 2 below was used. For each child at Level 1:

$$\text{Early Literacy Skill } (Y_{ij}) = \beta_{0j} + \beta_{1\text{follow-up}j} + \beta_{2\text{time}j} + \beta_{3\text{phase}*\text{time}j} + e_{ij}$$

where β_0 is the literacy skill during baseline for case j , β_1 is the shift in early literacy skill level from baseline to follow-up, β_2 is the shift in rate of growth of the early literacy skill from baseline to follow-up, and β_3 represents the interaction between phases and time.

At Level 2, each of the coefficients from the Level 1 model was allowed to vary across participants:

$$\beta_{0j} = \gamma_0 + u_{0j}$$

$$\beta_{1j} = \gamma_1 + u_{1j}$$

$$\beta_{2j} = \gamma_2 + u_{2j}$$

$$\beta_{3j} = \gamma_3 + u_{3j}$$

where γ_0 is the average baseline level of the early literacy skill and u_{0j} is the deviation of a particular participant (j) from the average value. In the second equation, γ_1 is the average shift from baseline to follow-up and u_{1j} is the deviation of a particular participant from the average value. Within the third equation, γ_2 is the average slope during baseline and u_{2j} is the deviation of a particular participant from the average value. Finally, γ_3 is the change in slope and u_{3j} is the deviation of a particular participant from the average value. Of note when examining results, a decision was made to increase the alpha level required for significance from $p=0.05$ to $p=0.10$. This decision was made in an effort to account for the small sample size used within the study (Glass & Hopkins, 1996).

Hierarchical Linear Modeling for FSF

Table 26 presents a summary of the fixed effects and variance components for FSF for Model 1 (baseline and intervention phases). A graphical representation can be found in Figure 3. According to the model, the initiation of the intervention produced an average effect size, γ_1 , of 1.48 (SE= 2.49, $p= 0.59$), indicating that there was not a significant difference in the average number of first sounds produced correctly as compared to the baseline phase. The average change in rate of growth between the baseline and intervention phase was 0.21 units per day (SE=0.15, $p= 0.19$), indicating that a statistically significant change in the rate of growth was not present between the baseline and intervention phases. When examining the variation differences in change in growth (i.e., slope), a statistically significant difference was found between the baseline and intervention phases (0.08; SE=0.06, $p= 0.10$). In contrast, the variance in the change between baseline and intervention was 26.26 (SE=22.78, $p= 0.12$), indicating no significant variance among participants in the shift. Results also indicated that the average variation within participants was 41.14 (SE=50.67, $p= 0.21$). This confirms the variation which was evident in visual analysis (Figures 1 and 2) and descriptive statistics, with fluctuation in each child's scores evident within each phase.

Table 26

Covariance and Fixed Effects for FSF from Baseline to Intervention

	Parameter		Test	
	Estimate	SE	Statistic	<i>P</i>
Fixed Effects			<i>t</i>	
Predicted value at first intervention point	5.01	2.98	1.68	0.137
Average change from baseline to intervention	1.48	2.62	0.56	0.592
Average baseline slope	0.09	0.06	1.42	0.169
Average change in slope from baseline to intervention	0.21	0.15	1.43	0.187
Variance Components			<i>z</i>	
Variation in baseline	40.65	28.44	1.43	0.077*
Variation in baseline slopes	0	.	.	.
Variation in change from baseline to intervention	26.26	22.78	1.15	0.125
Variation in change in slope from baseline to intervention	0.08	0.06	1.30	0.097*
Within person variation	18.33	4.32	4.25	<0.0001*
Serial dependency errors	0.58	0.10	5.72	<0.0001*

Note. An * indicates a p-value of 0.10 or less

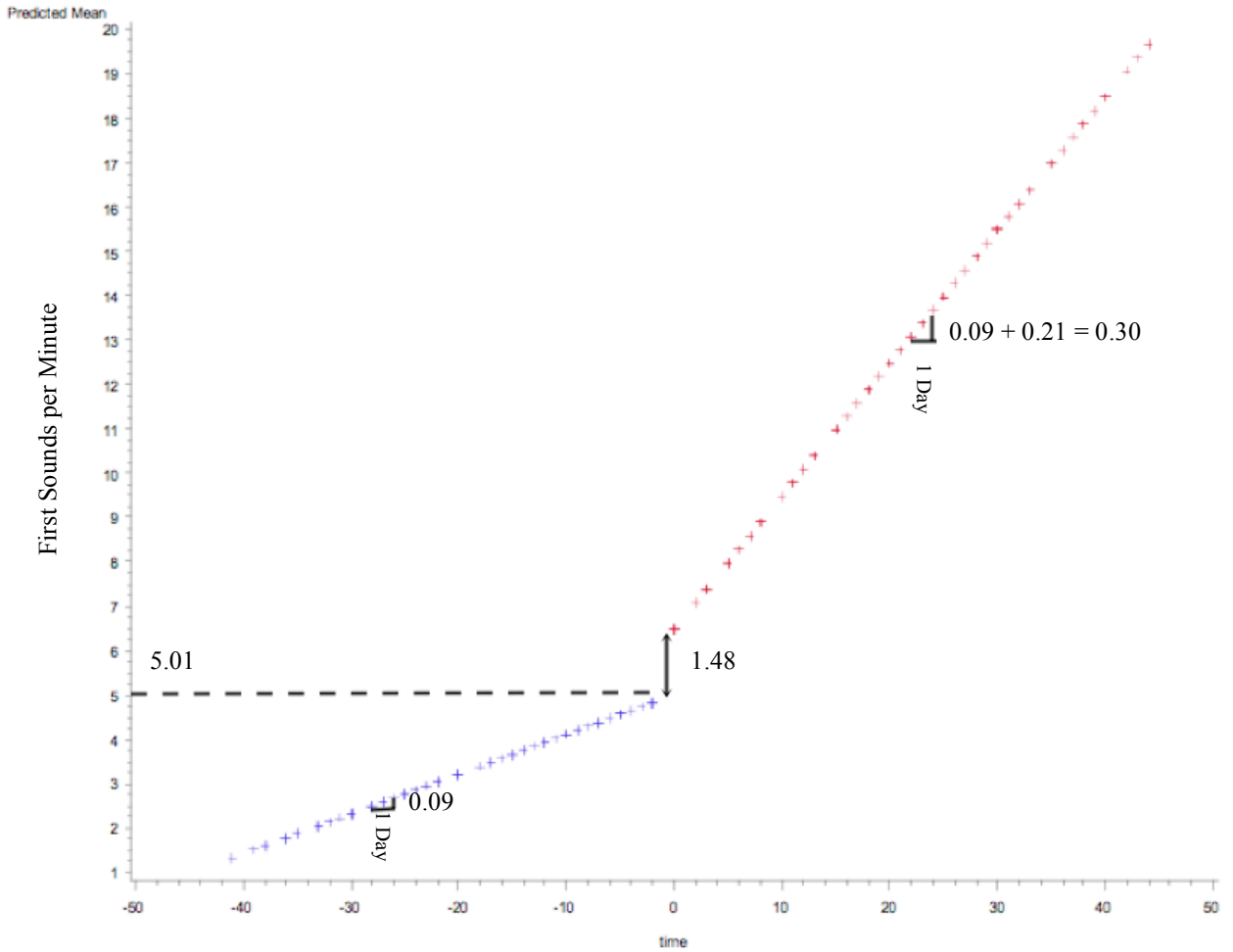


Figure 3. Hierarchical Linear Modeling of FSF Data in Baseline and Intervention Phases

Table 27 contains the fixed effects and variances from Model 2 for FSF, representing the changes from the baseline to the follow-up phase. The graphical representation of the data can be found in Figure 4. In comparing the baseline and follow-up phases, the average increase in effect was 9.20 (SE=8.34, $p= 0.31$), again indicating that there was not a significant change between the baseline and follow-up phases for the acquisition of first sound fluency. The average change in rate of growth between the baseline and follow-up phases was 0.17 units per day (SE=0.38, $p= 0.67$), which was not statistically significant. Variance estimates of 40.65 (SE=28.44, $p= 0.07$) at baseline and

65.39 (SE=49.44, $p= 0.09$) in the change from baseline to follow-up indicated that there was a statistically significant level of variance among the participants at these points.

Table 27

Covariance and Fixed Effects for FSF from Baseline to Follow-Up

	Parameter		Test	
	Estimate	SE	Statistic	<i>P</i>
Fixed Effects				
			<i>t</i>	
Predicted value at first follow-up point	9.60	9.30	1.03	0.358
Average change from baseline to follow-up	9.20	8.34	1.10	0.305
Average baseline slope	0.10	0.14	0.72	0.521
Average change in slope from baseline to follow-up	0.17	0.38	0.44	0.669
Variance Components				
			<i>z</i>	
Variation in baseline	17.38	49.45	0.35	0.363
Variation in baseline slopes	0	.	.	.
Variation in change from baseline to follow-up	65.39	49.44	1.32	0.930*
Variation in change in slope from baseline to follow-up	0.12	0.17	0.68	0.248
Within person variation	41.14	50.67	0.81	0.208
Serial dependency errors	0.85	0.19	4.48	<0.001*

Note. An * indicates a p-value of 0.10 or less

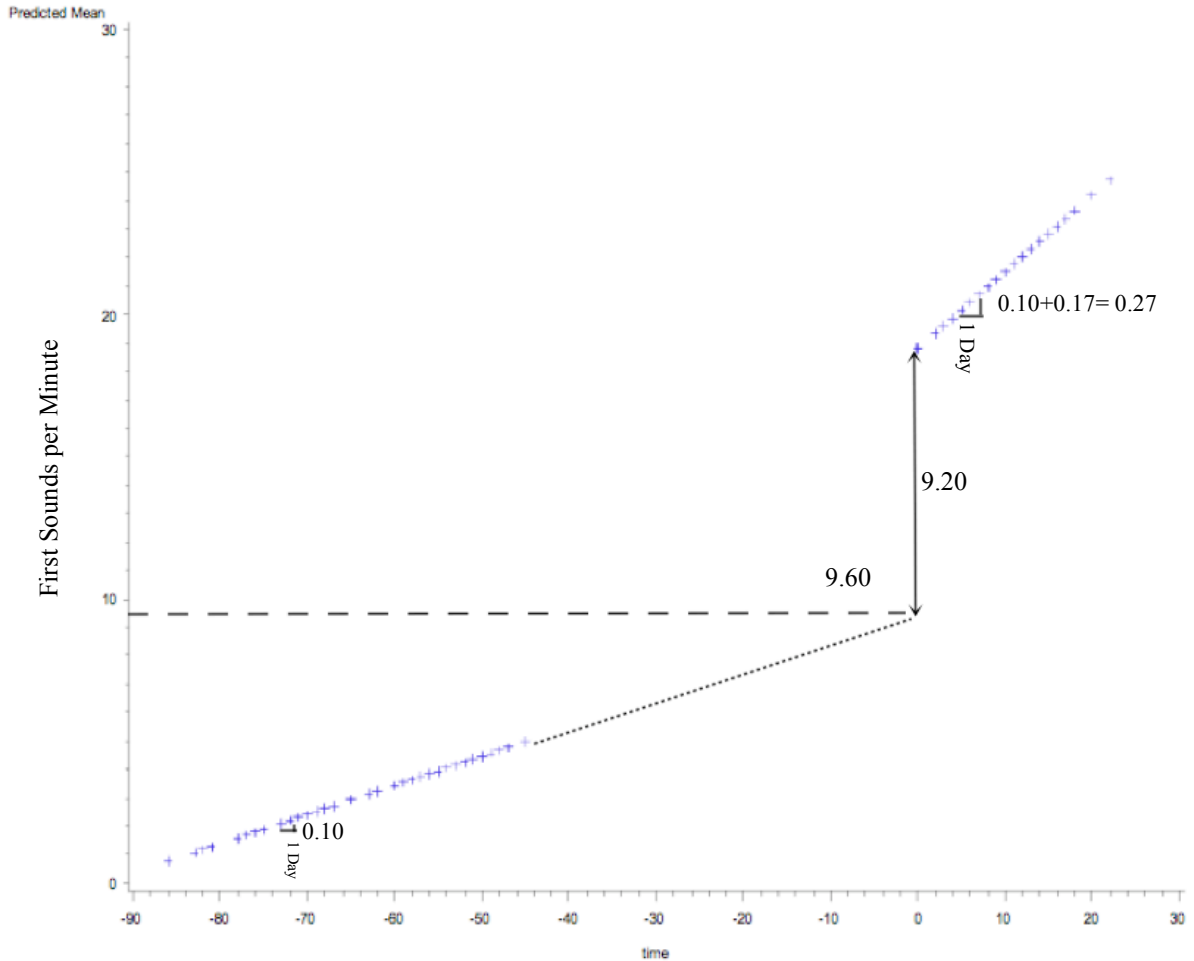


Figure 4. Hierarchical Linear Modeling of FSF Data in Baseline and Follow-Up Phases

In summary, these data indicate that with regard to the early literacy skill of first sound fluency: (a) there were no significant differences found between average number of first sound produced by student participants when comparing the baseline and intervention phases or the baseline and follow-up phases, (b) there was a statistically significant difference in the variance of children’s levels during the baseline phase, (c) there were statistically significant differences in variance of children’s growth from the baseline to intervention phase and in the change in level from the baseline to follow-up phase, and (d) there was significant variation within participants’ scores in some areas not accounted for by the intervention.

Hierarchical Linear Modeling for LK

A summary of the fixed effects and variance components for the data on letter knowledge (LK) is located with Table 28 with a graphical representation in Figure 5. According to the model employed (Model 1), the introduction of the intervention produced an average effect size of -0.95 ($SE= 1.35, p= 0.51$), indicating that there was not a significant difference in the average number of letters named produced correctly per minute as compared to the baseline phase. However, the change in the average rate of growth between the baseline and intervention was statistically significant ($0.24; SE= 0.11, p= 0.05$). With regard to variance in LK data, no statistically significant levels of variation were found at baseline ($16.70; SE=14.61, p= 0.13$), or in shifting from baseline to intervention ($2.77; SE=6.58, p= 0.34$). Statistically significant levels of variation were found in the change in rate of growth from the baseline phase to the intervention phase ($0.05; SE=0.04, p= 0.08$).

Table 28

Covariance and Fixed Effects for LK from Baseline to Intervention

	Parameter		Test	
	Estimate	SE	Statistic	<i>P</i>
Fixed Effects			<i>t</i>	
Predicted value at first intervention point	8.33	1.90	4.38	0.009*
Average change from baseline to intervention	-0.95	1.35	-0.71	0.512
Average baseline slope	0.11	0.05	2.36	0.058*
Average change in slope from baseline to intervention	0.24	0.11	2.29	0.058*
Variance Components			<i>z</i>	
Variation in baseline	16.70	14.61	1.14	0.123
Variation in baseline slopes	0.00	0.00	0.32	0.374
Variation in change from baseline to intervention	2.75	6.58	0.42	0.338
Variation in change in slope from baseline to intervention	0.05	0.04	1.37	0.085*
Within person variation	11.86	1.54	7.71	<0.0001*
Serial dependency errors	0.16	0.10	1.65	0.098*

Note. An * indicates a p-value of 0.10 or less

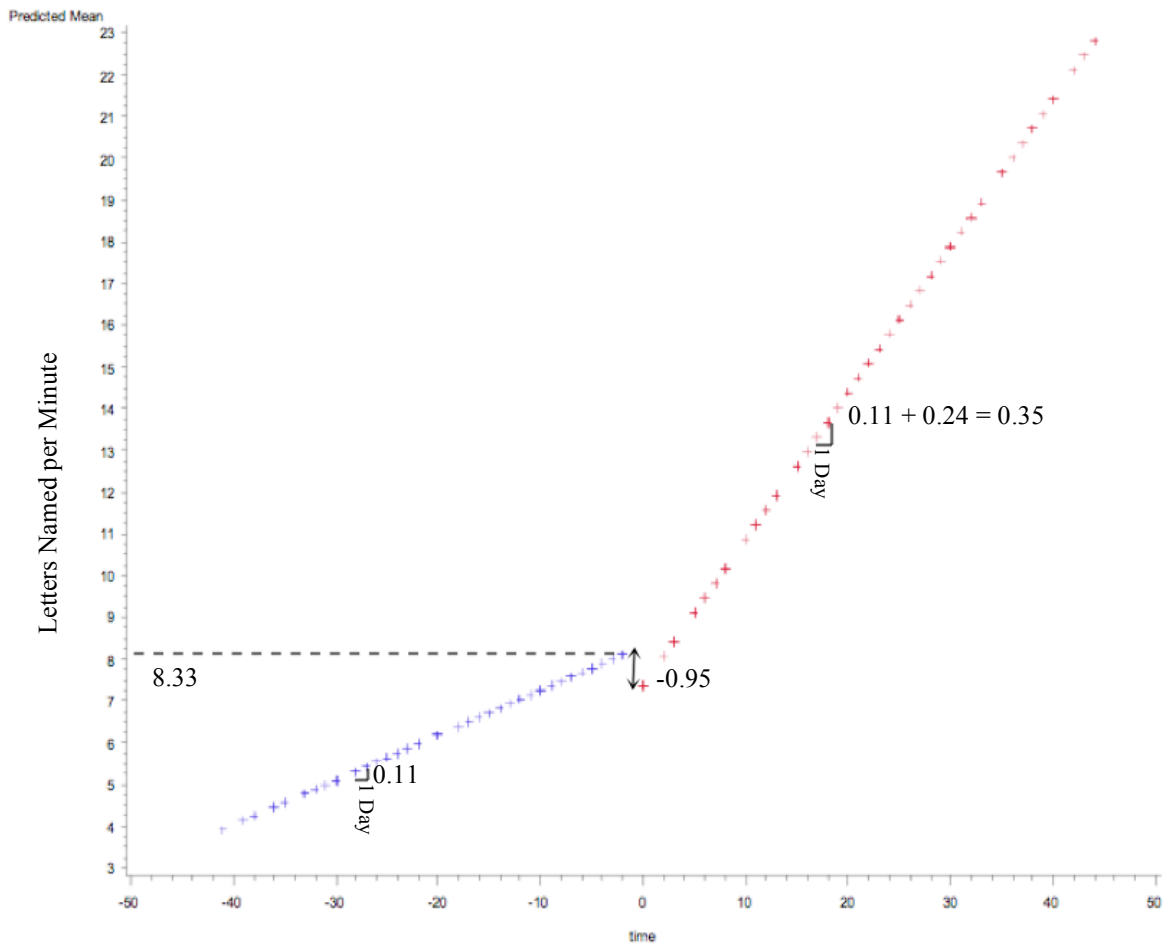


Figure 5. Hierarchical Linear Modeling of LK Data in Baseline and Intervention Phases

Table 29 contains the fixed effects and variances from Model 2 for LK, representing the changes from the baseline to the follow-up phase. The graphical representation of the data can be found in Figure 6. In comparing the baseline and follow-up phase, the average increase in effect was 9.45 (SE=4.93, $p= 0.09$), indicating a significant change between the baseline and follow-up phases for the acquisition of letter names. This suggests that, on average, children correctly named 9.45 more letters during the follow-up phase than they would be predicted from the baseline phase, a statistically significant difference. The average change in rate of growth from baseline to follow-up also was statistically significant (0.26; SE=0.11, $p= 0.07$), indicating that, on average,

children's growth with regard to letter naming was accelerated 0.26 units over the baseline rate of growth. No statistical significance was found in the change of slopes from baseline to follow-up phases (0.01; SE=0.04, $p= 0.34$). However, a statistically significant change was found in the change in level from baseline to follow-up phases (110.13; SE=73.19, $p= 0.07$). The average variation within participants was 9.04 (SE= 1.40; $p<0.0001$), indicating that there was less fluctuation within each child's scores these phases than was found with the FSF data.

Table 29

Covariance and Fixed Effects for LK from Baseline to Follow-Up

	Parameter		Test	
	Estimate	SE	Statistic	<i>P</i>
Fixed Effects			<i>t</i>	
Predicted value at first follow-up point	13.92	2.72	5.12	<0.0001*
Average change from baseline to follow-up	9.45	4.93	1.92	0.092*
Average baseline slope	0.12	0.03	3.40	0.002*
Average change in slope from baseline to follow-up	0.26	0.12	2.27	0.074*
Variance Components			<i>z</i>	
Variation in baseline	13.11	8.94	1.47	0.071*
Variation in baseline slopes	0	.	.	.
Variation in change from baseline to follow-up	110.13	73.19	1.50	0.066*
Variation in change in slope from baseline to follow-up	0.01	0.04	0.40	0.345
Within person variation	9.04	1.40	6.47	<0.0001*
Serial dependency errors	0.15	0.12	1.20	0.230

Note. An * indicates a p-value of 0.10 or less

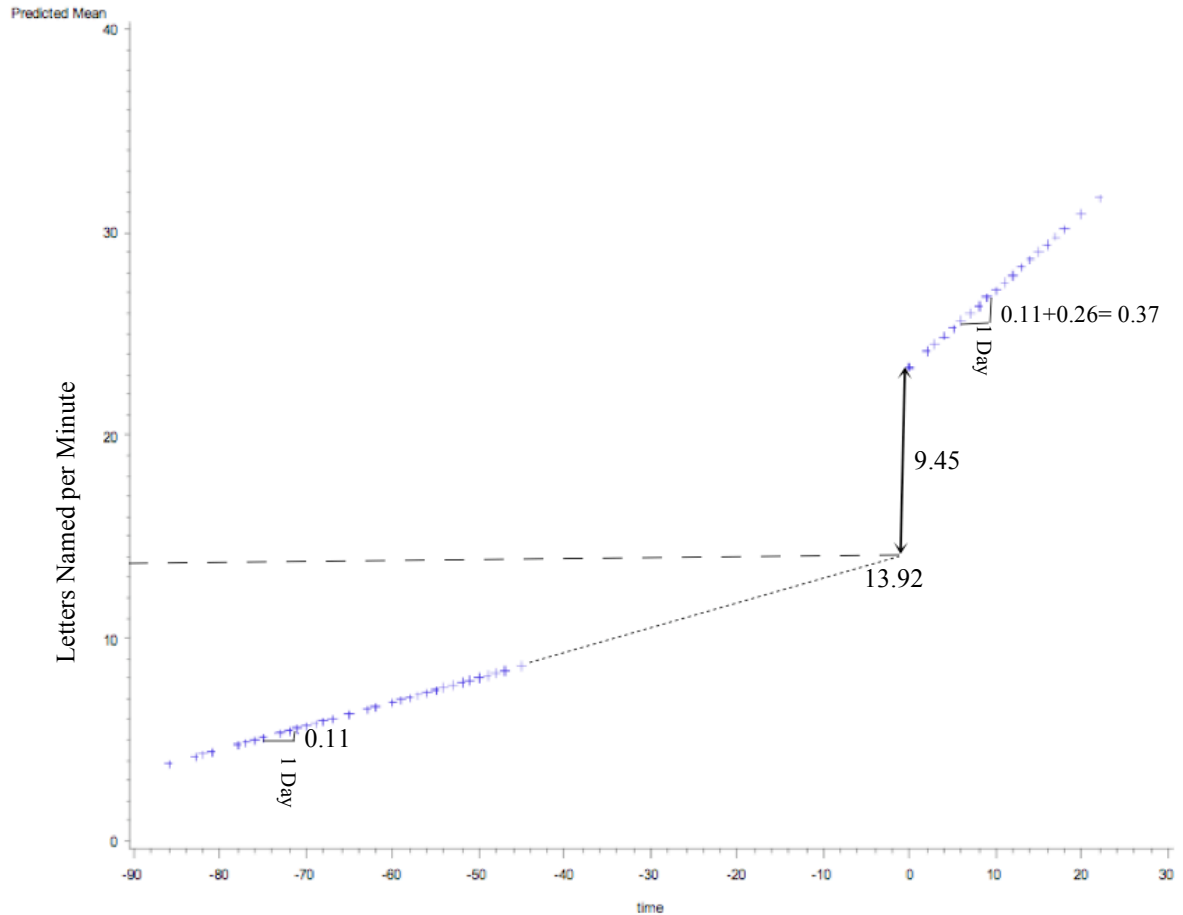


Figure 6. Hierarchical Linear Modeling of LK Data in Baseline and Follow-Up Phases

In summary, with regard to the early literacy skill of letter knowledge fluency: (a) statistically significant differences were found in average change and in variance of the shift in slopes from the baseline phase to the intervention phase, (b) statistically significant differences were found in the average change in level and variance from baseline to follow-up, (c) statistically significant variance was found within each participant, (d) no statistically significant differences were found in the average change from the baseline phase to the intervention or variations in that change, (e) no statistically significant variations were found in the baseline data or the change in rate of growth from

baseline to follow-up, and (f) there was significant variation within participants' scores in some areas not accounted for by the intervention.

Intervention Integrity

The integrity of intervention implementation was examined by evaluating the completeness of each lesson plan as well as evaluating whether each lesson plan was filled out correctly. All parents completed a lesson plan for each session they met with their child. Each lesson plan had blanks that required parents to record: (1) session logistics (i.e., date, time started, time finished), (2) completion of session activities (i.e., letter check, teaching a new letter, reviewing, and sound practice), and (3) a Likert scale rating of the session, along with blanks to write any concerns or problems. An example lesson plan can be found in Appendix C.

Analysis of the lesson plans indicated that all parents did not implement the intervention with the same level of integrity. Data summarizing the intervention integrity by participant is present in Table 30. Parents completed from 20 to 27 lessons with most completing at least 25 lessons ($M=25.17$). The completion of individual lesson plans ranged from 7.81% to 100%. The comments section at the end of the lesson plan showed patterns across participants. Rachel's mother often left this space blank or wrote a simple phrase to indicate how the session went (i.e., "good", "ok"). Wesley's mother often indicated sections that went well for him in each lesson and on occasion, wrote notes to the researcher asking for other materials or activities she could do with him to keep him learning. Jennifer's mother wrote detailed notes that included not only her daughter's performance on tasks, but also where she had trouble in working with her daughter because she was unsure of what to do. The mothers of Tanner, Melanie, Wesley, and

Jennifer often wrote positive comments about the intervention program or indicated their happiness with their child’s progress through smiley faces. Brenna’s mother rarely filled in the blanks with any comment.

Table 30

Lesson Plan Completion Data

	<i>Lessons</i>		<i>Average Percent</i>	
	<i>Completed</i>	<i>Complete</i>	<i>Min</i>	<i>Max</i>
Rachel	20	55.31	46.88	98.44
Wesley	27	98.84	92.19	100
Jennifer	27	94.73	76.56	100
Tanner	26	94.19	92.19	100
Melanie	25	87.78	7.81	100
Brenna	26	94.84	87.5	100

The lesson plans provided additional information about integrity of the intervention implementation. For instance, parents were instructed to implement the intervention three times throughout the week, with only one session occurring per day. Sometimes parents conducted two sessions on one day or conducted more interventions per week than what was originally planned. When the researcher noticed this, parents were contacted by phone and prompted to implement the intervention on the prescribed schedule, but were also asked to be honest in recording the days the intervention was implemented.

Overall, the lesson plans indicated variation in how many lessons were completed as well as the quality of completion. This variance led to an analysis of the relationship between intervention integrity and child outcomes.

Relationship between Intervention Integrity and Child Outcome Data

A Pearson’s Product Moment analysis was employed to examine the relationship between children’s average weekly scores on the FSF and LK measures and intervention integrity, defined as the mean of the lesson plans completed during that same week. The data from the correlations for both measures are presented in Table 31. In agreement with previous research literature (Roach & Elliott, 2008), statistically significant correlations were found between outcome measures and the fidelity of intervention integrity.

Table 31

Correlations for Intervention Integrity and Child Outcomes

	FSF	LK
Intervention Integrity	0.27; $p=0.04$	0.31; $p= 0.02$

Social Validity

To examine the parents’ perceptions of the intervention, two methods of data collection were employed. To gather quantitative data, the parents completed a modified version of the Intervention Rating Profile (IRP-15; see Appendix D). The rating given by each parent can be found in Table 32. Total ratings could fall between eight and 78. As can be seen in Table 32, parents rated the intervention as highly acceptable overall. For a complete breakdown of how parents answered each question, see Table 33.

Table 32

<i>Social Validity Ratings from the Modified IRP-15</i>	
<i>Parent</i>	<i>IRP-13 Rating</i>
Parent 1	74
Parent 2	77
Parent 3	73
Parent 4	70
Parent 5	72
Parent 6	77

Table 33

<i>Social Validity Ratings in Response to Each IRP Question</i>					
Questions	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1. Acceptable intervention				5	1 2 3 4 6
2. Most parents would find it appropriate					1 2 3 4 5 6
3. This intervention was effective	1				2 3 4 5 6
4. Would suggest to other parents				3 5	1 2 4 6
5. Behind enough to need intervention		4	5	2 6	1 3
6. Most parents would find suitable					1 2 3 4 5 6
7. No negative side-effects		4			1 2 3 5 6
8. Appropriate for a variety of children				3	1 2 4 5 6
9. Intervention was fair				3	1 2 4 5 6
10. Intervention was reasonable				5	1 2 3 4 6
11. Liked the procedures				3 4 5	1 2 6
12. Good way to handle child's concern				3	1 2 4 5 6
13. Beneficial for my child					1 2 3 4 5 6

Note. Numbers in the table represent the ID number for each parent

As can be seen in Table 33, most parents strongly agreed with statements on the modified IRP. However, the fifth question regarding whether their child was behind enough to warrant the use of the intervention generated a variety of responses from parents from slightly disagree to strongly agree. The most positive responses were given

to items indicating that the intervention would be found appropriate and suitable by other parents, and that the intervention was beneficial for the child.

Relationship between Social Validity and Child Outcome Data

A Pearson’s Product Moment analysis was employed to examine the relationship between children’s average weekly scores on the FSF and LK measures and total parent rating of social validity gathered from the modified IRP-15. The data from the correlations for both measures are presented in Table 34. In contradiction to previous research literature (Von Brock & Elliott, 1987; Wolfe, 1978), statistically significant correlations were not found between outcome measures and the implementer’s (i.e., parent) rating of social validity.

Table 34

Correlations for Social Validity and Child Outcomes

	FSF	LK
Social Validity	0.36; $p=0.48$	-0.69; $p= 0.13$

Semi-Structured Interviews

Information regarding the social validity of the intervention package was also gathered qualitatively through semi-structured interviews. Several themes emerged throughout the six interviews and are reported in the following paragraphs. Parents indicated that for the most part, their children loved doing the intervention with them. Jennifer’s mother (Parent 3), shared that “She would grab the notebook and ask to ‘play’ every night of the week”. Wesley’s mother (Parent 2) stated “even when it was hard for him, he kept trying. He enjoyed the challenge”.

With regards to what helped the parents complete lessons, the pre-packaged materials and pre-made lesson plans made conducting the intervention easier. Brenna's mother (Parent 6) indicated that "completing lessons were pretty easy. All the materials were right there and you just read the lesson." Jennifer's mother (Parent 3) was the only parent who reported using the included video, and she reported "it was very helpful. You [the PI] provided a great example of how to teach it." The most helpful section of the training session was the modeling and feedback portion where two sessions were conducted, one by the researcher and one by the parent. Tanner's mother (Parent 4) stated that after the training, she "felt confident about what I needed to do."

Difficulties regarding the intervention and its implementation were also discussed within the interview. The primary area where the intervention needed to be improved was the sound practice in lessons 10-18. Every parent indicated a negative reaction to that portion of the intervention. Sound practice in lessons 10-18 was described as "hard to understand" (Parent 1), "difficult to help my child with" (Parent 2), "unclear" (Parent 3), "frustrating for my child" (Parent 4), "skipped because it was too hard" (Parent 5), and "[making] no sense" (Parent 6). Other problem areas were remembering to turn in the lesson plans, which was reported by Parents 1, 5, and 6, and finding the time to sit down and complete the lessons, which was reported by Parents 1 and 5.

Every parent indicated that they would use the intervention again or suggest it to a friend or relative as they found it to work for their child and found the intervention to be a fun way to teach their child. Another related theme that appeared without any prompting was the increase in parent participation in early academic skill activities not included within the intervention program. Parents 2, 3, 5, and 6 shared that they were now

engaging in more activities with their child such as reading at bedtime, or teaching numbers and how to write the child's name. Both Jennifer's mother and Brenna's mother reported maintaining the same schedule every night, by reading to their children and asking them questions about the book when they were not completing a lesson.

Overall, the rating scale and interview data indicated that the intervention was acceptable to the parents using the program. More importantly, parents felt that the intervention package was effective at improving their child's skills in naming letters and forming sounds. Finally, an unintended but very positive effect reported by four of the six parents was an increase in other early academic skill activities that parents initiated in order to further prepare their children for kindergarten.

CHAPTER FIVE

DISCUSSION

Summary of Results

Numerous studies have clearly indicated the important influence that literacy has on students' outcomes in school and later in life. Empirical research demonstrates that interventions focusing on improving literacy skills can be effective when implemented by parents of children in grade school. However, research has yet to be conducted with a preschool population of children with the intent of involving parents extensively in the implementation of early literacy interventions. The purpose of this study was to investigate the effectiveness of an intervention package designed to increase the early literacy skills of phonological awareness and letter naming in pre-school children from low-income home environments. It was hypothesized that the children of parents who implemented the intervention package with integrity would evidence increases in both phonological awareness and letter naming ability as measured by the DIBELS PreK measures. This chapter includes a discussion of the results related to the research questions that guided this study. The chapter concludes with implications for future research, limitations of the study, and implications for practice.

Student Outcomes

The multiple baseline data from this study were analyzed through the use of visual presentation, descriptive statistics, and hierarchical linear modeling. While variability was observed in each child's response, there was evidence of a positive change in the early literacy skills of first sound fluency (FSF) and letter knowledge (LK) fluency. This growth was most evident when comparing data from the baseline and follow-up

phases. In examining the FSF scores, an average increase in level of 9.20 first sounds was found, although the degree of variability in this shift resulted in a statistically non-significant finding. In contrast, the average change in LK scores between baseline and follow-up was statistically significant, with the average increase across participants being 9.45 letters per minute.

Relevance to Research Questions

Research Question One

Is the parent-led intervention an effective method for improving a child's early literacy skills (phonological awareness and letter naming)?

For Wesley, Jennifer, Tanner, and Brenna (Children 2, 3, 4, and 6), improvement was noted through visual analysis and descriptive statistics in the ability to produce first sounds fluently. Also, the rates of growth through the intervention phase were higher than those documented as a standard for FSF (Cummings et al., 2007). In an assessment of the sensitivity of the measure, the average growth preschool children on the FSF measure was 0.10 first sounds per day. Wesley, Tanner, and Brenna evidenced rates of growth above 0.50 through the intervention phase, indicating that they were able to produce on average one new sound per minute every two days. However, this improvement, combined with performance of the other two participants in the study, did not yield statistically significant differences in the HLM analysis. Rachel and Melanie (Children 1 and 5) did not exhibit positive responses similar to the other four children to the first sound fluency intervention, contributing to insignificant effects on their FSF performance. For Rachel, the intervention appears to have created some variability in her performance that was not observed during baseline. Melanie's data display a high

percentage of overlapping data points between phases discouraging confident claims the intervention had any impact.

For the Letter Knowledge assessment, Wesley, Jennifer, Tanner, Melanie, and Brenna (Children 2, 3, 4, 5, and 6) all learned at least as many letter names as is required to be considered in the Low Risk category if they were given the Fall assessment of LNF in kindergarten. Also, Jennifer and Tanner evidenced very large gains that if maintained, would meet criteria for the kindergarten Winter benchmark in DIBELS LNF of 27 letters named in one minute. Again, Rachel displayed considerable variability in her performance, making it difficult to distinguish trends in her data and draw conclusions on the effects of the intervention package. When HLM was used to analyze the LK data, several areas were statistically significant. The first was the change in slope from baseline to intervention, revealing that when all participants' data were compiled, the change in slope was 0.24 ($p= 0.05$). Another finding was that the shift in level of performance from baseline to follow-up was significant, with the average change for participants being a gain of 9.45 ($p= 0.09$) letters named per minute. To place these findings in perspective, if a child began by knowing zero letter names fluently, completing this intervention and maintaining the level of performance at follow-up would place a child into the Low Risk range of scores. Without this intervention, these students would likely fall into the At Risk range, and fail to meet early literacy benchmarks. This shift in level of performance is meaningful because children who fall in the Low Risk category at the first benchmark have an 80% chance to achieve the second benchmark (Cummings et al., 2008).

The differences observed in outcomes between phonological awareness and letter knowledge, although small, could be attributed to several factors. First, many parents

struggled during the training session in understanding phonological awareness. This concept could be considered more abstract than labeling letters, making it more difficult to teach to parents and possibly leading to more difficulties when parents were asked to teach this skill to their child. Second, given the lesson plan design, more time was most likely spent on learning new letter names than on the “Sound Practice” section, which focused on phonological awareness. Over the course of the intervention, the variation in time spent practicing the separate skills could have played a role in the difference in child performance. A final, but related factor, were the problems associated with the “Sound Practice” section within lessons 10-18. In relation to parents’ difficulty with this section, the intervention integrity was lower throughout those lessons, resulting in children getting less exposure to these practice activities.

Research Question Two

Given the evidence-based practices used to increase intervention integrity (i.e., video-taped demonstration, pre-made lesson plans), was the intervention implemented with integrity?

Four out of the six parents completed the intervention lesson planes with average completion rates above 90%. A fifth parent completed on average 87.78% of the intervention protocol. The final parent did not implement the intervention with integrity, completing just above 50% of the lessons correctly. With five out of six parents completing the lessons at or above 85%, the intervention was implemented with integrity in most cases. However, it is of note that completion rates of individual lesson plans varied, especially during the middle phase of the intervention. In comparison to previous research, these rates of integrity are higher than other samples with similar interventions.

A parent-implemented intervention for 32 kindergarten children at risk for dyslexia found an average rate of 66% for intervention integrity, as measured by the number of lessons completed divided by the total number of lessons within the intervention program (van Otterloo, van der Leij, & Veldkamp, 2006). When the quality of the intervention was examined through videotaped lessons, intervention integrity rose to 74%, a level still below what was found in this study. Within Otterloo and colleagues' study, variability was found between parent-child dyads in adherence to the intervention protocol with two thirds of parents completing all lessons, and the remaining third completing between two and 12 weeks of the 14 week program.

The information gathered within the current study exceeds the overall rate of intervention integrity found in Otterloo and colleagues' (2006) study but appears to be similar to their findings regarding variability in adherence. Several factors that may explain the differences in intervention integrity between this study and the Otterloo et al., (2006) research can be found within the literature. Factors that contribute to increased intervention integrity include: (1) reducing the level of complexity of the intervention, (2) ensuring that those in charge of implementing the intervention have the necessary skills and time, and (3) implementing an intervention that the child does not resist significantly (Elliott, Witt, Kratochwill, & Stoiber, 2002). The higher level of intervention integrity found within this study may be related to the inclusion of these factors when the intervention was designed. Strategies used within this study included: (1) providing scripts for parents within lesson plans and providing lesson plans in easy to understand formats, (2) providing training and follow-up support for parents completing the intervention, and (3) ensuring that activities would be engaging for a preschool child and

also including prompts for parents to praise their children to make the experience more rewarding. Future research should examine factors that contribute to or predict parent adherence to intervention protocols in an effort to clarify which strategies lead to the greatest level of intervention integrity.

Research Question Three

What is the strength and direction of the relationship between intervention integrity and outcomes on phonological awareness and letter naming assessments?

As reported in Table 31, the relationship between intervention integrity and outcomes was $r = 0.27$ ($p = 0.04$) for the phonological awareness assessment (FSF), and $r = 0.31$ ($p = 0.02$) for the letter naming assessment (LK). This indicates a small but statistically significant relationship where increases in intervention integrity and increases in scores on the assessment measures often co-occur. These correlations are slightly lower than what has been documented in larger, more well-controlled studies, which commonly report a correlation of $r = 0.41 - 0.58$ (Roach & Elliott, 2008).

The lower than anticipated correlations found in this study could be attributed to the variability in the participant's outcome data. Younger children tend to perform academic skills with greater variability than older children (Plonsker, Petrosino, & Colcord, 2001), and this fact was observed within the data gathered in this study. Even with a consistent level of intervention integrity, the variability in child performance would lower the correlation between the two measures.

Another possible explanation for the low correlations could be the use of lesson plan completion as a measure of integrity. This type of measure relies entirely on parent-report instead of confirming intervention integrity through another format, such as video

or audio taping. These measures were not utilized within this study due to previous research documenting difficulties with having parents record sessions (Corbett, 2008). The use of lesson completion as a measure of intervention integrity may not have fully captured the aspects of how the parents carried out the intervention. The lesson plan completion does not capture the feedback and guidance parents provided for their children when they struggled with activities or provided an incorrect answer, a concept that could be termed the “quality of the interactions”. The quality of the interaction could be more related to intervention outcomes than the quantity of intervention received by the child. Unfortunately, the measure used within this study only captured the quantity of the intervention each child received. In addition, lessons were completed by parents who may not have responded honestly to completing all steps on the lesson plan. Future research should include multiple methods of assessing intervention integrity to determine if a stronger relationship exists between parent-implemented literacy interventions for preschoolers. An additional benefit of a line of research such as this would be determining which methods of monitoring intervention integrity have the greatest validity for the construct.

Research Question Four

What is the level of intervention acceptability of the early literacy intervention as rated by the Intervention Rating Profile (Witt & Elliot, 1985)?

Parents rated the intervention positively, with a small range in ratings from 70 to 77 being reported. Many ratings were very close to the highest possible rating on the measure which was 78. Individual parent’s ratings can be found in Table 32. When ratings were averaged across the six parents, the average IRP rating was 73.83,

demonstrating a high level of social validity for this intervention. Each parent's response to the individual IRP items is provided in Table 33. It is noted that there were only a few ratings of "Slightly Disagree" and "Disagree". These ratings of "Slightly Disagree" and "Disagree" are explored further below.

Rachel's mother disagreed with the statement that the intervention was effective which is in line with Rachel's performance of early literacy skill measures. Her low rating in this area could have contributed to her very low completion rates of the intervention lessons, which may have had an impact on Rachel's performance in phonological awareness and letter naming. Tanner's mother indicated "Slightly Disagree" to two items: (1) that her son was behind enough to require intervention and (2) that there were no negative side effects. All other ratings by parents were positive, with the majority of responses being "Strongly Agree". Tanner's mother, like many other parents in the study, did not believe her child was behind with regards to early literacy skills. This could be attributed to a lack of comparison population (i.e., not knowing other children around Tanner's age) or because progress data were not regularly sent home to parents regarding their child's early literacy development. When asked about the negative side effects for Tanner during the semi-structured interview, Tanner's mother described that occasionally Tanner became frustrated when he could not remember a letter or generate a correct sound. She did follow this statement by stating that this was not a frequent occurrence (i.e., once every two weeks).

Research Question Five

What qualities of the early literacy intervention (e.g., lesson plans, training session, follow-up support) do parents perceive to be the most helpful?

During the semi-structured interviews, parents listed multiple components that were helpful in completing the lessons with their child. When first asked about what materials helped them, parents indicated the lesson plans were “great” (i.e., “easy to follow”, “simple”). The intervention was also praised for being “parent-friendly” in that parents just picked up the three-ring binder and were ready to go in less than a few minutes. Jennifer’s mother also stated that the video included helped her to improve her skills as a teacher and clarified how the middle sessions (lessons 10-18) of the intervention should be taught for sound practice. She was the only parent to watch the video. The components of the training that were reported to be the most helpful were the role-playing section, especially the feedback given to parents. All parents indicated that after the training, they felt more comfortable in completing the lesson plans on their own.

Once parents gave their initial impressions on what was most helpful, additional questions were used to probe for specific information. When asked about the check-in phone calls, all parents reported that they were helpful, and that two times a week was not too often to call. The layout of the lesson plans, the review sessions embedded in the lessons, and the pre-made flashcards were all viewed as very helpful. No component was mentioned as being not helpful.

Research Question Six

What is the strength and direction of the relationship between the level of intervention acceptability as rated by the Intervention Rating Profile and the outcomes on phonological awareness and letter naming assessments?

As reported in Table 34, the relationship between social validity ratings and outcomes was $r = 0.36$ ($p = 0.48$) for the phonological awareness assessment (FSF), and

$r = -0.69$ ($p = 0.13$) for the letter naming assessment (LK). Neither correlation is statistically significant. A lack of statistical significance for this research question could be explained by the small sample size and very restricted range of the social validity ratings (Glass & Hopkins, 1996). To generate a strong relationship between social validity and intervention outcomes, a greater number of observations, such as more frequent ratings being collected or increasing the sample size, would be required to increase power and increase the likelihood that a greater range of social validity ratings would be found. A strong correlation between these two variables is only possible when the variation in social validity is sufficient (Otterloo et al., 2006).

Implications for Research

The results of this study indicate several areas that warrant future investigation. First, the children's differing responses to the intervention suggest that a similar study should be conducted with a larger sample to better determine if small effects are present. One possible explanation is that small effects of the intervention were present within the data, but the power of this study's design was not able to detect them (Glass & Hopkins, 1996). Future research could strengthen the power of the study design by increasing the sample size and improving the measures utilized for assessing both skill growth and intervention integrity in order to decrease measurement error (Glass & Hopkins, 1996).

Future research also should examine components of this intervention separately to determine their effectiveness, since some children responded more positively to one half of the intervention in comparison to the other. A study of separate components could also confirm whether either half of the intervention influenced the growth on the other early literacy skill. Currently, no empirical studies have been published examining the

relationship between increasing phonological awareness skills and how this may or may not impact letter naming ability. Also, no empirical studies have emerged that investigate how increases in letter naming skill may impact growth in phonological awareness skills.

Future research should take into account findings from this study that some children improved during the baseline possibly from: (1) outside influences (i.e., parents engaging in other home-literacy activities) or (2) the feedback incorporated into the instructions for the FSF assessment. Because two students improved rapidly after the initial survey-level assessments of first sound fluency, it is advised that prior to including a child in a study, expose them to the assessment over several days. This may decrease the likelihood of a large, increasing trend during the baseline phase.

Additionally, future studies should employ multiple methods for measuring intervention integrity. In designing the lesson plans, a concerted effort was made to balance between making them easy for parents to complete and reducing the likelihood that parents would complete the lesson plan without conducting the lesson with their child. Integrity could also be improved by collecting lesson plans more frequently and maintaining more consistent phone contact between the PI and the parents. Staying in contact with parents proved difficult at times, as families would lose their telephone service or change phone numbers without notifying the PI. Future research should examine other methods for maintaining communication, such as email or meeting at the preschool when the parent comes in to drop off or pick up their child, in order to improve intervention integrity.

A final and unexpected topic uncovered by this research, was the increase in other home literacy activities reported by four of the six parents. These activities may have

contributed to the performance on phonological awareness and letter naming tasks, instead of or in addition to the intervention package. Future research should monitor these activities as well and examine factors that prompt these extra efforts in parents.

Implications for Practice

The intervention used in this study represents a first attempt at increasing parent involvement in preschool children's early literacy skill development. School psychologists could use this program with parents of preschool children as a means of preventing these children from experiencing failure upon entering kindergarten due to deficits in early literacy skills. By encouraging all parents to use a program such as this, children can be provided a springboard for kindergarten. Employing a program similar to the one in this study has the potential to prevent the "Matthew Effect," where students who initially struggle with acquiring reading skills, continue to learn new reading skills at a slower rate than their peers (Stanovich, 1986). Students in this situation often fall further and further behind their peers in reading, leading to a higher likelihood of long-term negative outcomes such as not completing high school and being imprisoned (Arkansas Literacy Council, 2005).

In addition to using this intervention as a prevention strategy, the program also could be implemented as a targeted intervention program for children who are already experiencing deficits in early literacy skill development. This recommendation is supported given the intervention's effectiveness at increasing letter naming ability and the occasional increases in first sound fluency seen in some child participants. The intervention program has the potential to fill a need within the literature since few evidence-based interventions have been found for teaching letter names to children.

Interventions using parents as direct implementers of intervention is both practical and effective for children who may be delayed in the skill areas of phonological awareness and ability to fluently name letters. This parent training could be implemented by a wide variety of education professionals, facilitating implementation on a large scale. The effectiveness of the one-time training on implementation integrity indicates that this method along with the “reminder” phone calls may be enough to encourage parents to complete the intervention with fidelity. However, some parents may need further training and feedback, such as Rachel’s mother, to increase integrity throughout the intervention.

Another positive aspect of this program is that the materials were relatively inexpensive to develop and reproduce. The primary expense of this intervention was photocopying of materials, typically a small cost for educators who have access to a copier. After the copies are made, very few additional costs are incurred (i.e., three-ring binders, note cards). Therefore, the intervention developed for this study is an example of a cost-effective method for preschools to increase parent involvement, as is mandated by law in Section 1118.

Implementation or endorsement of this program by preschool staff, rather than an external researcher or consultant, would have several benefits over the way this study was designed. Materials could be collected more frequently and parents could be reminded to send in materials through notes home and face-to-face contacts. Also, feedback could be provided more regularly to parents who were not implementing the intervention with high levels of integrity receiving extra training at their child’s school when they either dropped off or picked up their child. Finally, children could be assessed on a more consistent

schedule, with data collection occurring on any day the child attends as opposed to when the PI was able to be present at the Head Start Center.

Limitations

The findings of this study must be interpreted with respect to several limitations. Limitations of this study include maturation, practice effects, statistical regression, implementation bias, and limited generalizability.

A multiple-baseline design was utilized in order to reduce the effects of maturation, however, it should still be considered when examining these results. The scores obtained from children in this study may have improved due to the passage of time, without assistance from the intervention. The effects of maturation are difficult to rule out given the variability within each student's performance on both tasks.

Practice effects also may have influenced outcomes for the children in this study (Glass & Hopkins, 1987). Growth during the baseline phase could be attributed to the built in correction methods within the administration instructions of the DIBELS probes. This effect appears to be especially clear in the FSF data of Wesley (Child 2). However, this level of support did not provide enough structure and assistance for the other students.

Another limitation to be considered when interpreting the results of this study is statistical regression. The children selected for this study had to perform below a certain level of performance to be included as participants. These students may have improved simply due to regression toward the mean, which is another reason why positive changes cannot be attributed solely to the effects of the intervention.

Implementation bias also may interfere with the interpretation of results.

Implementation bias is the likelihood that all parents did not implement the intervention package with the same level of integrity. This was more likely to occur as the number of intervention implementers (i.e., parents) increased. Multiple components were placed in the design to attempt to minimize this effect including, (1) individual caregiver training, (2) videotaped demonstrations, (3) support and feedback from the primary investigator, and (4) calculation of the integrity of each lesson. However, these measures cannot account for the all variability in parent's adherence to the intervention protocol.

Finally, the selection of children from low-income homes limits generalizability. Because a true random sample could not be used and a specific demographic was utilized, findings should only be extended to children who attend Head Start and will be attending kindergarten in the next school year. Caution should be used when extending results to children and parents who are not demographically similar to the sample used within this study.

Conclusions

This study explored the effectiveness of a parent-implemented early literacy skills intervention on the phonological awareness and letter naming ability of six children enrolled in a Head Start center who would be transitioning to kindergarten for the next school year. While positive trends were found in acquisition of first sound fluency, when aggregated through hierarchical linear modeling, the effect was not statistically significant. In contrast, statistically significant findings were found for the effect of the letter naming portion of the intervention in the following areas: (1) the change in rate of growth from the baseline to the intervention phase, (2) the shift in level of performance

from baseline to follow-up, and (3) the change in rate of growth from the baseline to the follow-up phase. The variability in effectiveness across each participant demonstrates a need for further research before this intervention package can be promoted as an evidence-based intervention for preschool children and their parents. However, this method of intervention shows promise in utilizing vital resources in a child's life to increase parent involvement in schooling and improve early literacy skills.

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Administration on Children, Youth and Families, Commissioner's Office of
Research and Evaluation and the Head Start Bureau.

APPENDICES

Appendix A: Consent Form

Dear Parent or Legal Guardian:

This letter provides information about a research study that will be conducted in the Head Start Classroom by investigators from the University of South Florida. Our goal in conducting the study is to determine the effect of a parent-implemented early literacy activity on children's early literacy skills.

- ✓ Who We Are: Ashley Sundman, a doctoral student in the College of Education at the University of South Florida (USF), is the Primary Investigator for this study. She is supervised by Dr. Bradley-Klug, a professor in the School Psychology Program at USF. We are planning the study in cooperation with the Head Start program to make sure that the study provides information that will be useful to the program.
- ✓ Why We are Requesting Your Child's Participation: This study is being conducted as part of a project entitled, "Developing Pre-literacy Skills in Preschool Children: The Utilization of Parents as a Vital Resource." Your child is being asked to participate because his or her scores on two early literacy skill assessments indicate that he or she is at risk for not acquiring skills necessary to easily learn how to read. Six additional children and their parents will also be asked to participate in this study.
- ✓ Why Your Child Should Participate: We need to learn more about how parents can help their children improve their reading skills! The interventions we will be using have been effective when used by teachers to help children with their pre-reading skills. The information that we collect from students may help increase our awareness of how parents can help their children improve their reading skills. It is not certain that participating in this study will improve your child's reading skills. ***Please note that you and your child will receive compensation of \$100 in the form of a Walmart giftcard for participation in this study. In addition, you will be provided with a small toy and several children's books at the completion of the study. The \$100 will be divided up into \$10 per week if you decide to decline participation during the study (i.e., if you participate for 5 weeks you will receive a \$50 giftcard).***
- ✓ What Participation Requires: If you consent to participate in the study, you will be asked to participate in a 90 minute training provided by the Primary Investigator at a location that will be convenient for you (i.e., your home, the University of South Florida). You will be asked to do the early literacy activities for 15-20 minutes a day, 3 days a week. The intervention period will last 9 weeks. In addition to doing the reading activity with you, your child will engage in brief early literacy skills assessments, 2 times a week for approximately 4 months.
- ✓ These tests require that your child name letters and say the beginning sounds of words for the Primary Investigator for less than 5 minutes per session, and will take place in the Head Start classroom during regular school hours.
- ✓ Please Note: Your decision to allow your child to participate in this research study must be completely voluntary. You are free to allow your child to participate in this research study or to withdraw him or her at any time. Your decision to participate, not to participate, or to withdraw participation at any point during the study will in no way affect your child's student status, his or her grades, or your relationship with Head Start, USF, or any other party.
- ✓ Confidentiality of Your Child's Responses: There are no known risks to your child for participating in this research. Your child's privacy and research records will be kept confidential to the extent of the law. Authorized research personnel, employees of the Department of Health

Appendix A: Consent Form

and Human Services, the USF Institutional Review Board and its staff, and other individuals acting on behalf of USF may inspect the records from this research project, but your child's individual responses will not be shared with school system personnel or anyone other than us. Your child's completed assessments and recordings will be assigned a code number to protect the confidentiality of his or her responses. Only we will have access to the locked file cabinet kept by the Primary Investigator that will contain: 1) all records linking code numbers to participants' names, and 2) all information gathered from assessments and surveys. All records from the study (completed surveys, assessments, recordings) will be destroyed in four years.

- ✓ What We'll Do With Your Child's Responses: We plan to use the information from this study to inform educators and psychologists about the effect of the parent reading activity on children's reading skills. The results of this study may be published. However, the data obtained from your child will be combined with data from other people in the publication. The published results will not include your child's name or any other information that would in any way personally identify your child.
- ✓ Questions? If you have any questions about this research study, please contact Ashley Sundman (407) 222-8645. If you have questions about your child's rights as a person who is taking part in a research study, you may contact a member of the Division of Research Integrity and Compliance of the USF at (813) 974-9343.
- ✓ Want Your Child to Participate? To permit your child to participate in this study, please complete the attached consent form.

Sincerely,

Ashley Sundman, M.A.
Doctoral Student, School Psychology
Department of Psychological and Social Foundations
University of South Florida

Consent for Child to Take Part in this Research Study

I freely give my permission to let my child take part in this study. I understand that this is research. I have received a copy of this letter and consent form for my records.

Printed name of child

Date

Signature of parent
of child taking part in the study

Printed name of parent

Statement of Person Obtaining Informed Consent

I certify that participants have been provided with an informed consent form that has been approved by the University of South Florida's Institutional Review Board and that explains the nature, demands, risks, and benefits involved in participating in this study. I further certify that a phone number has been provided in the event of additional questions.

Signature of person
obtaining consent

Printed name of person
obtaining consent

Date

Appendix B: Parent Training Session Checklist

Parent Training Protocol

Materials:

- Training Manual
- Completed binder with lesson plans, flash cards, picture cards, etc. for parent
- Primary Investigator's Manual
- Extra lesson plans
- DVD or VHS tape of demonstration
- Notebook paper

Objectives of the training session:

- To learn about the components of the study and how the information will be gathered (administration of probes, semi-structured interview, etc.)
- To learn how to implement the intervention
- To watch the intervention modeled
- To practice and role play the intervention
- To obtain 85% accuracy on administering the intervention and completing the lesson plan sheet
- To answer any questions about the intervention and the study

Review of the purpose of the project

- What we hope to learn from the study:
 - Reading is very important to a child's success and we know how important parent involvement is to child's success. Building blocks for good reading skills begin early, before entering kindergarten. We are examining a way to use parent involvement to improve the skills required before a child can start reading.
 - The information that will be collected from students may help increase our awareness of how parents can help their children improve their early reading skills.
- Benefits and Potential Benefits of Participation
 - The parts of this intervention have been proven effective when used by teachers to help children learn the names of their letters and begin establishing the building blocks for early reading.
 - These benefits may also occur when parents use these practices.
 - You will be compensated **\$100.00** for participation in the form of a Wal-Mart giftcard, and your child can receive a small gift (under \$6 of your choice. You will also receive some children's books that you can use to read to your child.

Appendix B: Parent Training Session Checklist

- Informed Consent
 - Allow time to read consent
 - Review salient points
 - Answer any questions

Review of Parent Implementation Procedures

- Discussion of each component of the intervention
 - Quiet area, free from distractions (TV, people moving in and out)
 - Use of Alphabet Flashcards
 - Recording correct and incorrect responses on lesson plan
 - Use of Letter naming strategy with paired image
- Parent begins session
 - Gets all materials prepared (pulls out flashcards, finds correct lesson in binder)
 - Fills out top of lesson plan (date, time started, names)
 - Tells child to come and sit down
 - Shows each flashcard individually to child
 - Records correct answers with a check and incorrect answers with an X
 - Teaches new letter as indicated on lesson plan.
 - Walkthrough of step-by-step procedure, answering any questions
 - Review of Letters
 - Walkthrough of step-by-step procedure, answering any questions
 - Sound Practice
 - Walkthrough of step-by-step procedure, answering any questions
 - Emphasize that the important aspect is the sound, not the letter used (e.g., ph=/f/ and f= /f/)
- PI models a typical session using the above steps
 - Includes modeling praise and specific feedback
- Parent Role Play
- PI provides parent with feedback
- Questions answered
- Problem-Solving
 - Plan when and where the intervention will take place
 - PI models the use of the included calendar to plan sessions
 - Brainstorm barriers and how they might be overcome

Lesson Plan

Parent's Name: _____ Child's Name: _____

Date: _____ Begin Time: _____ End Time: _____

Letter Check:

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

Do you have a mark for each letter? **Yes No****New Letter for today:****S s** Sentence for letter: Escalators are moving stairs.

Teaching S s:

___ Hold up the S s card and, next to it, the picture of an escalator.

___ Say: *"Here are two letters, and here is a picture. Every time you see these letters and this picture you are to say out loud, 'Escalators are moving stairs.'"*

- *"What are you going to say when you see these letters and this picture?"*
 - Did your child repeat the sentence correctly? **Yes No**
 - Did you praise your child's efforts? **Yes No**
- Say: *"The name of this letter is in the sentence. The name of this letter is S. What is the name of this letter?"*
 - Did your child say the name of the letter correctly? **Yes No**
- Say: *"Ok, here is the picture and here are the letters." (point to each one) "Every time you see this picture or these letters I want you to say the sentence 'Escalators are moving stairs' and S. Do that for me."*
 - Did your child say the sentence and letter name correctly? **Yes No**
 - Did you praise your child's efforts? **Yes No**
- Say: *"Now we are going to practice some more. First I am going to say it with you then I want you to do it all by yourself."*
 - *Repeat each step until your child has responded correctly**
 - ___ 1. Hold up both cards and say the sentence and letter name with your child
 - ___ 2. Hold up both cards and whisper the words while your child says it
 - (Take away the picture)**
 - ___ 3. Have your child whisper the sentence and say the letter name.
 - ___ 4. Have your child say the letter name.
 - Did your child correctly complete all steps? **Yes No**

Letter ReviewThe three letters from previous sessions should be **A a**, **M m** and **T t**.

- Hold up the A a card and the picture of an elephant. Ask your child, *"Do you remember the saying for this letter? Please tell me it and the name for this letter."*

Appendix D

Intervention Rating Profile

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1. This was an acceptable intervention for my child's kindergarten readiness.	1	2	3	4	5	6
2. Most parents would find this intervention appropriate for increasing their child's early reading skills.	1	2	3	4	5	6
3. This intervention did prove effective in increasing my child's early reading skills.	1	2	3	4	5	6
4. I would suggest the use of this intervention to other parents.	1	2	3	4	5	6
5. My child's early reading skills were behind enough to warrant use of this intervention.	1	2	3	4	5	6
6. Most parents would find this intervention useful for helping children with their early reading skills.	1	2	3	4	5	6
7. This intervention did <i>not</i> result in negative side-effects for my child.	1	2	3	4	5	6
8. This intervention would be appropriate for a variety of children.	1	2	3	4	5	6
9. This intervention was a fair way to increase my child's early literacy skills.	1	2	3	4	5	6
10. This intervention was reasonable for increasing my child's early literacy skills.	1	2	3	4	5	6
11. I liked the procedures used in this intervention.	1	2	3	4	5	6
12. This intervention was a good way to handle my child's early literacy concerns.	1	2	3	4	5	6
13. Overall, this intervention was beneficial to my child.	1	2	3	4	5	6

Appendix E
Semi-Structured Interview Questions:

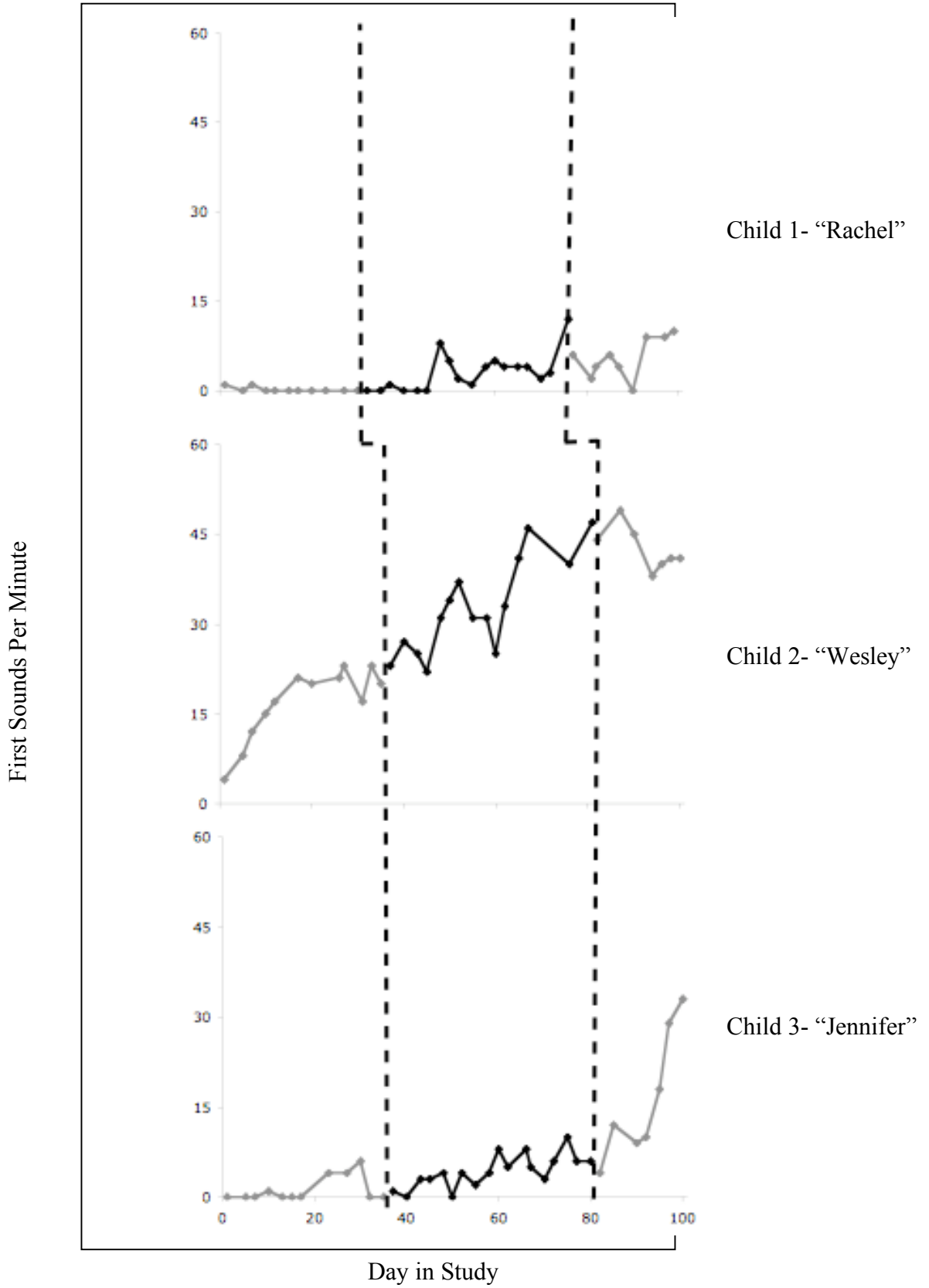
The interviewee will be thanked for their participation in the study and for taking time to complete this interview. They will also be informed that the purpose of this interview is to gather more information about their thoughts on the intervention and how it could be improved. The interviewee will also be informed that they will not be identified in any way, and if they prefer, an alternate name can be used throughout the interview recordings.

1. What are your thoughts on the early reading skills program?
2. What was your child's reaction to the early reading skills program?
3. What were some of the things you found helpful in completing the lessons?
4. What were some of the things you found helpful during the training?
5. What were some of the barriers you found in trying to carry out the lessons?
6. What could have been done to lessen these barriers?
7. What could be improved to make carrying out the intervention easier or more fun?
8. What would you change about the early reading skills program?
9. Would you use program again with another child, or suggest it to a friend or relative? Why or why not?

Thank-you for your time! The interviewee will receive the giftcard, toy(s), and children's books at the end of the interview.

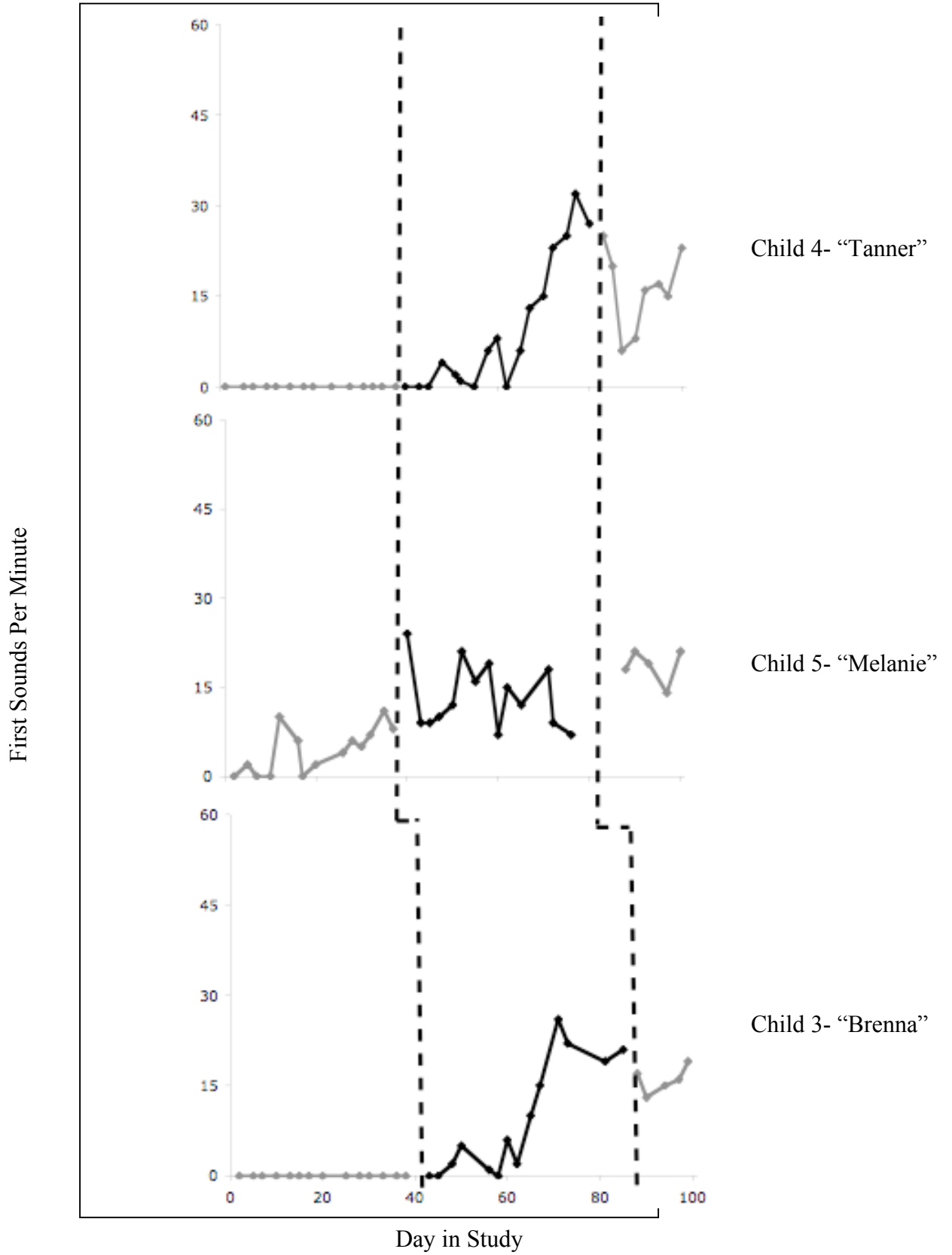
Appendix F- Figure 1

First Sound Fluency Across Participants

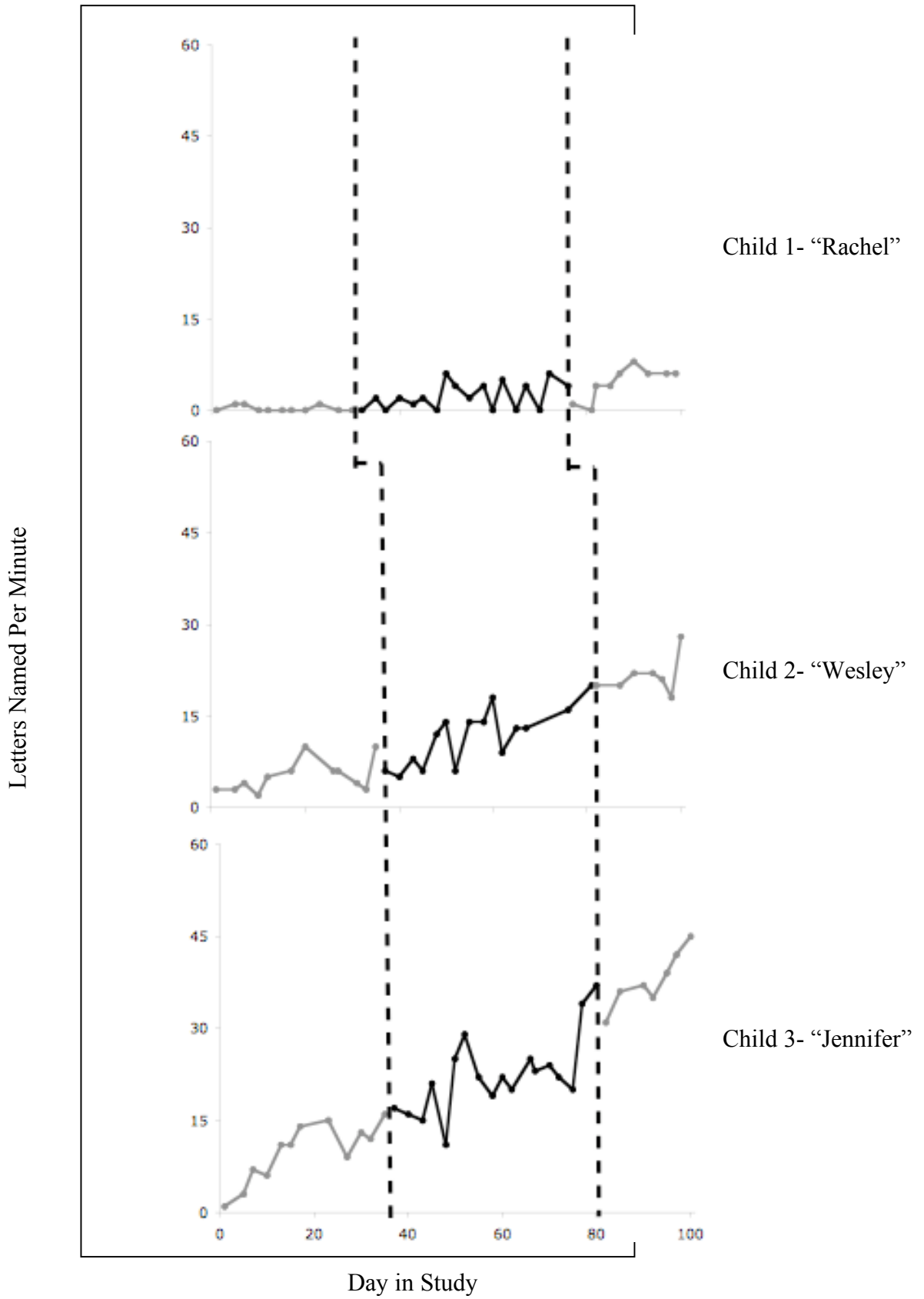


Appendix F- Figure 1 continued

First Sound Fluency Across Participants



Appendix G- Figure 2
Letter Knowledge Performance Across Participants



Appendix G- Figure 2 continued
Letter Knowledge Performance Across Participants

