The Effects of Interactive Writing Instruction on Kindergarten Students' Acquisition of Early Reading Skills

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THE EFFECTS OF INTERACTIVE WRITING INSTRUCTION ON
KINDERGARTEN STUDENTS’ ACQUISITION
OF EARLY READING SKILLS

by

Cindy D. Jones

A dissertation submitted in partial fulfillment
of the requirements for the degree

of

DOCTOR OF PHILOSOPHY

in

Education
(Curriculum and Instruction)

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2008
ABSTRACT

The Effects of Interactive Writing Instruction on Kindergarten Students’ Acquisition of Early Reading Skills

by

Cindy D. Jones, Doctor of Philosophy
Utah State University, 2008

Dissertation Directed by: D. Ray Reutzel, Ph.D.
Department: Elementary Education

This study focused upon the established importance of the reading-writing relationship and its posited effect on literacy development. A repeated-measures experimental design investigated the effects of interactive writing instruction on 151 kindergarten students’ acquisition of early reading skills. Multilevel modeling was used to evaluate the impact of the reading-writing relationship as operationalized with interactive writing and writing workshop on the acquisition of early reading skills as repeated outcome measures at four points in time (Level 1) were clustered within students (Level 2). Results of this study indicated that instruction grounded in the reading-writing relationship, namely, interactive writing and writers’ workshop combined with existing reading instruction, led to equal growth in kindergarteners’ acquisition of early reading skills for each of the outcome measures at each of the four time points assessed. The growth effects obtained from the use of the reading-writing instructional
treatments used in this study compared with the national normative samples from the outcome measures indicated that the reading-writing instruction significantly increased the rate of growth for the early reading skills of phonemic awareness, alphabet knowledge, and word reading.
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Cindy D. Jones
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CHAPTER I

INTRODUCTION

“The nature of writing is understood at an earlier age because it leaves visible traces; it changes the object visibly, while reading does not” (Tolchinsky, 2006, p. 84).

Early literacy instruction provides the foundation necessary for academic success throughout a child’s entire life (Butler, Marsh, Sheppard, & Sheppard, 1985; Cunningham & Stanovich, 1997; Francis, Shaywitz, Stuebing, Shaywitz, & Fletcher, 1996; Juel, 1988; Scarborough, 1998; Stanovich, 1986). It is imperative to identify quality instructional practices that significantly impact literacy learning (NICHD, 2000; Snow, Burns, & Griffin, 1998). Importance of the reading-writing interaction and its effect on literacy development is consistently demonstrated in over thirty-five years of research (Farnan & Dahl, 2003). These two “naturally interacting language skills” are shown to promote development in reading, writing, and thinking (Farnan & Dahl; Squire, 1983). Tierney and Pearson (1983) have emphasized that reading and writing are similar processes of meaning construction “involving continuous, recurring, and recursive transactions among readers and writers, their respective inner selves, and their perceptions of each other’s goals and desires” (p. 578). The synergies between reading and writing can strengthen a writer’s ability to read and a reader’s ability to write (Langer & Flihan, 2000). However, literacy research and educational policy often disregard the role of writing as part of literacy instruction (Halladay et al., 2007; National Commission on Writing, 2003). There is insufficient information on how the interaction between writing and reading functions relative to instructional practices (Durkin, 1989; Shanahan,
Jagger, Carrara, and Weiss (1986) have pointed out most research on the reading-writing relationship has provided “little information about what children learn from their reading that influences their writing and what they learn from their writing that influences their reading” (p. 298). A lack of understanding exists of how various reading or writing experiences may benefit the other (Shanahan).

Recently, Pressley and Fingeret (2007) emphasized high priority should be given to direct evaluation of how reading and writing impact each other. Farnan and Dahl (2003) posed the question, “What best practices take advantage of the writing-reading interaction?” (p. 1005). Research conveys the theoretical importance of the writing-reading interaction. Literacy research has identified skills crucial for success in early reading. Interweaving these two strands of research permits examination of how the writing-reading interaction operates at the fundamental level of literacy. Can early literacy instruction be more effective when including instructional methods that take advantage of the reading-writing relationship?

Importance of Writing for Beginning Readers

Understanding the reading-writing relationship may be of particular importance for instruction in the primary grades when the foundations of literacy are being established. Benefits of this interactive relationship often go untapped in early literacy instruction. Indeed, writing may be more important to effective early literacy instruction than is realized. Shatil, Share, and Levin (2000) found writing of kindergarten students was predictive of first grade reading achievement, even after controlling for IQ effects. In a study of children who learned to read before entering school, Durkin (1966) noticed
that writing came first for many children and the “ability to read seemed almost like a by-
product of ability to print and spell” (p. 137). Writing behaviors may be organizers of reading behaviors for early contact with written language (Clay, 1975).

Rather than developing after reading, writing is often the first indicator of a child’s interest in print. Chomsky (1976) suggested that due to the concreteness of creating written text, children are ready to write before they are ready to begin the more abstract task of reading. Independent of socioeconomic status or language, by the age of 4, children’s writing exhibits linearity, presence of units, directionality, and spacing (Tolchinsky, 2006). Preschool children typically begin to write letters and words at the same time they start to recognize printed words (Mason, 1980). Exploration of writing reveals the alphabetic principle. After children learn to write and recognize the letters of the alphabet, they begin to use invented spellings to communicate their thoughts. Chomsky emphasizes composing of words according to sounds is a first step toward reading.

A writer must consciously dissect each component of a writing piece—thoughts, words, sentences, paragraphs—and then reassemble the components in an organized manner to create meaning. The constructive processes of writing clearly reveal the subtleties of the various components of text. As children write, they analyze letters and sounds, experiment with words, and learn concepts of directionality, sequencing, and spacing. Writing requires the writer to combine knowledge of letter features, forms, and patterns with conventions of the printer’s code (Clay, 2002). Furthermore, Clay has emphasized that while a reader may overlook information and rely on anchor points of
previously learned skills, a writer is forced by the very nature of the task to act analytically on print, letter by letter.

The importance of writing as a way to develop reading skills is clearly recognized. Even the well-known report issued by the Commission on Reading (Anderson, Heibert, Scott, & Wilkinson, 1985), *Becoming a Nation of Readers*, emphasized that writing develops reading skills such as phonics, spelling, vocabulary, and comprehension. Loban’s (1976) 13-year study found that good reading and good writing were generally associated and that this relationship became stronger as students grew older. Clay (2002) provided the analogy that just as the right hand can aid the left hand and vice versa, reading and writing are two different ways to learn about written language; knowledge in writing can be helpful in reading and knowledge in reading can be helpful in writing. In reality, the conventions of letter-sound correspondence cannot be learned outside the written system (Tolchinsky, 2006). Writing provides a definitive representation of students’ growing knowledge of the alphabetic principle, phonemic awareness, and word recognition.

Problem Statement

Given the established reading-writing relationship and the potential benefits of writing instruction in the primary grades, the question becomes: How does writing instruction affect student acquisition of early reading skills? One of the goals of the Institute of Educational Sciences is “identifying curriculum and instructional practices that are associated with better reading or writing outcomes as well as mediators and
moderators of the relations between these practices and student outcomes;” (U.S. Department of Education, 2007).

Interactive writing is frequently recommended as an instructional strategy that may impact early literacy achievement by building upon the shared knowledge base of reading and writing (Biddle, 2007; Brotherton, & Williams, 2002; Button, Johnson, & Ferguson, 1996; Herb & Bufalino, 1997; McCarrier, Pinnell, & Fountas, 2000; Patterson, Schaller, & Clemens, 2008; Pinnell & Fountas, 1998; Ritterskamp & Singleton, 2001; Rubadue, 2002; Sipe, 2001; Stachoviak, 1996; Williams & Lundstrom, 2007). Interactive writing is a “group experience that increases children’s participation in the act of writing and helps them attend to the details of letters, sounds, and words while working together on meaningful text” (Pinnell & Fountas, p. 29).

Although interactive writing is a widely-promoted instructional method, there is a lack of experimental research that examines the effect of interactive writing instruction on student achievement in early literacy. The present research base regarding the impact of interactive writing on early literacy growth lacks the necessary evidence for making informed decisions about this instructional method. A better understanding of the impact of instruction that cultivates the reading-writing relationship through the use of interactive writing is needed.
CHAPTER II
REVIEW OF LITERATURE

“Writing is the foundation of reading . . . When our students write, they learn how reading is put together because they do it. They learn the essence of print” (Hansen, 1987, cited in Farnan & Dahl, 2003, p. 994).

Interactive writing is frequently recommended as an instructional strategy that may impact early literacy achievement by building upon the shared knowledge base of reading and writing (Biddle, 2007; Brotherton & Williams, 2002; Button et al., 1996; Herb & Bufalino, 1997; McCarrier et al., 2000; Patterson et al., 2008; Pinnell & Fountas, 1998; Ritterskamp & Singleton, 2001; Rubadue, 2002; Sipe, 2001; Stachoviak, 1996; Williams & Lundstrom, 2007). Interactive writing is a “group experience that increases children’s participation in the act of writing and helps them attend to the details of letters, sounds, and words while working together on meaningful text” (Pinnell & Fountas, p. 29).

The purpose of this review of the literature was to evaluate and synthesize research exploring the impact of interactive writing on literacy growth and achievement for beginning readers. Objectives for this review of the literature were:

1. To describe the current state of research regarding the use of interactive writing in primary-grade classrooms.
2. To discuss the purposes and outcomes of previous studies of interactive writing.
3. To draw conclusions based on this information to guide the focus and design of this current study.
Locating the Studies

A general internet search using the term “interactive writing” revealed 250,000 results, indicating the popularity of this instructional practice. The use of interactive writing is promoted in several states (e.g., California, Florida, New Jersey, Texas) as well as in other countries (e.g., Australia, Canada, England, Germany). Professional educational organizations have produced videos and lesson plans for interactive writing (e.g., Association for Supervision and Curriculum Development, National Council of Teachers of English, International Reading Association). Interactive writing is also the topic of several books designed for practitioners (e.g., Callella & Jordano, 2000; McCarrier et al., 2000; Swartz, 2001).


Inclusion/Exclusion Criteria

For the purpose of this review, interactive writing was defined as an instructional strategy in which the teacher and the students collaboratively generate oral text and then share the pen in writing an original text, focusing on the details of sentence construction, letters, sounds, words, and concepts of print (McCarrier et al., 2000).

Articles included in the review of literature meet the following criteria:

1. Studies published in educational journals.
2. Studies in which participants were primary grade students.
3. Studies that experimentally examined the effects of interactive writing.

Description of Studies

Given the importance of using quality instructional practices that significantly impact literacy learning (NICHD, 2000; Snow et al., 1998; U.S. Department of Education, 2007), the widespread promotion of interactive writing should be built upon a
strong scientific research base. The search of the research literature yielded more than 100 articles published in educational journals describing how to implement interactive writing or promoting the use of interactive writing. Some articles with descriptive information of interactive writing instruction that involved assessments were located. However, a comparison of purported literacy growth with nonparticipants or with typical growth of kindergarten students for the descriptive information presented in these articles was lacking. Button et al. (1996) reported literacy growth for seventeen kindergarten students based on student means from the OSELA (Clay, 1993) administered as a pretest in September and as posttest administered in May. McCarrier et al. (2000) presented similar information of literacy growth based on changes in mean scores for students of three primary-grade teachers using OSELA (Clay) as pretest measures for 60 students and as posttest measures for 68 students. Again, these teachers “did not make precise use of control groups or random assignment” (McCarrier et al., p. 185). Finally, Pinnell and McCarrier (1994) presented evidence on the “potential of interactive writing” using mean scores of kindergarten students involved in an instructional project involving six elements, one of which was interactive writing. The end-of-year spring scores of kindergarten students who participated in this project were compared to entry scores of students selected for Reading Recovery at the beginning of first grade. Pinnell and McCarrier provided the disclaimer: “The groups represented above are by no means comparable; therefore, no conclusions can be drawn from these data. For kindergarten classrooms, student gains could be attributed to the extra half day of instruction” (p. 168)

Only two published research studies that experimentally examined the effects of interactive writing with primary grade students were located in this search of the
literature. Both of these publications were derived from dissertations. The first study, O’Connor (2002, 2004), used single-subject, multiple-baseline design to examine the effects of interactive writing on the phonological processing of struggling first-grade students. The five participants, from one first-grade classroom, were placed in two groups. Baseline lasted 20 days for the first group and 16 days for the second group. Intervention sessions averaged 30 minutes per day. Intervention lasted 41 days for the first group and 40 days for the second group. There were two interventions for this study: 1) a planned interactive writing instructional intervention, and 2) an unplanned intervention combining a behavioral intervention with interactive writing.

Pretests for this study included six assessments from the Observation Survey of Early Literacy Achievement (OSELA, Clay, 1993): letter identification, Ohio word test, writing vocabulary, concepts about print, dictation task, and a running record; two forms of Rapid Automatic Naming: an original form and a researcher-adapted form; and four phonemic awareness tasks: Morris Spelling Task (Morris, 1999), Lindamood Auditory Conceptualization Test (Lindamood & Lindamood, 1979), the Yopp-Singer Test of Phoneme Segmentation (Yopp, 1995), and the Classroom Phonemic Segmentation Blending Test (Taylor & Pearson, 1988). Daily writing samples were also collected. Student progress was analyzed by calculating a composite score of phonemes/letters per word that were either correctly spelled or reasonable representations from the daily writing samples. These measures were repeated during posttesting.

O’Connor (2002) reported that all children showed progress on all six tasks of the OSELA. Student scores on both forms of the Rapid Automatic Naming tasks were all within one standard deviation. Results were mixed on the four phonemic awareness tasks.
Findings from the daily writing samples showed interventions produced a positive response to instruction 75% of the time. For four of the children, the behavioral plus instructional intervention resulted in a less positive impact than the instructional intervention alone. Overall, this study reports that although children progressed, there was little evidence of substantial change due to the study intervention.

The second study on interactive writing, Craig (2001, 2006), compared the effects of two interventions: “adapted interactive writing plus letter-sound instruction” and “metalinguistic games plus letter-sound instruction” on student achievement in phonological awareness, alphabetic knowledge, and early reading for kindergarten students. The 87 participants for this study came from four half-day kindergarten classes in a predominantly white middle-class school. Participants were randomly assigned to one of the interventions. Students were then placed in 18 small groups according to common strengths and needs as indicated by pretest results. Instruction took place outside of the regular classroom in intervention classes of 4-5 students during four 20-minute lessons per week for sixteen weeks.

The interactive writing-plus instruction typically followed a four day rotation that consisted of text sharing (day 1), interactive writing (days 2 and 3), and word building lesson (day 4). Instruction for the metalinguistic games-plus was based on a program of phonological awareness and alphabet training created by Adams, Foorman, Lundberg, and Beeler (1998), supplemented by word building tasks.

Pretests for this study included Clay’s (1993) Test of Letter Identification and Hearing Sounds in Words, Snider’s (1997) test of phonemic awareness, and the word attack subtest of the Woodcock Reading Mastery Test (Woodcock, 1987). Posttests
included Tangel and Blachman’s (1992) 5-word Developmental Spelling Test and the Word Identification and Passage Comprehension subtests of the Woodcock Reading Mastery Test. Three pretests were also used for posttests: Clay’s (1993) Hearing Sounds in Words, Snider’s test of phonemic awareness, and the Woodcock word attack subtest.

Results of this study found no difference between groups for phonological awareness ($F = 2.98, p = .09$) and spelling achievement ($F = 3.17, p = .08$). There was a statistically significant difference between the two groups on word identification ($F = 6.77, p = .01$), passage comprehension ($F = 12.17, p = .001$), and word reading development (chi square = 4.611, $p = .05$). Craig (2001) concluded that “children participating in a contextualized program matched or exceeded the achievement of the children participating in a structured program of metalinguistic games” (p. 714).

Overview of Studies

Purpose

Neither of these two studies had the sole intent of examining the effects of interactive writing on literacy achievement in a regular classroom setting. O’Connor (2002) expressed interest in examining a balanced literacy approach and Craig (2001) considered the comparison of child-constructed experiences to scripted teacher-directed instruction. O’Connor focused on an adapted form of interactive writing used as an intervention in small group settings of 2-3 students. Craig utilized still another adaptation of interactive writing with intervention classes of 4-5 students.
Site selection

Neither study addresses the rationale for the site selection. O’Connor (2002) provided no information on how the setting of one suburban elementary school sample was chosen or information on student demographics for the school population. Only one classroom participated in this study because that is what the principal of the school had determined appropriate (O’Connor, p. 72). Craig (2001) also provided no information on the reason for selection of the one elementary school chosen for participation in her study.

Participants

Selection of participants is a major area of concern for the O’Connor (2002) study. O’Connor reported that participants were chosen by the classroom teacher because the students were the lowest performing on the “normal beginning of the year testing, and those that she (the teacher) considered needed extra attention, grouping them into two equal sized groups. . . . The classroom teacher did not remember how the children were initially grouped” (p. 72).

Specific information on participants for this study is also very limited. At the end of the dissertation, O’Connor (2002) does state that the six students were all struggling, low SES African American children living in an affluent inner ring suburb. Initially, O’Connor began the study with six participants who were placed in two groups, with 2 boys and 1 girl in one group and 2 girls and 1 boy in the second group. Participant “D”, a boy, withdrew from the study, leaving one group with only two students, presumably 2
girls. Withdrawal of this student from the study could have significantly impacted the
results, given that gender plays a role in literacy achievement, typically favoring girls
(Berninger & Fuller, 1992; Coker, 2006; Englehard, Gordon, & Gabrielson, 1991;
Knudson, 1995; Lynch, 2002; Peterson, 2006).

Participation in the Craig (2001) study was more inclusive of the school
population. All students enrolled in the school were invited to participate in the study,
resulting in 87 of 90 students participating. Little information on student demographics is
given, except that the setting was a predominantly white middle-class population in a
rural-suburban school system.

**Group Assignment**

Group assignment is another area of concern in these two studies. The study by
O’Connor (2002) was a single-subject design; thus, each student served as his/her own
control. Craig (2001) used a comparison group design. Following the pretest, children
within each class were randomly assigned to the interactive writing-plus treatment group
or the metalinguistic games plus comparison group. Although students were randomly
assigned to treatment or comparison, children were then placed in small flexible groups
based on common strengths and needs for instruction.

**Treatment Intervention**

In both the Craig (2001) and O’Connor (2002) studies, interactive writing was the
only writing intervention examined. Interactive writing instruction was confounded by
addition of several other parallel interventions in the O’Connor study. The students
participating in this study also began working with a reading tutor on a daily basis at the same time baseline testing began. O’Connor also reported the addition of a behavioral intervention was necessary after 16 days with group one and 7 days with group two due to inappropriate behaviors of students including “one student who sulked every day for 12 days . . . both groups as a whole acted out with talking out, off-task conversations, social posturing, and bickering during the group intervention sessions . . .” (p. 97). Extrinsic rewards were given as part of this behavioral intervention, which included stickers and sticker books, a “surprise before winter break,” and a concluding pizza party. This study was also confounded by additional instruction and time with the researcher and daily independent writing, which was more beneficial for two of the students than interactive writing.

The two interventions in the Craig (2001) study were interactive writing-plus and metalinguistic games of phonemic awareness-plus. One construct of interest in this study was phonemic awareness; inclusion of an intervention specifically designed to teach phonemic awareness may have contributed to the finding of no statistical difference between interventions for this construct.

**Data Collection and Analysis**

O’Connor (2002) included many outcome measures that were not particularly useful for the constructs being examined. For example, the letter naming assessment was of little value for this study because results were near ceiling at the baseline, with scores ranging from 46 to 52 and posttest scores ranging from 52 to 54. Although information for validity and reliability of scores is available for some of the assessments administered,
this study did not provide any indication of this information. In addition, one of the Rapid Automatic Naming assessments was a researcher-created adaptation, and consequently would have no established validity or reliability. While many assessments were included in an attempt to capture growth; even with increased odds of finding statistical significance due to inclusion of numerous measures, this study found no significant results.

Four pretests for the Craig (2001) study were administered in October. Seven posttests were administered in April. Only three of the tests were administered both pre and post: Test of Phonemic Awareness (Snider, 1997), Woodcock Reading Mastery Test Word Attack subtest (Woodcock, 1987), and OSELA Hearing Sounds in Words (Clay, 1993). Although the Woodcock and the OSELA are established, reputable tests, use of the Test of Phonemic Awareness is questionable. Reliability of the Test of Phonemic Awareness was established during a pilot study of 16 children selected randomly from kindergarten to third-grade classes in one school district. One week test-retest reliabilities for the kindergarten students as part of this extremely small sample ranged from .69 to .97. Snider then made adjustments to the assessment and did not conduct any further analyses of validity or reliability. Furthermore, four assessments were administered as a posttest only, resulting in a lack of specific pre-intervention data.

Results

Literacy development for the students participating in the O’Connor (2002) study cannot be highly correlated with the interactive writing intervention because of all the confounding circumstances for the study participants, including, but not limited to, an
additional daily reading tutor, daily pull out, small-group reading tutoring, and weekly tutoring, in addition to the increased instructional literacy time in with yet another instructor for this intervention. As O’Connor stated, “There is no evidence that only manipulation of the variables, or the actual intervention used, was solely responsible for the changes in behavior” (p. 198).

Results of the O’Connor (2002) study are inconclusive. As would be expected of students, regardless of the instructional practices, data from this study showed that each child presented a specific profile that differed from other students both before and after the intervention. Given the difficulties expressed by O’Connor in managing student behavior, this study appeared to be more of an exercise of classroom management rather than writing instruction.

The Craig (2001) study indicated no statistical difference for phonological awareness as a result of treatment interventions. This result may be misleading due to the fact interactive writing was compared with metalinguistic games, an intervention specifically designed to foster student growth in phonemic awareness. Craig points out a greater portion of time was devoted to phonological awareness tasks for the metalinguistic games intervention group and that the intervention tasks mirrored the assessment measure. Furthermore, data collected at the end of the study resulted in ceiling effects on the Test of Phonemic Awareness (Snider, 1997).

This study indicated a statistically significant difference between treatment groups on word identification based on results of one posttest-only measure. This purported result may also be misleading. The sole pretest of children’s reading was as measure of pseudoword reading, the Word Attack subtest of the Woodcock Reading Mastery Test
(Woodcock, 1987). Pseudoword reading is a more difficult task and a less constrained construct than word reading of regular or sight words. Results comparing pre- and posttests of the Word Attack subtest found no significant difference between groups. The Word Identification subtest of the Woodcock Reading Mastery Test (Woodcock) was given as a posttest only measure, thereby an established baseline of word identification is lacking. It would have been more sensible to give this test as a pre- and posttest rather than the more difficult test of pseudoword reading.

Clearly, interactive writing is lacking the scientific research base as defined by the U.S. Department of Education (2007). This is rather surprising given the widespread use of interactive writing as a method of instruction. Neither of the two research articles located had the sole intent of examining the impact of interactive writing on literacy achievement. Both of these studies utilized a modified form of this instructional method in contrived, small group settings. Potential for generalizing results from either study is constrained due to the limited information provided by the studies, the small sample sizes, and the inclusion of a demographically narrow participant population. Data collection for both studies included some instrumentation measures lacking established validity and reliability. (See Table 1 for a summary overview of the studies.) Thus, results from both of these studies are far from conclusive. Experimental studies are needed to evaluate how interactive writing instruction impacts student growth and development of early literacy skills.
Table 1

*Overview of Interactive Writing Studies*

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>To investigate effects of two instructional approaches (interactive writing-plus and metalinguistic games-plus) on phonological awareness, alphabetic knowledge, and early reading of kindergarten children</td>
<td>To examine the effects of interactive writing on the phonological processing of struggling first-grade students</td>
</tr>
<tr>
<td>Participants</td>
<td>87 kindergarten students from white middle-class population</td>
<td>5 African American students with low SES</td>
</tr>
<tr>
<td>Selection and Assignment</td>
<td>Students from two classrooms within one elementary school. Random assignment to treatment condition, then divided into 18 small groups based on common strengths and needs of students</td>
<td>Students from one classroom selected and divided into two groups by the classroom teacher</td>
</tr>
</tbody>
</table>
Table 1

*Overview of Interactive Writing Studies (Continued)*

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Design</strong></td>
<td>Experimental Group: Interactive writing plus letter-sound instruction through word building</td>
<td>Single-Subject Design</td>
</tr>
<tr>
<td></td>
<td>Comparison Group: Metalinguistic games plus letter sound activities</td>
<td></td>
</tr>
<tr>
<td><strong>Intervention</strong></td>
<td>Students participated in 4 twenty-minute sessions per week outside of the regular classroom for 16 weeks</td>
<td>Students participated in 40-41 intervention sessions lasting 30 minutes</td>
</tr>
<tr>
<td><strong>Results</strong></td>
<td>No difference between groups for phonological awareness and spelling achievement, Statistically significant difference between groups on word identification, passage comprehension, and combined tests for word reading</td>
<td>Children demonstrated literacy growth, but little evidence of substantial change due to the study intervention</td>
</tr>
</tbody>
</table>
Early Literacy Skills

Given the established need of an experimental study to evaluate the impact of interactive writing on early literacy growth, it is necessary to examine constructs literacy research has identified as important for beginning readers. Kindergarten students must traverse the bridge between oral and written language. Young learners become aware of the sound structure of spoken words. They learn the skills to identify markings as printed letters and to know those printed letters correlate to spoken sounds, thereby creating words and texts that convey meaning. The National Reading Council (Snow et al., 1998) provided details of particular accomplishments successful literacy learners are likely to exhibit in kindergarten: (1) Recognize and name all uppercase and lowercase letters; (2) Understand that the sequence of letters in a written word represents the sequence of sounds in a spoken word; (3) Learn many, but not all, one-to-one letter-sound correspondences; (4) Demonstrate understanding that spoken words consist of sequences of phonemes; (5) Merge spoken segments into a meaningful target word; (6) Recognize some words by sight, including a few common ones: a, the, I, my, you, is, are.

Reading development is supported by two different kinds of skills: (1) skills to identify individual words in print, and (2) skills to help construct meaning (Torgesen, 1998, 2002). The skill set to identify printed words is made of small sets of knowledge, many of which are what Paris (2005) referred to as “constrained skills.” Constrained skills are learned quickly, with a brief duration of acquisition; other skills, such as vocabulary, are unconstrained in terms of the knowledge to be acquired or the duration of learning (Paris).
Because early reading skills that enable students to identify individual words in print are typically learned quickly with a brief period of acquisition, investigation of any single early reading skill would likely not fully capture the rapid growth and development of reading in kindergarten. Research converges on a restricted set of skills used to identify individual words in print that are valid predictors for the identification of children at risk for reading difficulties (Foorman & Moats, 2004). The importance of phonemic awareness, alphabet knowledge, and word reading is firmly established as fundamental for early reading development. For the purposes of this study, skills in phonemic awareness, alphabet knowledge, and word reading were used to represent the construct of early reading skills because these skills provide the foundation for further growth and development of proficient reading.

**Phonemic Awareness**

Phonological awareness is the ability to attend to sounds of spoken words. Phonological awareness skills range in difficulty from the simple tasks involving word units such as syllables to the more difficult tasks of manipulating phonemes. A phoneme is the smallest unit of sound in a word that makes a difference in its meaning (Torgesen, 1998); the ability to focus and manipulate phonemes in spoken words is a more discrete subskill of phonological awareness, known as phonemic awareness.

Research has clearly demonstrated the importance of phonemic awareness to reading ability and that early assessments of phonemic awareness are highly predictive of later reading achievement (Ball & Blachman, 1991; Blaiklock, 2004; Foorman, Francis, Novy, & Liberman, 1991; Foy & Mann, 2006; Lonigan, Burgess, & Anthony, 2000;...
NICHD, 2000; Perfetti, Beck, Bell, & Hughes, 1987; Stahl & Murray, 1994; Torgesen, Wagner, & Rashette, 1994). In fact, phonemic awareness has been identified as one of the two best school-entry predictors of reading ability (Chiappe, Siegel, & Gottardo, 2002; Muter & Diethelm, 2001; NICHD, 2000).

The strong association between early phonemic awareness skills and reading achievement is evident. The presence of phoneme awareness is a hallmark of good readers, its deficiency consistent of poor readers (Mann, 1993). Brady and Shankweiler (1991) emphasized that phonemic awareness skills are often lacking for students who experience difficulty learning to read. Juel (1988) found phonemic awareness difficulty in first grade to affect reading achievement even four years later. In a study of one-hundred kindergarten students, Mann found that phoneme awareness test scores predicted 30% - 40% of variance in first grade reading ability. Even more interesting is the predictive capability reported by Wood, Hill, Meyer, and Flowers (2005) that phonemic awareness measured in first grade predicted almost half the variance of a standard reading achievement test given in the eighth grade.

Other studies have shown that good readers outperform poor readers on a wide range of phoneme awareness tasks, even when controlling for socioeconomic status and general intelligence (Torneus, 1984; Zifcak, 1981). Analysis of longitudinal data collected from 49 students in kindergarten and first grade conducted by Stanovich, Cunningham, and Cramer (1984) determined that phonemic awareness tasks have predictive accuracy equal to or better than global measures such as an intelligence test or a reading readiness test. Research evidence has clearly established the importance of
phonemic awareness skills for literacy growth and as a predictor of reading success for beginning readers with long-lasting effects.

**Alphabet Knowledge**

A number of studies have confirmed the importance of alphabet knowledge for reading achievement and have shown tests of alphabet knowledge to be highly predictive of later reading achievement (Adams, 1990; Ball & Blachman, 1991; Duncan & Seymour, 2000; Foy & Mann, 2006; Muter & Diethelm, 2001; Shatil et al., 2000; Snow et al., 1998; Treiman & Kessler, 2003; Treiman, Tincoff, & Richmond-Welty, 1997; Treiman, Weatherston, & Berch, 1994; Vellutino & Scanlon, 2001). Indeed, longitudinal research from the past two decades identifies letter identification as the strongest single predictor of reading skills (Scarborough, 1998). Share, Jorm, Maclean, and Matthews (1984) reported that letter-name knowledge and phonemic awareness, assessed at the beginning of kindergarten, were the two best predictors of later reading achievement, even to the end of first grade. A longitudinal study of reading development conducted by Scanlon and Vellutino (1996) involving 1,400 participants reports kindergarten letter-name knowledge as the best single predictor of first-grade reading performance.

Alphabet knowledge refers to knowledge of the names and sounds made by letters of the alphabet (McBride-Chang, 1999). However, knowledge of letter sounds and letter names is not completely overlapping (Blaiklock, 2004; Scarborough, 1998; Treiman et al., 1997; Wagner, Torgesen, & Rashotte, 1994). Knowledge of letter sounds usually lags behind knowledge of letter names (Adams, 1990; Blaikock, 2004; Mason, 1980; Treiman et al., 1994; Worden & Boettcher, 1990). A study of 660 children between the
ages of 3 years 6 months and 7 years 6 months found that students use knowledge of letter names to learn letter sounds (Treiman, Tincoff, Rodriquez, Mouzaki, & Francis, 1998).

Furthermore, letter-name knowledge and letter-sound knowledge contribute unique variance in reading acquisition (Foy & Mann, 2006; McBride-Chang, 1999). A longitudinal study of developing readers, conducted by Schatschneider, Francis, Carlson, Fletcher, and Foorman (2004), found that letter-name knowledge was predictive of first grade reading outcomes only at the beginning of kindergarten while knowledge of letter sounds was predictive both at the beginning and the end of kindergarten. Since letter name and letter sound knowledge develop at different rates, with different relationships with reading, Blaiklock (2004) recommended that studies consider both letter name and letter sound knowledge. Given that alphabet knowledge consists of letter names and letter sounds, which both contribute uniquely to early literacy, measures of knowledge of letter names and of letter sounds were logical inclusions for this study of early literacy growth.

*Word Reading*

Studies of early literacy development routinely use word reading tests (Ball & Blachman, 1991; Blaiklock, 2004; Hatcher et al., 2006; Mann, 1993; Shatil et al., 2000). In an examination of factors of beginning reading, Lomax and McGee (1987) found a developmental sequence of reading acquisition beginning with concepts about print, moving to graphic awareness, phonemic awareness, grapheme-phoneme correspondence, and culminating in word reading. Wood et al. (2005) reported that word reading tests can improve the strength of prediction for literacy growth.
Word reading ability was included in this study to help measure growth of students that progressed rapidly through the earlier, more constrained reading skills. Ehri (2005) proposed that sight words are learned by connections formed from the reader’s knowledge of the alphabetic system, including knowledge of phonemic awareness and knowledge of letter sounds; “When readers acquire sufficient knowledge of the alphabetic system, they are able to learn sight words quickly and to remember them long term” (p. 172). In a study of reading and writing achievement of low SES children, Chall and Jacobs (1983) found that recognition of single words was important for general reading achievement in the early grades. According to Adams and Huggins (1985), word recognition abilities effectively discriminate between good and poor readers and are strongly related to overall reading ability. Thus, a measure of word reading helped to assess differences in literacy growth that may have otherwise been overlooked.

Summary of Important Early Literacy Skills

Evidence from literacy research converges on a set of important skills for beginning readers; skills that are also valid predictors of reading success: phonemic awareness, knowledge of letter names and sounds, and word reading (Fletcher et al., 2002; O’Connor & Jenkins, 1999; Vellutino, Scanlon, & Lyon, 2000; Wood et al., 2005). Torgesen (2002) confirmed that in kindergarten, a reliable assessment of phonemic awareness and letter-sound knowledge will identify most students in need of special support for the development of word reading ability. Scanlon and Vellutino (1996) also concurred that kindergarten literacy instruction should place emphasis on phonemic
awareness, alphabetic knowledge, and word identification skills. These three components of early reading will be used to evaluate growth of early reading skills.

Summary

An important goal for literacy research is to identify instructional practices that significantly impact literacy learning (NICHD, 2000; Snow et al., 1998; U.S. Department of Education, 2007). Importance of the reading-writing interaction and its effect on literacy development is consistently demonstrated in over 35 years of research (Farnan & Dahl, 2003); yet, there is insufficient information on how the interaction between writing and reading functions relative to instructional practices (Durkin, 1989; Jagger et al., 1986; Shanahan, 2006; Stotsky, 1983). Consideration must be given to direct evaluation of how reading and writing impact each other (Farnan & Dahl, 2003; Pressley & Fingeret, 2007).

Understanding the reading-writing relationship may be of particular importance for instruction in the primary grades when the foundations of literacy are established. Writing as a way to develop reading skills is clearly recognized (Anderson et al., 1985; Chomsky, 1976; Clay, 1975, 2002; Durkin, 1966, 1989; Loban, 1976; Tolchinsky, 2006). This relationship holds promise of potential benefits for acquisition of early reading skills.

Research conveys the theoretical importance of the writing-reading interaction. Literacy research has identified skills crucial for success in early reading, including phonemic awareness, alphabet knowledge, and word reading. Interweaving these two strands of research permits examination of how the writing-reading interaction operates
at the fundamental level of literacy. Can early literacy instruction be more effective when including instructional methods that take advantage of the reading-writing relationship?

Interactive writing is a frequently recommended instructional practice that may impact early literacy achievement by building upon the shared knowledge base of reading and writing (Biddle, 2007; Brotherton & Williams, 2002; Button et al., 1996; Herb & Bufalino, 1997; McCarrier et al., 2000; Patterson et al., 2008; Pinnell & Fountas, 1998; Ritterskamp & Singleton, 2001; Rubadue, 2002; Sipe, 2001; Stachoviak, 1996; Williams & Lundstrom, 2007). However, there is a lack of experimental research that examines the effect of interactive writing instruction on student achievement in early literacy. The present research base lacks information necessary for informed decisions regarding interactive writing.

The need for experimental studies to evaluate how interactive writing instruction impacts student growth and development of early literacy skills is evident. Thus, this study sought to investigate the effect of interactive writing instruction on kindergarten students’ acquisition of early reading skills as measured by: (a) phonemic awareness, (b) alphabet knowledge, and (c) word reading. Therefore, the following hypothesis will be tested: Using a 2-level model to hold constant student level differences, with the three identified components of early reading skills as the outcome variables, the predictor variable for random assignment to interactive writing will not be statistically significant \( (p < .05) \).
CHAPTER III

METHODOLOGY

One of the greatest problems for the beginning reader is that he/she cannot tell by watching others what readers are actually doing (Meek, 1982).

Introduction

The purpose of this study was to investigate the effect of interactive writing instruction on kindergarten students’ acquisition of early reading skills as measured by: a) phonemic awareness, b) alphabet knowledge, and c) word reading.

The design of this study attempted to address concerns and limitations associated with educational research of writing instruction. One concern with research in writing instruction is the lack of experimental design, especially with elementary-age students. Juzwik and colleagues (2006) conducted an overview of writing research for the years 1999-2004. Of the 1502 articles reviewed, only 11% used experimental or quasi-experimental group designs. Even fewer studies, only 5%, involved writing instruction with elementary school children. Yet, identification of effective instructional procedures for beginning readers and writers is crucial.

Singer and Willett (2003) focused on another concern with educational research: the lack of longitudinal studies. Although the use of longitudinal studies has dramatically increased in the fields of medicine, psychology, sociology, economics, and forestry, there has been an 8% decline in the field of education. Singer and Willett concluded that not only is education falling behind in randomized controlled trials, but in other areas of quantitative research as well; “given the power of modern longitudinal methods to
address research questions about change and event occurrence, this as a serious problem
that needs addressing” (p. 5).

The design of this study also attempted to address the limitations of previous
reading-writing studies as identified by Fitzgerald and Shanahan (2000):

Most of these studies have been small scale (fewer than 50 participants), have
been conducted at a single point in time (few longitudinal or cross-panel studies),
and have usually focused on bivariate relations as opposed to multivariate
relations. Consequently, the results of such studies are more provocative than
informative, as they are unable to address issues of covariance or development,
and their generalizability is often questionable. (p. 41)

To address these concerns and limitations, this study employed a repeated-
measures experimental design involving 151 kindergarten student participants randomly
assigned to the writing instructional groups. Data were collected at four points during the
sixteen-week study from all participants using four repeated assessments.

Participants

Participants for this study were from a school district in a western city in the
United States. The IES Common Core of Data (Sable & Garofano, 2007) classifies this
school district as Mid-size Central City/2. Although several districts indicated a
willingness to participate, two factors made this district favorable for inclusion in this
study: (1) interactive writing was not an established instructional practice in the
kindergarten classrooms, and (2) potential for generalizing the sample to a larger target
population. In comparison to the U.S. percentage of population by ethnic subgroups, this
district was more reflective of four of the five subgroups than the state from which this
sample was drawn (Table 2). This district is not reflective of the U.S. ethnic subgroup of “Black, non-Hispanic.”

After obtaining permission from district personnel, two elementary schools within the district were randomly selected to participate in the study. Kindergarten teachers in the two randomly selected schools participated, for a total of five teachers and eight sessions of half-day kindergarten classes with 156 students. Parental consent was obtained for 153 kindergarten students. Two students did not complete the entire study due to relocation out of the district. Parents declined participation for three students. One hundred fifty-one kindergarten students completed the study. Of these participants, 65% were White, non-Hispanic, 27% Hispanic, 7% Asian/Pacific Islander, less than 1% American Indian/Alaskan Native, and 0% Black, non-Hispanic. Twenty-one percent of participants were classified as English as a second language learners.

At the beginning of the study, participants ranged in age from 5 years 0 months to 5 years 11 months. Fifty-three percent of participants were male, forty-five percent female. Forty-three percent of participants qualify for free or reduced-price lunch status. However, this number is probably slightly lower than the actual percentage of students qualifying for free and reduced-price lunch due to the fact that application for free and reduced-price lunch status does not have to be completed unless the child participates in school lunch, which typically does not occur in kindergarten.
Table 2.

*Population and Sample Demographics*

<table>
<thead>
<tr>
<th></th>
<th>American Indian/</th>
<th>Asian/</th>
<th>Black, non-Hispanic</th>
<th>White, non-Hispanic</th>
<th>Non-Hispanic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Students</td>
<td>% of</td>
<td>Total %</td>
<td>Total</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>n</td>
<td>Total</td>
<td>n</td>
<td>Total</td>
</tr>
<tr>
<td>United States</td>
<td>48,610,6</td>
<td>594,663</td>
<td>1.2</td>
<td>2,241,809</td>
<td>4.6</td>
</tr>
<tr>
<td>Sample State</td>
<td>508,258</td>
<td>7,770</td>
<td>1.5</td>
<td>15,522</td>
<td>3.1</td>
</tr>
<tr>
<td>Sample District</td>
<td>2922</td>
<td>40</td>
<td>1.4</td>
<td>117</td>
<td>3.7</td>
</tr>
<tr>
<td>Participants</td>
<td>151</td>
<td>1</td>
<td>.7</td>
<td>11</td>
<td>7.3</td>
</tr>
</tbody>
</table>

Source: Compiled from CCR state and national demographic data and study data.
Group Assignment

Each student was assigned a number, from 001-151, which was used throughout the study for means of student identification, such as for initial assignment, and to maintain confidentiality. Using randomization software, students within each class were assigned to the treatment or the comparison group. Seventy-five students were randomly assigned to interactive writing. Seventy-six students were randomly assigned to writing workshop. Comparison of the treatment and control groups showed no statistically significant difference between the randomly assigned interactive writing and writing workshop groups for student characteristics of gender, ethnicity, English as a second language, socioeconomic status, and initial literacy level (Table 3).

Teachers within each of the two schools were randomly assigned to instruct the treatment or comparison group, resulting in a total of four treatment groups and four comparison groups. Students received writing instruction from the teacher of their randomly assigned group. All participating teachers in this study had a bachelor’s degree in education with an early childhood endorsement; none of the teachers had a reading endorsement. The mean of years teaching in kindergarten was 3.41, $SD = .119$. Class size ranged from 19 to 21, with a mean of 20 students per kindergarten session ($SD = .84$). All classrooms followed a 9-month instructional schedule.
Table 3

Overview of Student Characteristics by Group Assignment

<table>
<thead>
<tr>
<th>Description of Intervention</th>
<th>Treatment</th>
<th>Comparison</th>
<th>$\chi^2$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Participating Students</td>
<td>75</td>
<td>76</td>
<td>1.93</td>
<td>.16</td>
</tr>
<tr>
<td>Male</td>
<td>44</td>
<td>36</td>
<td>47%</td>
<td>1.93</td>
</tr>
<tr>
<td>Female</td>
<td>31</td>
<td>40</td>
<td>53%</td>
<td>1.93</td>
</tr>
<tr>
<td>Ethnicity (Ethnic group membership identified by student’s family)</td>
<td></td>
<td></td>
<td>.10</td>
<td>.75</td>
</tr>
<tr>
<td>% White</td>
<td>50</td>
<td>48</td>
<td>63%</td>
<td></td>
</tr>
<tr>
<td>% Hispanic</td>
<td>20</td>
<td>21</td>
<td>27%</td>
<td></td>
</tr>
<tr>
<td>% Asian/Pacific Islander</td>
<td>5</td>
<td>6</td>
<td>1.3%</td>
<td></td>
</tr>
<tr>
<td>% Native American/Alaskan</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>% African</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>% ESL (Qualify for services as a non-native speaker of English in the USA)</td>
<td>14</td>
<td>17</td>
<td>22%</td>
<td>.32</td>
</tr>
<tr>
<td>% Free/Reduced Lunch Eligibility (Eligible for federal free and reduced priced meal program; a proxy for SES)</td>
<td>33</td>
<td>32</td>
<td>42%</td>
<td>.06</td>
</tr>
<tr>
<td>Initial Literacy Level (Outcome measure pretest results)</td>
<td></td>
<td></td>
<td>.84</td>
<td>.41</td>
</tr>
<tr>
<td>% Lowest Quartile of Sample</td>
<td>22</td>
<td>15</td>
<td>20%</td>
<td></td>
</tr>
<tr>
<td>% Top Quartile of Sample</td>
<td>19</td>
<td>19</td>
<td>25%</td>
<td></td>
</tr>
</tbody>
</table>

Description of Intervention

Participating students were randomly assigned to one of two groups to investigate the effects of interactive writing as a means of literacy instruction for kindergarten students. Teachers in both the treatment and comparison groups continued the standard practice of ninety minutes of literacy instruction per day. However, for both groups, a
portion of this literacy instruction included a “walk to write” time. Students from within each of the classes met together to receive writing instruction from the teacher randomly assigned to their instructional group. For the treatment group, interactive writing was implemented for fifteen minutes per day. In order to present a more naturalistic baseline against which the treatment group may be evaluated (Snow, 1974), the comparison group spent this same 15 minutes per day in writing workshop. Interactive writing is a form of shared writing. Writing workshop involves more independent writing with teacher guidance. Interactive writing results in accurately written text. Writing workshop involves more invented spelling. During the study, all participating students continued to receive instruction in the traditional kindergarten curriculum, which included instruction in early reading skills using the same core reading program.

*Internal Validity Threats*

In an effort to minimize the four threats to internal validity identified by Shadish, Cook and Campbell (2002) that are not ruled out by use of two-group designs with random assignment (diffusion of treatment, compensatory equalization of treatments, compensatory rivalry, demoralization of respondents), this study considered recommendations made by Borg (1984) that “as many other aspects of these treatments as possible should be similar” (p. 12). The three aspects Borg identified as most important are: (a) similar duration of the treatments, (b) similar perceived value of the treatments, and (c) similarity in the treatment procedure.
**Similar Duration of the Treatments**

Participation in either of the two groups required the same amount of time, fifteen minutes of writing instruction per day. This time allotment helped to control for systematic differences between the treatments stemming from differences in instructional time.

**Similar Perceived Value of the Treatments**

For all intents and purposes, both the treatment and the comparison group were of equal value. Writing workshop and interactive writing are widely promoted methods of writing instruction with the potential of providing worthwhile information for this study. All participating teachers received instruction and guidance for implementing the writing instruction that included viewing of videos of implementation in the classroom and modeling within the teachers’ own classrooms. Teachers were also given lesson plans, lesson ideas, and supporting materials. All teachers received an equal stipend for participating and maintaining confidentiality regarding instructional practices during the study. Because the kindergarten students involved in the study are familiar with varied grouping and rotation for instruction during center times, it was unlikely this writing instruction was perceived as anything less than normal practice. The age of the students, and the fact that all students are participating in writing instruction, also limited potential novelty or Hawthorne effects.

**Similarity in the Treatment Procedure**

Data collection and teacher communication for the comparison group focused on writing workshop instructional practices and student literacy growth. Data collection and
teacher communication for the treatment group focused on interactive writing
instructional practices and student literacy growth. Classroom observations, contact
hours, and fidelity checks were of the same frequency and duration for both treatment
and comparison groups. Student literacy assessments were administered for all
participating students in both groups.

Treatment Group

Fifteen minutes per day as part of the ninety minutes of literacy instruction were
devoted to interactive writing instruction. Interactive writing is a “group experience that
increases children’s participation in the act of writing and helps them attend to the details
of letters, sounds, and words while working together on meaningful text” (Pinnell &
Fountas, 1998, p. 29). This daily instruction time consisted of the teacher and students
composing text of various lengths while gathered for group instruction. As teachers and
students shared the pen to construct the letters, words, and sentences, this text was written
on large chart paper. Approximately 75% of the writing time was devoted to group
writing experiences, with the remaining 25% devoted to individual writing time. As
recommended by Pinnell and Fountas, during written text construction, instruction
included: (1) analyzing letter-sound correspondence and sequencing, (2) identifying
words, word parts, letter clusters, and letters, (3) noticing how frequently used words
look and relate to other words, and (4) generating words, and making links among words,
word parts, and word sets.
Comparison Group

Fifteen minutes per day as part of the ninety minutes of literacy instruction were devoted to writing workshop. Writing workshop is reported to be the most popular approach to writing instruction in the primary grades (Graham, Harris, & Mason, 2005) and can be used in kindergarten to help students become “early writers and readers” (Schulze, 2006). The main components of the writing workshop include a mini-lessons, writing and conferencing, and sharing. During writing workshop, student write, receive feedback about their writing, and share and publish writings. Approximately 25% of this writing time was devoted to mini-lessons, with the remaining 75% devoted to writing, conferencing, sharing, and publishing. In an effort to minimize differences in content between the treatment and comparison groups, teachers within each school focused on the same topic each week. For example, if a book was read as part of the writing lesson, both the treatment and the comparison group were exposed to the same book. This modified the writing phase of the writing workshop slightly as students were often given prompts for use in their independent writings rather than completely free choice of topic. The emphasis was on differentiation of writing instructional methods while maintaining the same lesson content.

Instructional Documentation

Teachers in both the treatment and comparison groups provided the same documentation regarding classroom writing instruction. All teachers completed an Intervention Validity Checklist/Instructional Log detailing the writing instruction and
time spent in writing instruction (see Appendix A). The instructional log for teachers in the interactive writing group contained a checklist of components that could be incorporated during interactive writing lessons. This checklist served as a self-check tool for teachers to monitor incorporation of interactive writing components during writing instruction. The instructional log for teachers in the writing workshop group contained a checklist of the components of writing workshop, again as a way for teachers to monitor use of writing workshop components during instruction. Each week, all teachers would briefly describe one of the week’s writing lessons. The daily logs were also used to measure the total time devoted to writing instruction for each group.

*Description of Instruction*

*Interactive Writing*

Periodic visits were made to classrooms to observe writing instruction. These visits were typically unannounced. Following is a description of an interactive writing lesson based upon field notes taken on October 9, 2007. Prior to this lesson, students had learned the procedures of interactive writing such as sharing the pen, sounding out words, and writing on whiteboards or forming letters in the air with their finger as a pencil. Students had participated in interactive writing lessons to create words, labels, and lists. The week prior to this lesson, students had practiced counting words in an oral sentence and using their fingers to count the words. Students then practiced this skill with sentences written on the whiteboard. The teacher also provided instruction about spacing and ending punctuation with the written sentences. This instruction was to prepare the
students to move from creating lists and labels to composing complete sentences in writing texts.

Twenty-one students gathered on the rug for writing time. To begin the lesson, the teacher identified the topic of the lesson as writing sentences to tell about oneself. After a brief discussion, a simple sentence was decided upon that would teach the concept of written sentence while providing practice with sight words and writing students’ names, “My name is . . .” The students used their fingers to count the number of words and the spaces between the words. The teacher asked students to identify the word that would be written first. The teacher pointed out the word “my” is a sight word and they could use the word wall to spell this word. A piece of large chart paper was taped on the whiteboard for the interactive writing text. The top half of the chart paper was for the teacher to write on as instructional needs dictated; the bottom half was for the student writing of the composed text. Students raised their hands to write on the chart paper. One student went to the chart paper and wrote the word “My.” The teacher pointed out that since this was the beginning of a sentence, “My” would be capitalized. Students then identified the next word in the sentence to be written and the space that would have to come before this word. One student used the end of a ruler to act as a space holder in preparation for writing the next word. The teacher and the students said the word “name,” stretching the word to listen for the beginning sound /n/.

Teacher: *What sound do we hear at the beginning of the word “name”?*

Students: /nnnnnnnn/

Teacher: *What letter makes the /n/ sound?*

Students: n
Teacher: *Point to the letter “n” on the alphabet chart. Show me in the air how to write the letter “n.”*

Students wrote the letter “n” in the air. The teacher then called on a student to write the letter “n” on the chart paper and directed the rest of the class to, “Write the letter ‘n’ on your palm using your finger as a pencil.” This process continued for the letters “a” and “m.” The teacher then drew an Elkonin box on the top half of the chart paper in which she wrote the letters “n,” “a,” and “m.” The teacher then explained the concept of words with a silent “e” at the end of the word and how that affects the sound of the first vowel letter. Then another student wrote the silent letter “e” on the chart paper. Another student pointed to the two words written on the chart paper as the rest of the class read the words, “My name.” Again, students identified the next word to be written, “is,” and a student went to the chart paper to construct the text. The student wrote an uppercase letter “i.” The teacher discussed with the class why an uppercase “i” was not need for this word, and then covered the letter with cover-up tape and the student wrote a lowercase “i.” The process continued until the four words in the sentence were correctly written. Then the teacher asked, “Is this a statement or a question?” The sentence was finished as a student added a period for the ending punctuation and the class reread their own text. This sentence served as a base sentence for writing practice with other student names. The lesson effectively incorporated important components of interactive writing. Students had actively participated in a group experience of writing that attended to the details of letters, sounds, and words while constructing text (Pinnell & Fountas, 1998). Samples of text constructed from interactive writing are contained in Appendix C.
Following is a description of a writing workshop mini-lesson based upon field notes taken on September 17, 2007. The teacher sat on a small chair with a whiteboard easel next to her. Twenty students sat on the rug in front of her for the writing mini-lesson. The focus of the lesson was how to think of a topic for writing by brainstorming a list of ideas. The teacher was combining practice with the letter “b” for this lesson. To begin the lesson, the teacher began by explaining:

Sometimes a certain word will remind me of something that has happened to me; for example, the word butterfly. When I think of the word butterfly, I think of many stories. One time when I was outside, a whole bunch of butterflies came flying around. The butterflies landed on the trees and the grass. They were the monarch butterflies; the butterflies that are orange and black. There were more butterflies than I had ever seen in my life. I wondered why there were so many butterflies that day. Later, I found out that the butterflies were migrating. They were moving to a warmer place.

The teacher wrote the word butterfly on the whiteboard easel. The teacher then asked if the students could think of some “b” words that reminded them of events that have happened in their lives. One student told a story about getting stung by a bee. Another told a story about a bucking bronco. Students orally told stories of “b” words. As students would identify a word and briefly describe the event, the teacher would write the word on the easel and draw a simple picture next to the word. After creating the list of words, the teacher emphasized that one way to get an idea of what to write about is to create a list of possible topics:

A list can give ideas for many stories. We have a list of words we have created today. I could use this list to remind me to write a story about basketball. When I finish that story, I could look at my list again and be reminded about the time I saw a badger and write a story about that.
After the mini-lesson on using brainstorming to create a list of ideas for writing topics, the students created their own list of possible topics by drawing pictures and labeling the pictures. Samples of student work from writing workshop are contained in the Appendix C.

Instrumentation

Growth of literacy skills in kindergarten is interesting and complex. Kindergarten is typically a time of rapid growth of early reading skills. Yet, this is crucial period of development with potential lifelong consequences. Previous studies confirm measures of language and language-based skills administered to kindergarten children are among the best predictors of reading achievement in later grades (Blaiklock, 2004; Butler et al., 1985; Scarborough, 1998; Share et al., 1984; Vellutino & Scanlon, 2001; Wood et al., 2005). In fact, a review by Scarborough reported that kindergarten measures of early reading skills accounted for almost one-third of reading variance in grades first through third.

Because early reading skills that enable students to identify individual words in print are typically learned quickly with a brief period of acquisition (Paris, 2005), any single measurement of early reading skill would likely not fully capture the rapid growth and development of diverse kindergarten students. In an effort to systematically examine the impact of interactive writing instruction on acquisition of early reading skills, this study used repeated measurements of phonemic awareness, alphabet knowledge, and word reading. Thus, careful consideration was given to instrumentation aspects of this study.
Multiple sources were consulted in selecting specific outcome measures for this study. One source was a search of websites for the established publishing companies of: CTB McGraw Hill, Educational Testing Service, Pearson (AGS & subsidiaries), Riverside, and Harcourt. These websites were first searched by terms such as “reading,” “early literacy,” “achievement assessments,” “early learner,” and “early childhood.” In order to make sure no test was overlooked, each website was then searched using the “Products A-Z” catalog listing. Each measure that could be applicable to reading and early literacy was examined. In addition, a representative of each company was contacted for their recommendations of appropriate measurements.

Published journal articles of literacy investigations served as another source for identifying appropriate measures. Over 175 journal articles were reviewed to identify measures used to assess student achievement in phonemic awareness, alphabet knowledge, and word reading. Information on measures was also obtained from the Buros Institute of Mental Measurements, the National Research Center on Learning Disabilities, and the Institute for the Development of Educational Achievement.

Specific assessments for measuring student literacy achievement in: (a) phonemic awareness, (b) alphabet knowledge, and (c) word reading were evaluated on the basis of: (1) appropriateness for kindergarten students; (2) potential to adequately measure constructs of this study; (3) substantiated validity, (4) reliability above .8; and (5) an established measure of use as indicated by inclusion in published research journal articles. The outcome measures selected for this study are shown in Table 4.
Table 4  

*Design Matrix of Outcome Measures*

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<th>Assessment Procedures</th>
<th>Measure</th>
<th>Administered</th>
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<tbody>
<tr>
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<td><strong>Measure</strong></td>
<td><strong>Administered</strong></td>
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<td>Phonemic Awareness</td>
<td>CTOPP</td>
<td>Four Time Points</td>
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<tr>
<td>Oddity</td>
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<td>Blending</td>
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<td>Segmenting</td>
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<td>Manipulation</td>
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<td></td>
</tr>
<tr>
<td>Alphabet Knowledge</td>
<td>OSELA</td>
<td>Four Time Points</td>
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<tr>
<td>Letter Names</td>
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<tr>
<td>Letter Sounds</td>
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<tr>
<td><strong>Word Reading</strong></td>
<td>TOWRE</td>
<td>Four Time Points</td>
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<tr>
<td>Sight Words</td>
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<tr>
<td>Nonsense Words</td>
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</table>

**Assessment Procedures**

To examine the development of literacy growth, the measurements should be carried out frequently enough to enable examination of the identified constructs and the measurements should be identical across measurements because of examination of both intra-individual changes and inter-individual differences across time (Leppanen, Niemi, Aunola, & Nurmi, 2004). Frequent assessments have the potential to contribute additional information about the relationship between variables; the power of a test can be
dramatically increased by adding only a few additional points of data collection (Maxwell, 1998; Willett, 1989). Use of the same tests provides consistency in evaluating growth of literacy development over time (Blaiklock, 2004; Plewis, 1996; Taris, 2000).

The Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgesen & Rashotte, 1999), the Observation Survey of Early Literacy Achievement-Letter Identification task (OSELA; Clay, 2002), and the Test of Word Reading Efficiency (TOWRE; Torgesen, Wagner, & Rashotte, 1999) were individually administered to all participating students four times during the 16-week study. Testing periods were scheduled at fixed occasions to give as equal as intervals as possible during the study. At each assessment frame, assessments were administered over a 2-week period. Participants in one school were assessed in 1 week, followed by assessment of participants in the other school the next week. Testing was completed during regular class time to avoid identification of a student with assignment to the treatment or comparison group. Pretests for this 16-week study were administered during a 10-day testing window beginning August 27, 2007. Implementation of instruction began September 10, 2007. The second point of assessments took place during a 10-day testing window beginning October 1, 2007. The third round of assessments was administered during a 10-day testing window beginning November 5, 2007. Posttests were administered during a 10-day testing window beginning December 3, 2007.

Total testing time per student did not exceed 15 minutes for the measures, with average testing time being about 12 minutes. There did not appear to be incidents of students remembering particular test items during the four testing points. Order of test
Outcome Measures

Phonemic Awareness

Research has clearly demonstrated the importance of phonemic awareness to reading ability and that early assessments of phonemic awareness are highly predictive of later reading achievement (Ball & Blachman, 1991; Blaiklock, 2004; Foorman et al., 1991; Foy & Mann, 2006; Mann, 1993; NICHD, 2000; Perfetti et al., 1987; Stahl & Murray, 1994). Share and colleagues (1984) reported phonemic segmentation was the best of 39 measures in predicting reading success after 2 years.

Measurements of phonemic awareness use various tasks to evaluate differing levels of phonemic awareness identified by Adams (1990): sounds of words, oddity, blending and syllable splitting, segmentation, and manipulation. In a study of tests used to operationalize phonemic awareness, Yopp (1988) found phonemic awareness to be constructed of two factors: Factor 1) Simple Phonemic Awareness; and Factor 2) Compound Phonemic Awareness. Phoneme blending, phoneme segmentation, and sound isolation tests loaded highly on Factor 1. Phoneme deletion tasks loaded on Factor 2. As a result, Yopp recommended, “A combination of two tests, one from each factor, holds greater predictive validity for the initial steps in reading acquisition than does any test alone” (p. 175). In contrast, other studies (Stahl & Murray, 1994; Stanovich et al., 1984) report factor analysis of phonemic awareness tasks load on only one factor. Given that
phonemic awareness develops in a gradual progression, some phonemic awareness tasks are more difficult than others (Bruce, 1964; Foorman & Moats, 2004; Perfetti et al., 1987; Stahl & Murray, 1994; Yopp, 1988); thus, different measures of phonemic awareness may be needed to effectively assess student growth. Rather than relying on a single measure to evaluate phonemic awareness, the Comprehensive Test of Phonological Processing (CTOPP; Wagner et al., 1999) provides subtest scores and a composite score useful for evaluating phonemic awareness. Because this test provides several measures of phonemic awareness, it is more likely to capture growth in phonemic awareness and less likely to exhibit ceiling effects for kindergarten students.

The CTOPP is a standardized, norm-referenced measure with a version specifically designed for five and six year-old students. Normative information is provided by the half year. Each of the three subtests used for this study include 20 items which helped to provide adequate floors and ceilings. Concurrent validity for this measure is established with other measures including the Lindamood Auditory Conception Test (Lindamood & Lindamood, 1979) and the Woodcock Reading Mastery Test-R (Woodcock, 1987). Reliability for the phonological awareness subtest measures range from .84 to .89 (Rashotte, MacPhee, & Torgesen, 2001).

**Alphabet Knowledge**

This study assessed student knowledge of letter names and letter sounds. Previous studies have confirmed the importance of letter knowledge for reading achievement and have shown tests of letter knowledge to be highly predictive of later reading achievement (Adams, 1990; Duncan & Seymour, 2000; Muter & Diethelm, 2001;
Snow et al., 1998; Treiman & Kessler, 2003; Treiman et al., 1994, 1997; Vellutino & Scanlon, 2001). Scarborough (1998) reported that letter sounds and letter names are not completely overlapping. Blaiklock (2004) stated “Future studies should consider both letter-name knowledge and letter-sound knowledge as these types of knowledge develop at different rates and have different relationships with phonological awareness and reading” (p. 53).

Student letter knowledge was assessed using the Letter Identification task, a subtest from Clay’s (2002) Observation Survey of Early Literacy Achievement. This test measures ability to identify all 26 upper-case letters and 28 lower-case letters (includes the “printer’s” form of a and g). In a recent study, Denton, Ciancio, and Fletcher (2006) reported a .65 Pearson correlation with the Woodcock-Johnson III Letter-Word Identification for the beginning of first grade. Alternate forms are not available, but this “... measure would be unlikely to have a practice effect, because it requires students to identify all uppercase and lowercase letters” (Denton et al., p. 31). Additionally, the measurement task was discontinued after eight consecutive failures (Foy & Mann, 2006). Reliability coefficients are reported as .97 (Clay, 1993) and .95 (Pinnell, McCarrier, & Button, 1990).

Although standard instructions for this test allow students to provide a name, a sound, or a word beginning with the letter in order to identify the child’s preferred mode of identification, Clay (2002) includes optional administration procedures of asking only for the sound of each letter. Furthermore, Denton et al. (2006) stated, “The utility of the OS Letter Identification task might be improved by requiring the child to supply only letter names or only letter sounds” (p. 31). Using this assessment as a measure of
alphabet knowledge, Stahl and Murray (1994) had students identify letters by name only. Stuart (1995) also had students supply letter names when administering this test in a study of predictive validity of phonological awareness and letter-sound correspondence tasks. Hatcher et al. (2006) used this measure to assess student knowledge of letter sounds only, while Foy and Mann (2006) used this measure for assessing knowledge of letter sounds and letter names. This study used the Observation Survey Letter Identification task as a measure of letter name knowledge and letter sound knowledge by asking students to complete the assessment the first time providing only letter names and then a second time providing only letter sounds.

Word Reading

The ability to quickly and accurately read sight words and to decode unfamiliar words is critical to overall reading ability and indicative of skilled readers (Adams & Huggins, 1985; Ehri, 2005; Foorman & Moats, 2004; McKeown, 1985; Stanovich, 1993-94; Torgesen, 1998, 2002). Wood et al. (2005) found word reading to account for 17% of student variance in first-grade reading ability. As Stahl and Murray (1994) pointed out, the “ability to decode words not previously seen . . . often measured by pseudo word decoding tasks, is the hallmark of children who read well” (p. 232). Children’s ability to read words has also been shown to exhibit a reciprocal relationship with ability to write words (Domico, 1993; Richgels, 1995).

This study evaluated student ability to read sight words and to decode unfamiliar words using the Test of Word Reading Efficiency (TOWRE; Torgesen et al., 1999). This standardized, nationally-normed measure has two subtests. The Sight Word Efficiency
subtest measures the number of words accurately identified in 45 seconds. The Phonetic Decoding Efficiency subtest measures the number of accurately decoded nonwords in 45 seconds. Each subtest has two forms. Extensive validity of the TOWRE test has been established. Reliability is .93 for the sight word subtest and .94 for the nonword decoding subtest (Rashotte et al., 2001).

Explanatory Measures

Previous research suggests the relationship of early reading skills and explanatory variables (Chall, 1996; Leppanen et al., 2004; Snow et al., 1998; Taylor & Pearson, 2002). Clements, Reynolds, and Hickey (2004) identified three factors that contribute independently to learning outcomes in early childhood instruction: individual factors, school factors, and program factors. In an effort to further refine the study in order to accurately portray any differences in writing instructional methods on the acquisition of early reading skills, data were collected for use as covariates in the statistical analysis to evaluate factors of potential importance at the individual student level including gender, race or ethnicity, and socioeconomic status. Variables at the classroom level were measured to ensure comparability of participating classrooms. Data were also collected at the program level to evaluate fidelity of implementation of the treatment and comparison writing instructional methods. Explanatory variables considered in this study are shown in Table 5.
Table 5

Design Matrix of Explanatory Measures

<table>
<thead>
<tr>
<th>Level</th>
<th>Variable</th>
<th>Indicator</th>
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<tbody>
<tr>
<td>Student Level</td>
<td>Gender</td>
<td>School Records</td>
</tr>
<tr>
<td></td>
<td>Ethnicity and ESL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SES (Free/reduced lunch status)</td>
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<tr>
<td>Classroom Level</td>
<td>Literacy Environment</td>
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<tr>
<td>Program Level</td>
<td>Writing Instruction Fidelity</td>
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<td></td>
<td></td>
<td>Intervention Validity Checklist</td>
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</tbody>
</table>

Student Level Explanatory Variables

Student level explanatory variables were of potential interest for this study due to possible effects on outcome measures. Student level explanatory variables provided information for the second level in the multilevel model of data analysis. Student level predictor variables included gender, race/ethnicity, and socioeconomic status.

Gender

The relationship of gender and literacy achievement for beginning readers is not clearly established. Some studies indicate that gender is a weak predictor of reading achievement (Badian, 1994, 1998; Scanlon & Vellutino, 1996; Scarborough, 1998; Share et al., 1984). However, other studies report that gender plays a role in literacy achievement, typically favoring girls (Berninger & Fuller, 1992; Christian, Morrison, &
Bryant, 1998; Coker, 2006; Englehard et al., 1991; Knudson, 1995; Lynch, 2002; Peterson, 2006). At the release of the 2002 National Assessment of Educational Progress (NAEP) The Nations' Report Card for writing, Plisko (2003) stated, “There are substantial performance gaps between males and females at all three grades, with female students outscoring their male counterparts” (p. 1). In 2002, female students' average writing scale score was higher than male students' by 17 points at grade 4, 21 points at grade 8, and 25 points at grade 12. This gender gap in writing scale scores has been documented in results of both national writing assessments (1998 and 2002). Although not as severe, this gender gap is also demonstrated on the 2005 Nation’s Report Card on reading (Perie, Grigg, & Donahue, 2005) with female students' average scale score higher than scores for male students by 5 points at grade 4, 10 points at grade 8, and 13 points at grade 12. Information on student gender was obtained from school records as a factor of possible importance to this study.

Race/Ethnicity

Differences in literacy achievement levels have been shown to correlate with race and ethnicity (Clements et al., 2004; Coker, 2006; Meece & Kurtz-Costes, 2001). Results from the 2002 NAEP Nation’s Report Card on writing (Persky, Daane, & Washington, 2003) show Asian/Pacific Islander students and White students outperformed Black and Hispanic students at all three grades in writing, with a 21 point difference for average scores of white students and black students and 19 point difference for average scores of white students and Hispanic students. Results from the 2005 Reading Report Card (Perie et al., 2005) show gaps at all three grade levels, with an average difference of 28 points.
for scores of white students and black students and 24 points for scores of white students and Hispanic students. Early Childhood Longitudinal Study data indicate that by kindergarten, twice as many Asian American students score in the top quartile in overall reading performance than do African American and Hispanic (National Center of Educational Statistics, 2000). Information on student ethnicity and English as a second language was obtained from student records, and confirmed by participating teachers, as a student level variable for data analysis.

**Socioeconomic Status**

Previous research has documented a relationship between socioeconomic status and reading achievement (Bowey, 1995; Dickinson & McCabe, 2001; Duncan & Seymour, 2000; Entwisle, Alexander, & Olson, 2007; Molfese, Modglin, & Molfese, 2003). Clements et al. (2004) reported that socioeconomic status serves as an index to social and educational supports of a community; thus, the level of concentrated poverty within a school area is an important negative predictor of student outcomes, independent of child and family attributes. In a review of 93 studies, the average correlation for school socioeconomic status and student achievement level was .68; while in 174 studies, the average correlation for individual socioeconomic status and student achievement level was .23, indicating socioeconomic differences between sites account for greater variability than socioeconomic differences within sites (White, as cited in Scarborough, 1998). The two elementary schools within the district identified for this study have similar levels of socioeconomic status. However, socioeconomic status at the individual level impacts literacy outcome measures. Results from the 2002 NAEP Nation’s Report
Card on writing (Persky et al., 2003) show students at the fourth grade level eligible for free or reduced-price lunch have average scaled scores in writing 20 points lower than students who are ineligible for free or reduced-price lunch. Students qualifying for free or reduced-price lunch exhibit average scale scores in reading 27 points lower than students who do not qualify (Perie et al., 2005).

Eligibility for free or reduced-price lunch under the National School Lunch Program is an indicator of socioeconomic status. Family income at or below 130% of the poverty level qualify children as eligible for free meals and income between 130% and 185% of the poverty level qualify children as eligible for reduced-price meals (USDA, 2007). In an effort to evaluate effects of socioeconomic status at the student level, information was collected of eligibility for free and reduced-price lunch.

*Initial Level of Student Literacy*

Even at the beginning of kindergarten, students exhibit a wide range of literacy skills (Adams, 1990; Christian et al., 1998; Dickinson & Tabors, 2001; Hart & Risley, 1995; Leppanen et al., 2004; Senechal & LeFevre, 2002; Smith & Dickinson, 1994; Snow, Burns, & Griffin, 1998). These initial levels of literacy can be an indicator of home influences and cognitive abilities. There is research suggesting that the initial level of reading is associated with subsequent growth in reading. In a study of 142 kindergarten students, McBride-Chang, Wagner, and Chang (1997) found a .51 correlation between initial phonological awareness and growth in phonological awareness, leading to the conclusion that “. . . ability and practice effects interact, bringing further up those who are skilled and leaving behind those who are unskilled. . .”
A study by Bast and Reitsma (1997) of 234 students from kindergarten through third grade found levels of initial decoding ability were predictive of growth of decoding over time. Because students with an initial advantage in early literacy skills may improve at a faster rate than students who began with lower abilities (Leppanen et al., 2004; Stanovich, 1986), this was a variable of importance for this study.

Initial literacy level was based on assessments at time one in this study. Because the multilevel analyses will evaluate trends in growth over time within students and between students, initial literacy level will not be included as a separate predictor variable in the analyses. Initial literacy level is presented as part of the student level demographic information to indicate comparability of instructional groups at the beginning of the study.

*Classroom Level Explanatory Variables*

In addition to individual student factors, differences in outcome measures may be affected by classroom or school level factors (Clements et al., 2004). However, using the first 4 waves of data from the kindergarten cohort of the Early Childhood Longitudinal Study, McCoach, O’Connell, Reis, and Levitt (2006) found student-level variables (including socioeconomic status, ethnicity, and gender) were better able to explain between-schools variability in students’ initial reading scores and students’ reading growth than school-level variables (percentage of minority students, percentage of free-lunch students, and school sector). In fact, none of the school-level variables had a statistically significant influence to explain the between-schools variability in reading growth rates (McCoach et al.). Because of the number of kindergarten class sessions was
eight, the number of teachers was five, and the number of schools was only two, this study did not include an additional class, teacher or school level in the analysis as there was not enough power at these levels to detect statistical significance.

However, data were gathered at the classroom level to show comparability of participating classrooms and to provide another level of detail about this study. These data were treated as a fixed effect in the statistical analysis. Random assignment to the treatment or comparison group combined students from within other classes for writing instruction from the randomly assigned teacher, which helped to somewhat control for differences. One class level factor left to consider was classroom literacy environment.

Classroom environment has been shown to affect literacy growth (Clark & Kragler, 2005; Morrow & Weinstein, 1986; Neuman, 1999; Roskos & Neuman, 2001). Therefore, to thoroughly investigate this potential factor, classroom literacy environment was evaluated using two measures: (1) The Classroom Literacy Environment Profile (CLEP; Wolfersberger, Reutzel, Sudweeks, & Fawson, 2004), and (2) the Early Language and Literacy Classroom Observation Toolkit, Research Edition (ELLCO; Smith, Dickinson, Sangeorge, & Anastasopoulos, 2002a).

The Classroom Literacy Environment Profile (CLEP; Wolfersberger et al., 2004) was used to gather information about individual classroom environments. This observation tool is designed to evaluate the literacy environment of early childhood and elementary classrooms, grades K-6. Generalizability studies conducted with the CLEP showed an acceptable level of generalizability (G Coefficient = .85) is obtained with two raters on one occasion (Wolfersberger et al.). The CLEP evaluates several environmental aspects of a classroom, including: (1) provisioning the classroom with literacy tools; (2)
arranging classroom space and literacy tools; (3) promoting student interest in literacy events; and (4) sustaining student interaction with literacy tools.

The Classroom Observation section of the *Early Language and Literacy Classroom Observation Toolkit, Research Edition* (ELLCO; Smith et al., 2002a) was also used to confirm relative equality of the classroom environments. This observation tool is reported as being sensitive to change over time and has been used in research studies for Head Start and the Literacy Environment Enrichment Project as a pre, mid, and post intervention measure (Smith, Dickinson, Sangeorge, & Anastasopoulos, 2002b). The Classroom Observation yields three scores: General Classroom Environment subtotal; Language, Literacy, and Curriculum subtotal; and overall score. Cronbach’s alpha \( n = 308 \) = .90 for the Classroom Observation overall score. The Classroom Observation has been used in classrooms from kindergarten to fifth grade to determine contributions of classroom quality to early literacy scores accounting for “67% of between classroom variance in early literacy” (Dickinson, as cited in Smith et al., 2002a, p. 11).

**Program Level Explanatory Variables**

Outcome measures can be affected by fidelity of program implementation (Dumas, Lynch, Laughlin, Smith, & Prinz, 2001; Hall & Loucks, 1977; Mowbray, Holter, Teague, & Bybee, 2003; O’Donnell, 2008; U.S. Department of Education, 2007). Fidelity of implementation refers to how well an intervention is implemented in comparison with the intended use or how well actual use matches the ideal (Fullan & Pomfret, 1977; O’Donnell). Gresham, MacMillan, Beebe-Frankenberger, and Bociant (2000) regarded fidelity as one of the most important aspects of instructional
investigations, reflecting the accuracy and consistency of the implementation of the treatment. Disregard of fidelity of implementation can lead to false assumptions and misleading interpretations about the effects of the treatment being studied (Hall & Loucks, 1977). Consideration of fidelity provides another level of detail about the intervention and is an important aspect of investigation and application of instructional procedures (Gresham, 1989; Summerfelt, 2003). Criteria for fidelity of implementation include length and duration of the intervention, and adherence to quality of content and procedures (Mowbray et al.; O’Donnell).

To gauge the degree to which instructional procedures were delivered as planned, this study incorporated an intervention validity checklist to identify specific components of an intervention (Vaughn, Hughes, Schumm, & Klingner, 1998). A two-year study by Wold (2003), which examined implementation of interactive writing lessons, produced a list of teacher behaviors during interactive writing instruction. Lyons and Pinnell (2003) also created An Interactive Writing Analysis Scale to evaluate interactive writing lessons. Using these two sources, an intervention validity checklist was developed to specify components of interactive writing. A similar intervention checklist was created using the well-established components of writing workshop (Calkins, 1986). Each checklist was incorporated into an instructional log, which participating teachers completed daily. These checklists provided information on inclusion of specific instructional components. An additional component of this instructional log was inclusion of a brief description of one of the lessons completed that week and sample of writing samples.

This checklist was also integrated into a classroom observation form. This classroom observation form was used for formal data collection during three observations
of each participating teacher, occurring in September, October, and November. (Informal classroom visits averaged once per week.) The first two formal observations were unannounced. The third observation was scheduled with the teacher because a specialist in Early Childhood Education completed the classroom observation as an independent evaluator. The observation form was modified slightly after the first observation.

Initially, the observation form was designed to be a quantitative count of the number of components incorporated into a lesson. However, to increase the usefulness of the tool, a 5-point Likert scale was added to provide information on the quality of each instructional component. The first observation was recoded to this modified form. This observation checklist provided a simple measure, useful for this particular study, on fidelity of implementation of writing instruction (see Appendix B).

Another way to measure treatment fidelity is time (Gresham at el., 2000). Although time for the intervention was established as 15 minutes per day, the actual time dedicated to writing instruction was detailed as part of the instructional log. Writing time at each school was coordinated between teachers in order for students to receive instruction in their randomly assigned group. However, teachers maintained separate writing instruction logs, which provided a built-in check for comparing dedicated writing instruction time between teachers. These measures provided data for analysis of fidelity of writing instruction over time and within lessons.
Method of Data Analysis

Analysis of data collected from 151 kindergarten students over a sixteen-week period sought to investigate the effect of interactive writing instruction on kindergarten children’s acquisition of early reading skills. Specifically, this study evaluated how interactive writing impacts kindergarten student development in early reading skills as measured by: (a) phonemic awareness, (b) alphabet knowledge, and (c) word reading.

Descriptive statistics were computed to evaluate distributions of the study variables using SPSS Version 15. Multilevel modeling was used to test the study hypothesis. In this study, outcome measures were nested within students and students were nested within treatments; thus, the use of a multilevel modeling was appropriate for data analysis so the interdependency of levels could be taken into account when measuring changes in student achievement (Bryk & Raudenbush, 1992; Hox, 1998, 2002; Hox & Kreft, 1994; Hox & Maas, 2005; Willett, 1988; Willms, 1992).

Multilevel modeling also allows examination of within-level interactions and cross-level interactions; a multilevel model allows for prediction of individual scores adjusted for group differences and prediction of group scores adjusted for individual differences within groups (Snijders, 2003; Tabachnick & Fidell, 2007; Willett & Singer, 2003). Multilevel models are generally more conservative and result in more accurate significance tests than models that do not consider clustering or nesting (Goldstein, 2003; Van Keer & Verhaeghe, 2005).

A two-level model was used to evaluate the impact of interactive writing and writing workshop on students’ acquisition of early reading skills. Repeated outcome
measures at four points in time (Level 1) were clustered within students (Level 2). Students were also clustered within classes, teachers, and schools. Theoretically, a third level could have been modeled (classroom/teacher level), but due practical and fiscal constraints related to the limited number of units at this level, this was not feasible (Maas & Hox, 2004). To partially account for the inability to include a third level in the model, variables related to the classroom (i.e., literacy environment) were treated as fixed predictors at the second-level rather than specifying a third level of analysis (Tabachnick & Fidell, 2007). The multilevel model accounted for the effects of classroom grouping through clustering or nesting. Level 1 data consisted of the repeated outcome measures (four waves or points in time x 151 students) for phonemic awareness \((n = 604)\), alphabet knowledge \((n = 604)\), and word reading \((n = 604)\). Level 2 data consisted of information about the participating students \((n = 151)\) including gender, ethnic category, English as a second language, and socioeconomic status. This level also included the predictors for teacher and school. The multilevel structure of this analysis is illustrated in Figure 1.

Data Entry

All original student measures were checked for accuracy of scoring by an independent evaluator. All data were entered after completion of the four testing points to avoid bias or pre assumptions of the study results. Twenty-five percent of the student measures were randomly selected and checked for accuracy of data entry by a senior researcher with an independent research company. No discrepancies were found.
Level 2—Between Subjects

- Predictors =
  Writing Instructional Group  Fidelity of Instruction
  Gender  Ethnic Category  English as Second Language  Socio-economic Status

Figure 1. Layout of the multilevel data.
Data Transformations

To prepare the data for multilevel modeling, continuous data were centered as recommended by Hox (2002), Kreft, de Leeuw, and Aiken (1995), Raudenbush and Bryk (2002), using SPSS Version 15. Centering helps to reduce multicollinearity when interactions are introduced, thereby promoting statistical stability without changing the model (Hox; Tabachnick & Fidell, 2007). Therefore, data for fidelity of implementation were centered around the grand mean. Dichotomous data were coded as dummy variables of zero and one (i.e., gender, ethnic category, ESL, SES). For example, data for socio-economic status were entered as zero for students qualifying for free and reduced-price lunch and as one for students who did not qualify for free and reduced-price lunch. The treatment variable was also coded with a dummy variable using the values of zero for writing workshop and one for interactive writing.

Developing the Multilevel Linear Models

This study used a two-level model to investigate the relationships among the data. The first level was repeated measures over time; the second was student level. The intercept and slope coefficients are treated as random coefficients. Residuals were assumed normally distributed with a mean of 0 and variance $\sigma^2$ (the lowest level residual errors).

Level Models. Multilevel analysis for this study involved two stages. In multilevel analysis, it is important to consider variance between and among levels (Hox, 2002; Kreft & de Leeuw, 1998). If intraclass correlation exists, Kreft and de Leeuw argue the
assumption of independent observations has been violated and multilevel analysis is 
appropriate rather than traditional linear model analysis.

In the first stage, the unconditional growth model (with only time as the predictor) 
was developed to estimate the proportion of variance in the dependent variable found at 
the respective model levels as recommended by Singer and Willett (2003). This model 
was also the Level 1 model due to the longitudinal design of this study. The second stage 
of the multilevel analysis developed the ‘intercept as outcomes model’ (Raudenbush & 
Bryk, 2002). For this study, this involved identifying the final fitted Level 2 model. 
Multilevel data analysis was conducted using the program Mplus, version 5.0 (Muthén & 
Muthén, 2007).

First Stage, Level 1 Model. A hierarchical system of regression equations can 
represent the multilevel model (Hox, 2000). Equation 3.1 specifies the model for Level 1; 
this unconditional growth model represented the repeated measures over time. In the 
Level 1 equation:

\[ Y_{ij} \] represented the early reading skills outcome for time \( t \) in student \( j \),

\[ \pi_{0i} \] represented the intercept for the outcome measure,

\[ \pi_{1t} \] represented the regression coefficient (regression slope) for the relationship 
between the outcome variable and time

\[ T \] represented time,

\[ e \] was the residual error term,

\[ i \] was the repeated measurement,

and

\[ j \] represented the student.
Equation 3.1: \( Y_{ij} = \pi_{0i} + \pi_{1i}T_{ti} + e_{ti} \)

Thus, for example, Equation 3.1 could read:

*Early Reading Skill = intercept + regression slope * time + residual error.*

*Second Stage, Level 2 Model.* The second stage of multilevel analysis developed the ‘intercept as outcomes model’ (Raudenbush & Bryk, 2002). For this study, this began with an alternative model consisting of the hypothesized main effects and proceeded to identify the final fitted Level 2 model. The Level 2 model predicts the intercept and slope presented in Equation 3.1 as shown by Equations 3.2 and 3.3.

Equation 3.2: \( \pi_{0i} = \beta_{00} + \beta_{01}Z_{ti} + u_{0i} \)

Equation 3.3: \( \pi_{1i} = \beta_{10} + \beta_{11}Z_{ti} + u_{1i} \)

In Equation 3.2, the average outcome measure (intercepts) are predicted by Level 2 predictor variables, such as \( Z_{ti} \), which could represent a treatment effect. In this equation:

\( \beta_{00} \) represents the overall intercept,

and

\( \beta_{01} \) represents the overall regression coefficient for the slope between a Level 2 predictor \((Z)\) and the dependent variable.

In Equation 3.3:

\( \beta_{00} \) represents the overall slope for the randomly varying predictor specified in Equation 1.

Various predictors can be also be included (e.g., Treatment) at this level to explain the relationship between an outcome measure and the randomly varying slopes (e.g., Time), thus forming a cross-level interaction \((\beta_{11}, \text{between Treatment and Time})\). Interactions
among Level 2 predictors were also included in this model represented by Equation 3 (e.g., Treatment x Ethnicity). In both equations, \( u \) represents the error.

The multilevel model can also be written as a single equation:

\[
Y_{ij} = [\beta_{00} + \beta_{01}Z_{ti} + \beta_{10} + \beta_{11}Z_{ti}] + [u_{0i} + u_{0i} + e_{it}]
\]

Thus, the hypothesized main effects model for this study was:

**Early Reading Skill Outcome Variable = \( \beta_{00} + \beta_{10}(\text{Time}_{it}) + \beta_{01}(\text{Tx}) + \beta_{02} \)**

\( (\text{fidelity}) + \beta_{03} (\text{gender}) + \beta_{04} (\text{ethnic category}) + \beta_{05} (\text{ESL}) + \beta_{06} (\text{SES}) + \beta_{11}(\text{Tx}_i * \text{Time}_{it}) + \beta_{12} (\text{fidelity}_i * \text{Time}_{it}) + \beta_{13} (\text{gender}_i * \text{Time}_{it}) + \beta_{14} (\text{ethnic category}_i * \text{Time}_{it}) + \beta_{15} (\text{ESL}_i * \text{Time}_{it}) + \beta_{16} (\text{SES}_i * \text{Time}_{it}) + \text{error}. \)

Level 2 model development began by including all student-level explanatory variables identified as having possible importance to the outcome. Using backward elimination, a series of analyses were completed to create a more parsimonious model by trimming nonsignificant variables. Other than the treatment variable, variables with individual \( p \) values larger than .05 were removed from the model one variable at a time. Guiding the analyses were the considerations of: (1) Does the writing intervention affect the early reading skill being modeled, and (2) Does the writing intervention interact with individual-level demographic variables?

Using the multilevel modeling techniques, this study sought to examine the effect of interactive writing instruction on growth of early reading skills. The null hypothesis for this question stated: Using a 2-level model to hold constant student level differences, with the three identified components of early reading skills as the outcome variables, the predictor variable for random assignment to interactive writing will not be statistically
significant \((p < .05)\). If this predictor variable proved statistically significant in the model for predicting early reading skills, then the argument that interactive writing instruction promotes development of early reading skills is strengthened.

Summary

The purpose of this study was to investigate the effect of interactive writing instruction on kindergarten students’ acquisition of the early reading skills represented by: (a) phonemic awareness, (b) alphabet knowledge, and (c) word reading. This study employed a repeated-measures experimental design involving 151 kindergarten student participants and 5 teacher participants randomly assigned to the writing instructional groups. Participants in the four treatment groups received instruction in interactive writing. Participants in the four comparison groups received instruction in writing workshop.

Data were collected at four points during the sixteen-week study from all participants using valid, reliable outcome measures that included the Comprehensive Test of Phonological Processing (Wagner et al., 1999), the Observation Survey of Early Literacy Achievement Letter Identification Task (Clay, 2002), and the Test of Word Reading Efficiency (Torgesen et al., 1999). Data were collected for explanatory factors of potential importance including gender, ethnicity, socioeconomic status, classroom literacy environment, and fidelity of implementation of writing instruction. Multilevel modeling was used to test the study hypothesis.
This study investigated the effect of interactive writing instruction on kindergarten children’s acquisition of early reading skills. This study employed a repeated-measures experimental design involving 151 kindergarten student participants randomly assigned to a treatment or comparison group. Early reading skills that enable students to identify individual words in print are typically learned quickly with a brief period of acquisition (Paris, 2005). Thus, measurement of any single early reading skill would likely not capture the rapid growth and development of reading in kindergarten. This study used repeated measurements of phonemic awareness, alphabet knowledge, and word reading to monitor acquisition of early reading skills. Multilevel modeling was used to evaluate the impact of interactive writing on early reading skills as repeated outcome measures at four points in time (Level 1) were clustered within students (Level 2).

Descriptive Statistics Results

Descriptive statistics were computed to examine distributions, measures of central tendency, and correlations, for preliminary investigation of study variables and differences between instructional groups.
Assumptions

Phonemic Awareness

Phonemic awareness was assessed using the Comprehensive Test of Phonological Processing (CTOPP; Wagner et al., 1999). CTOPP is a standardized, individually administered measure of phonological processing with a version specifically designed for 5- and 6- year old students. This measure is comprised of three subtests, Elision, Blending Words, and Sound Matching. Student performance is gauged by the composite score of the number of correct responses given for each of the 20-item subtests. Scores can theoretically range from zero to sixty. Reliability for the phonological awareness subtest measures range from .84 to .89 (Rashotte et al., 2001).

Examination of the score distributions revealed that scores were approximately normally distributed on three of the four assessments, with skew and kurtosis values less than 1. On the first CTOPP assessment, values were greater than one for skew (1.317) and kurtosis (2.455), indicating the initial score distribution was positively skewed. Figure 2 shows the distribution of the phonemic awareness outcome variable. Table 6 provides information on skewness and kurtosis for this variable. This outcome variable was acceptably distributed and was analyzed as a normal distribution.

Across the four administrations, CTOPP scores ranged from 0 to 56. The first assessment frame had 5 scores of 0 and one high score of 47. The fourth assessment frame had no scores of 0 and one high score of 54. There were 5 outliers in the first assessment point, with scores 2 standard deviations above the mean. Time points two and
three each have one outlier, resulting from scores by the same student. Figure 3 shows the outliers in phonemic awareness scores.

CTOPP score correlations across the four waves of data assessment ranged from a high of 0.899 between time points one and two, to a low of 0.763 between time point one and four (Table 7). The correlations are high, indicating a large degree of stability in scores across time.

Figure 2. Distribution of phonemic awareness outcome measure for each time point.
Table 6

Phonemic Awareness Outcome Skewness and Kurtosis

<table>
<thead>
<tr>
<th>Time</th>
<th>Statistic</th>
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<th>Limit</th>
<th>Statistic</th>
<th>SE</th>
<th>Limit</th>
<th>Limit</th>
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<td>1.12</td>
<td>.78</td>
<td>.39</td>
<td>.01</td>
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<tr>
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<td>.60</td>
<td>.20</td>
<td>.22</td>
<td>.99</td>
<td>-.06</td>
<td>.39</td>
<td>-.83</td>
</tr>
<tr>
<td>4</td>
<td>-.03</td>
<td>.20</td>
<td>-.42</td>
<td>.36</td>
<td>-.67</td>
<td>.39</td>
<td>-1.44</td>
</tr>
</tbody>
</table>

Figure 3. Box plots of phonemic awareness scores for the four time points.

Table 7

Correlation of Phonemic Awareness Outcome Measures

<table>
<thead>
<tr>
<th>Time</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.90</td>
<td>0.80</td>
<td>0.76</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>0.88</td>
<td>0.83</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>0.89</td>
<td></td>
</tr>
</tbody>
</table>
Alphabet Knowledge

Student knowledge of letter names and sounds was evaluated using the Letter Identification task, a subtest of Clay’s (2002) Observation Survey of Early Literacy Achievement. This test measures ability to identify all 26 upper-case letters and 28 lower-case letters (includes the “printer’s” form of a and g). Reliability coefficients are reported as .97 (Clay, 1993) and .95 (Pinnell et al., 1990).

Distribution of scores for this measure exhibited skewness for time points three (-1.29) and four (-2.45). Kurtosis was highest in time point four (6.89). Figure 4 shows the distribution of the alphabet knowledge outcome variable. Table 8 provides information on skewness and kurtosis. Data transformations did not alleviate the problems with distribution. Therefore, the data were analyzed in violation of the assumption of normal distribution.

The number of correct responses given for the letter name and letter sound was used for the composite score representing alphabet knowledge. Scores could range from 0 to 108, which was the case during the four waves of administration. The first assessment frame had 23 scores of 0, representing floor effects of the measure for 15.2% of the sample. There were 7 scores of 0 at time two (4.6%), and no scores of 0 at time three. On the high end, there were 2 scores of 108 at times one and two (1.3% of the sample), 6 at time three (4%), and 16 at time four (10.6%). There were outliers at time point three, with 8 students scoring < 26, two standard deviations below the mean. At time point four, there were outliers due to 8 students scoring < 56, two standard deviations below the mean. Figure 5 shows the outliers in alphabet knowledge scores.
Correlations across the four time points of data assessment for alphabet knowledge also showed stability across time, ranging from a high of 0.893 between time point one and two, to a low of 0.585 between time point one and four (Table 9).

Figure 4. Distribution of alphabet knowledge outcome measure for each time point.
Table 8

*Alphabet Knowledge Outcome Skewness and Kurtosis*

<table>
<thead>
<tr>
<th>Time</th>
<th>Statistic</th>
<th>SE</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
<th>Statistic</th>
<th>SE</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
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<td>-.02</td>
<td>.76</td>
<td>-1.00</td>
<td>.39</td>
<td>-1.77</td>
<td>-.23</td>
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<td>-.41</td>
<td>.20</td>
<td>-.79</td>
<td>-.02</td>
<td>-1.15</td>
<td>.39</td>
<td>-1.91</td>
<td>-.38</td>
</tr>
<tr>
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<td>-1.29</td>
<td>.20</td>
<td>-1.68</td>
<td>-.90</td>
<td>.80</td>
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<td>1.56</td>
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<td>4</td>
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<td>.20</td>
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<td>-2.06</td>
<td>6.89</td>
<td>.39</td>
<td>6.11</td>
<td>7.66</td>
</tr>
</tbody>
</table>

Figure 5. *Box plots of alphabet knowledge scores for the four time points.*

Table 9

*Correlation of Alphabet Knowledge Outcome Measures*

<table>
<thead>
<tr>
<th>Time</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.89</td>
<td>.75</td>
<td>.59</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>.86</td>
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</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>.87</td>
<td></td>
</tr>
</tbody>
</table>
Word Reading

Ability to read sight words and to decode unfamiliar words was measured using the Test of Word Reading Efficiency (TOWRE; Torgesen et al., 1999). This standardized, nationally normed measure has two subtests. The Sight Word Efficiency subtest measures the number of words accurately identified in 45 seconds. The Phonetic Decoding Efficiency subtest measures the number of accurately decoded nonwords in 45 seconds. Reliability is .93 for the sight word subtest and .94 for the nonword decoding subtest (Rashotte et al., 2001).

Score distributions for this measure were not normally distributed (Figure 6) and exhibited skewness and kurtosis for each of the four time points (Table 10). At time point one, 130 students (86%) had a score of 0; 121 (80%) at time point two, 83 (55%) at time point three, and 47 (31%) at time point four. There were also outliers in this measure resulting from the top 10% of students scoring more than 1 standard deviation above the mean on the task. The most extreme outlier resulted from one student reading 71 words in 90 seconds at the fourth time point, almost 5 standard deviations above the mean. Figure 7 shows the outliers in word reading scores.

As was expected, this outcome measure resulted in a large proportion of scores of zero for several time points; data transformations cannot change this result. Therefore, attempts were made to recode and analyze this as a binary variable and a categorical variable. Again, this did not successfully address the problem. The Poisson distribution is a better fit for these data than a normal distribution because the results are nonnegative whole numbers and the distribution is positively skewed (Long, 1997). Because of the high frequency of zeros in the data, a zero-inflated Poisson is best to reflect the zeros in
the coefficients portion of the model (Atkins & Gallop, 2007). Therefore, this outcome variable was analyzed using a zero-inflated Poisson model.

Correlations for word reading ranged from 0.825 between time point one and two, to 0.761 between time point one and four, again indicating stability in scores across time for this measure (Table 11).

Figure 6. Distribution of word reading outcome measure for each time point.
Table 10

*Word Reading Outcome Skewness and Kurtosis*

<table>
<thead>
<tr>
<th>Time</th>
<th>Skewness Statistic</th>
<th>SE</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
<th>Kurtosis Statistic</th>
<th>SE</th>
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<th>Upper Limit</th>
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<td>9.58</td>
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<tr>
<td>4</td>
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<td>2.60</td>
<td>6.41</td>
<td>.39</td>
<td>5.64</td>
<td>7.19</td>
</tr>
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</table>

*Figure 7. Box plots of word reading scores for the four time points.*

Table 11

*Correlation of Word Reading Outcome Measures*

<table>
<thead>
<tr>
<th>Time</th>
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<tr>
<td>3</td>
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<td>0.83</td>
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Descriptive statistics for the outcome measures across time points are shown in Tables 12-14. The average gain of mean scores of students on the phonemic awareness measure was 15 points, from a mean score at time one of 12.36 to a mean score at time four of 27.44. Growth between time points was consistent, with an average of 5.18 point increase between time points. Student knowledge of letter names and sounds more than doubled during the sixteen-week study, from an initial mean of 41.44 to 94.74, an average gain of 53 letter names and/or sounds. Growth of alphabet knowledge was consistent over time for the group, averaging about 18 letter names or sounds per time point. Word reading ability increased from a mean of 1.34 at time one to 9.36 at time four. The greatest period of increase for word reading ability was from time points three and four, an average of 4.26 words as compared 1.14 words from time point one to time point two.

Comparison of scores by writing instructional group shows student growth to be equivalent over time for each of the three outcome measures. Descriptive statistics for the outcome variables by assignment to writing instructional group are shown in Tables 15-17. Information on these same statistics by assignment to writing instructional group for the four repeated measures is presented in Tables 18-20. Figures 8-10 show this information in line graphs. Descriptive statistics for this study indicated there was no statistically significant difference ($p < .05$) between the interactive writing group and the writing workshop group for any of the outcome measures at any of the time points (Table 21).
Table 12

**Phonemic Awareness Outcome Measure Descriptive Statistics**

<table>
<thead>
<tr>
<th>Time</th>
<th>Mean Statistic</th>
<th>SE Statistic</th>
<th>Median Statistic</th>
<th>SD Statistic</th>
<th>Variance Statistic</th>
<th>Minimum Statistic</th>
<th>Maximum Statistic</th>
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<tr>
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<td>12.36</td>
<td>.69</td>
<td>11</td>
<td>8.50</td>
<td>72.14</td>
<td>0</td>
<td>47</td>
</tr>
<tr>
<td>2</td>
<td>16.89</td>
<td>.72</td>
<td>16</td>
<td>8.90</td>
<td>79.13</td>
<td>0</td>
<td>49</td>
</tr>
<tr>
<td>3</td>
<td>21.81</td>
<td>.85</td>
<td>20</td>
<td>10.43</td>
<td>108.75</td>
<td>4</td>
<td>56</td>
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<tr>
<td>4</td>
<td>27.44</td>
<td>.86</td>
<td>28</td>
<td>10.45</td>
<td>109.20</td>
<td>4</td>
<td>54</td>
</tr>
</tbody>
</table>

Table 13

**Alphabet Knowledge Outcome Measure Descriptive Statistics**

<table>
<thead>
<tr>
<th>Time</th>
<th>Mean Statistic</th>
<th>SE Statistic</th>
<th>Median Statistic</th>
<th>SD Statistic</th>
<th>Variance Statistic</th>
<th>Minimum Statistic</th>
<th>Maximum Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>41.44</td>
<td>2.71</td>
<td>37.00</td>
<td>33.34</td>
<td>1111.64</td>
<td>0</td>
<td>108</td>
</tr>
<tr>
<td>2</td>
<td>60.56</td>
<td>2.82</td>
<td>69.00</td>
<td>34.69</td>
<td>1203.58</td>
<td>0</td>
<td>108</td>
</tr>
<tr>
<td>3</td>
<td>80.88</td>
<td>2.22</td>
<td>93.00</td>
<td>27.24</td>
<td>742.20</td>
<td>1</td>
<td>108</td>
</tr>
<tr>
<td>4</td>
<td>94.74</td>
<td>1.48</td>
<td>102.00</td>
<td>18.01</td>
<td>324.36</td>
<td>3</td>
<td>108</td>
</tr>
</tbody>
</table>

Table 14

**Word Knowledge Outcome Measure Descriptive Statistics**

<table>
<thead>
<tr>
<th>Time</th>
<th>Mean Statistic</th>
<th>SE Statistic</th>
<th>Median Statistic</th>
<th>SD Statistic</th>
<th>Variance Statistic</th>
<th>Minimum Statistic</th>
<th>Maximum Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.34</td>
<td>.41</td>
<td>1.34</td>
<td>5.03</td>
<td>25.28</td>
<td>0</td>
<td>36</td>
</tr>
<tr>
<td>2</td>
<td>2.48</td>
<td>.61</td>
<td>2.48</td>
<td>7.46</td>
<td>55.61</td>
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<td>51</td>
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<tr>
<td>3</td>
<td>5.10</td>
<td>.81</td>
<td>5.10</td>
<td>10.00</td>
<td>100.06</td>
<td>0</td>
<td>63</td>
</tr>
<tr>
<td>4</td>
<td>9.36</td>
<td>1.02</td>
<td>9.36</td>
<td>12.39</td>
<td>153.49</td>
<td>0</td>
<td>71</td>
</tr>
</tbody>
</table>
Table 15

*Descriptive Statistics for Phonemic Awareness by Group Assignment*

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Mean &amp; SE</th>
<th>SD</th>
<th>Range</th>
<th>Skew &amp; SE</th>
<th>Kurtosis &amp; SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phonemic Awareness</td>
<td>604</td>
<td>19.59 (.45)</td>
<td>11.07</td>
<td>0 56</td>
<td>.57 (.10)</td>
<td>-.28 (.20)</td>
</tr>
<tr>
<td>Treatment Group</td>
<td>300</td>
<td>19.62 (.66)</td>
<td>11.47</td>
<td>0 56</td>
<td>.62 (.14)</td>
<td>-.17 (.28)</td>
</tr>
<tr>
<td>Comparison Group</td>
<td>304</td>
<td>19.56 (.61)</td>
<td>10.69</td>
<td>0 47</td>
<td>.50 (.14)</td>
<td>-.44 (.28)</td>
</tr>
</tbody>
</table>

Table 16

*Descriptive Statistics for Alphabet Knowledge by Group Assignment*

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Mean &amp; SE</th>
<th>SD</th>
<th>Range</th>
<th>Skew &amp; SE</th>
<th>Kurtosis &amp; SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alphabet Knowledge</td>
<td>604</td>
<td>69.07 (1.45)</td>
<td>35.61</td>
<td>0 108</td>
<td>-.69 (.10)</td>
<td>-.89 (.20)</td>
</tr>
<tr>
<td>Treatment Group</td>
<td>300</td>
<td>68.4 (2.09)</td>
<td>36.23</td>
<td>0 108</td>
<td>.63 (.14)</td>
<td>-1.00 (.28)</td>
</tr>
<tr>
<td>Comparison Group</td>
<td>304</td>
<td>69.73 (2.01)</td>
<td>35.04</td>
<td>0 108</td>
<td>-.76 (.14)</td>
<td>-.77 (.28)</td>
</tr>
</tbody>
</table>

Table 17

*Descriptive Statistics for Word Reading by Group Assignment*

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Mean &amp; SE</th>
<th>SD</th>
<th>Range</th>
<th>Skew &amp; SE</th>
<th>Kurtosis &amp; SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word Reading</td>
<td>604</td>
<td>4.55 (.39)</td>
<td>1.00</td>
<td>0 71</td>
<td>3.12 (.10)</td>
<td>12.07 (.20)</td>
</tr>
<tr>
<td>Treatment Group</td>
<td>300</td>
<td>4.99 (.61)</td>
<td>1.05</td>
<td>0 71</td>
<td>3.16 (.14)</td>
<td>12.59 (.28)</td>
</tr>
<tr>
<td>Comparison Group</td>
<td>304</td>
<td>4.11 (.49)</td>
<td>.95</td>
<td>0 50</td>
<td>2.90 (.14)</td>
<td>9.07 (.28)</td>
</tr>
</tbody>
</table>
Table 18

Descriptive Statistics for Phonemic Awareness by Time

<table>
<thead>
<tr>
<th></th>
<th>Treatment</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Comparison</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>76</td>
<td>76</td>
<td>76</td>
<td>76</td>
</tr>
<tr>
<td>Time</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>12.15</td>
<td>17.07</td>
<td>21.53</td>
<td>27.72</td>
<td>12.58</td>
<td>16.71</td>
<td>22.09</td>
<td>26.87</td>
<td></td>
</tr>
<tr>
<td>SE</td>
<td>1.01</td>
<td>1.072</td>
<td>1.23</td>
<td>1.27</td>
<td>.95</td>
<td>.98</td>
<td>1.18</td>
<td>1.12</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>8.74</td>
<td>9.28</td>
<td>10.66</td>
<td>11.03</td>
<td>8.29</td>
<td>8.56</td>
<td>10.26</td>
<td>9.79</td>
<td></td>
</tr>
<tr>
<td>Range--Min</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Range--Max</td>
<td>47</td>
<td>49</td>
<td>56</td>
<td>56</td>
<td>43</td>
<td>38</td>
<td>47</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>Mean Gain Score</td>
<td>4.92</td>
<td>9.38</td>
<td>15.57</td>
<td>4.13</td>
<td>9.51</td>
<td>14.29</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 8. Growth over time for phonemic awareness by writing instructional group.
Table 19

Descriptive Statistics for Alphabet Knowledge by Time

<table>
<thead>
<tr>
<th></th>
<th>Treatment</th>
<th></th>
<th>Comparison</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>76</td>
<td>76</td>
<td>76</td>
</tr>
<tr>
<td>$n$</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>76</td>
<td>76</td>
<td>76</td>
</tr>
</tbody>
</table>
| Time   | 1         | 2        | 3          | 4        | 1        | 2        | 3        | 4
| Mean   | 40.31     | 60.39    | 79.97      | 92.93    | 42.20    | 60.38    | 81.41    | 94.93|
| $SE$   | 3.97      | 4.02     | 3.36       | 2.46     | 3.76     | 4.05     | 3.06     | 1.95|
| $SD$   | 34.39     | 34.80    | 29.08      | 21.28    | 32.81    | 35.29    | 26.66    | 16.98|
| Range--Min | 0 | 0 | 1 | 7 | 0 | 0 | 5 | 3 |
| Mean Gain Score | 20.08 | 39.66 | 52.62 | | 18.18 | 39.21 | 52.73 |

*Figure 9. Growth over time for alphabet knowledge by writing instructional group.*
Table 20

Descriptive Statistics for Word Reading by Time

<table>
<thead>
<tr>
<th></th>
<th>Treatment</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>Time</td>
<td>1 2 3 4 1</td>
<td>2 3 4</td>
</tr>
<tr>
<td>Mean</td>
<td>1.64 2.93 5.59 9.81 1.05</td>
<td>2.03 4.62 8.75</td>
</tr>
<tr>
<td>SE</td>
<td>.66 .98 1.3 1.53 .49</td>
<td>.73 1.0 1.3</td>
</tr>
<tr>
<td>SD</td>
<td>5.74 8.45 11.22 13.21 4.23</td>
<td>6.35 8.69 11.35</td>
</tr>
<tr>
<td>Range--Min</td>
<td>0 0 0 0 0</td>
<td>0 0 0</td>
</tr>
<tr>
<td>Range--Max</td>
<td>36 51 63 71 27</td>
<td>39 43 50</td>
</tr>
<tr>
<td>Mean Gain Score</td>
<td>1.29 2.66 8.17</td>
<td>.98 3.57 7.70</td>
</tr>
</tbody>
</table>

Figure 10. Growth over time for word reading by writing instructional group.
Table 21

*Significance Tests for Outcome Measures over Time Comparing Treatment and Control Groups*

<table>
<thead>
<tr>
<th>Outcome Variable</th>
<th>Time</th>
<th>t</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phonemic Awareness</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>.31</td>
<td>149</td>
<td>.76</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>.25</td>
<td>149</td>
<td>.81</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>.33</td>
<td>149</td>
<td>.74</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>.45</td>
<td>146</td>
<td>.66</td>
<td></td>
</tr>
<tr>
<td>Alphabet Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>.28</td>
<td>149</td>
<td>.78</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>.07</td>
<td>149</td>
<td>.95</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>.24</td>
<td>149</td>
<td>.81</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>.62</td>
<td>146</td>
<td>.54</td>
<td></td>
</tr>
<tr>
<td>Word Reading</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>.72</td>
<td>149</td>
<td>.48</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>.75</td>
<td>149</td>
<td>.46</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>.59</td>
<td>149</td>
<td>.55</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>.50</td>
<td>146</td>
<td>.62</td>
<td></td>
</tr>
</tbody>
</table>

*Explanatory Variable Descriptive Statistics*

Data were collected on student, classroom, and writing program factors that contribute independently to learning outcomes in early childhood instruction (Clements et al., 2004). These covariate data were analyzed to examine impact on reading growth of the participating students. These factors included: gender, ethnicity, English as a second language, socioeconomic status, classroom literacy environment, and fidelity of implementation of the treatment and comparison writing instructional methods.
Student Level Predictor Variables

Information was collected for potentially outcome-relevant student background characteristics as indicated by other reported research (Chall, 1996; Coker, 2006; Entwisle et al., 2007; Leppanen et al., 2004; Meece & Kurtz-Costes, 2001; Peterson, 2006; Snow et al., 1998; Taylor & Pearson, 2002). A series of dummy coded variables identified gender, ethnicity, English as a second language, and socioeconomic status. Similarities were identified in preliminary analyses regarding the initial literacy status and growth of Asian students and non-Hispanic White students and similarities in the literacy performance of Hispanic students and Native American students. These similarities are also reflected in NAEP trends in reading and writing achievement for ethnic subgroups (Persky et al., 2003; Perie et al., 2005; Salahu-Din, Persky, & Miller, 2008). These similarities served as a basis for grouping students into two larger analytic categories for statistical analysis. The two categories were identified as Asian/White \( (n = 109) \) and Hispanic/Native American \( (n = 42) \).

Correlations for student demographic variables are shown in Table 22. The highest correlation was between ethnic category and ESL \( (r = .556) \). Because of this strong correlation and the likelihood these two variables were representative of the same trait for the study sample, these two explanatory variables were introduced in the multilevel models alternatively. Gender was not correlated with any other student demographic variable.
Table 22

*Correlations Among Student Explanatory Variables*

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Ethnic Category</td>
<td>0.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. ESL</td>
<td>0.01</td>
<td>0.56**</td>
<td></td>
</tr>
<tr>
<td>4. SES</td>
<td>0.04</td>
<td>0.34**</td>
<td>0.35**</td>
</tr>
</tbody>
</table>

**p < .001.

*Classroom Level Predictor Variables*

In addition to student level variables, inclusion of classroom level variables as fixed predictors at the second-level helped to partially account for the variance attributable to classrooms. The classroom literacy environments that students experience can affect student literacy achievement outcomes (Clark & Kragler, 2005; Morrow & Weinstein, 1986; Neuman, 1999; Roskos & Neuman, 2001). In this study, data were collected on classroom environment using two measures: (1) *The Classroom Literacy Environment Profile* (CLEP; Wolfersberger et al., 2004), and (2) the *Early Language and Literacy Classroom Observation Toolkit, Research Edition* (ELLCO; Smith et al., 2002a).

The CLEP and ELLCO were completed by a Ph.D. early childhood specialist, not associated with this study, and by the researcher. As recommended, observers compared ratings after completion of the observation to establish interrater reliability (Smith et al., 2002b), resulting in 100% interrater agreement.

Results of the CLEP and ELLCO show the classrooms to be relatively equal in classroom environment. CLEP ratings for the five classrooms were all in the
“Satisfactory” range of 4.0 to 5.4. Classroom observation ratings on the ELLCO for the classrooms were all in the “High-Quality Support” range of 3.51 to 5.0. Statistical analysis of results, using a Mann-Whitney U, from both the CLEP and the ELLCO show there is no statistically significant difference ($Z = 1.73, p > .05$) in the classroom literacy environment.

Correlation of these two classroom literacy environment scales was .956, $p < .001$. A decision was made to use the results of the CLEP to represent classroom literacy environment because this instrument reflected 33 descriptors of literacy environment as compared to 13 descriptors for the ELLCO. (As expected, exploratory analysis conducted afterward showed no difference in the model results when the CLEP and ELLCO were used alternatively in the multilevel model data analysis.) Table 23 presents descriptive statistics on classroom literacy measures by group assignment.

Table 23

**Comparison of Literacy Environment Measures by Instructional Group**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Treatment</th>
<th>Mean</th>
<th>SD</th>
<th>SE</th>
<th>Comparison</th>
<th>Mean</th>
<th>SD</th>
<th>SE</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLEP</td>
<td>Mean</td>
<td>4.77</td>
<td>.09</td>
<td>.01</td>
<td>4.42</td>
<td>.06</td>
<td>.01</td>
<td>1.73</td>
<td>.08</td>
<td></td>
</tr>
<tr>
<td>ELLCO</td>
<td>Mean</td>
<td>4.37</td>
<td>.02</td>
<td>.00</td>
<td>4.18</td>
<td>.07</td>
<td>.01</td>
<td>1.73</td>
<td>.08</td>
<td></td>
</tr>
</tbody>
</table>
Outcome measures can be affected by fidelity of program implementation (Dumas et al., 2001; Hall & Loucks, 1977; Mowbray et al., 2003; O’Donnell, 2008; U.S. Department of Education, 2007). Criteria for fidelity of implementation include length and duration of the intervention and adherence to quality of content and procedures (Mowbray et al.; O’Donnell). Fidelity of writing instruction was evaluated using information from teacher instructional logs and classroom observations. The instructional logs showed that two teachers at one school (one teacher of interactive writing instruction and one teacher of writing workshop) taught five fewer writing lessons than teachers at the other school due to scheduling conflicts within the school (i.e., picture day, an assembly). Time dedicated to writing instruction for these participants was 89.9% compared with the other teacher participants.

Information from three rounds of classroom observations and the instructional log was used to compute an implementation composite score for each writing instruction provider. The implementation score was computed from the average scores of the three observations, moderated by time. The observation scores accounted for 75% of the total implementation score. Because dedicated time was very similar for all groups, it accounted for 25% of the total implementation score. Implementation scores could range from 0 to 100. In this study, actual implementation scores ranged from 81 to 100, with a mean of 89 and a standard deviation of 0.58. This fidelity of implementation score provided information on accuracy and consistency of implementation of writing instruction. Correlation between writing instructional group and fidelity was small.
(r = .218, p = .725) indicating that fidelity was a unique predictor variable important for this study. Results of a Mann-Whitney U indicated there was no statistically significant difference (Z = .15, p > .05) for instructional fidelity between groups based on information gathered during this study. Table 24 shows information on fidelity of implementation by group assignment.

None of the classroom level or program level indicators revealed statistically significant differences between instructional groups (p > .05). Nonetheless, the classroom and program level variables were tested in the multilevel models to allow for estimation of complex multivariate relationships. Because fidelity of implementation reflected quality of treatment, multilevel analysis included an interaction between fidelity and treatment.

Table 24

*Comparison of Writing Instruction Fidelity by Instructional Group*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Treatment</th>
<th>Comparison</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fidelity</td>
<td>90.50</td>
<td>87.67</td>
<td>0.15</td>
<td>.89</td>
</tr>
</tbody>
</table>

Multilevel Model Results

This study sought to investigate the effect of interactive writing instruction on kindergarten students’ acquisition of early reading skills as measured by: (a) phonemic awareness, (b) alphabet knowledge, and (c) word reading. The null hypothesis for this study stated: Using a 2-level model to hold constant student level differences, with the
three identified components of early reading skills as the outcome variables, the predictor variable for random assignment to interactive writing will not be statistically significant \((p < .05).\)

Hypothesis tests were conducted to examine the effects of interactive writing instruction and writing workshop on kindergarten students’ acquisition of each of the outcome variables for early reading skills. If the predictor variable for interactive writing proved statistically significant in the models for predicting acquisition of early reading skills, then the argument that interactive writing instruction promotes development of early reading skills is strengthened.

The unconditional means (null) model was computed to evaluate variance (Singer & Willett, 2003). Results indicated that the effect of Level 2 variables were significant \((\chi^2_{L2} = 918.23, p_{L2} < .001).\) This model analyses revealed that 56% of the total variance in acquiring early literacy skills was attributable to differences between students.

A hierarchical system of regression equations represented the two-level model of growth in early reading skills. The Level 1 model was represented as: \(\text{Early Reading Skill Outcome Variable} = \text{intercept} + \text{regression slope} \ast \text{time} + \text{residual error}.\) Level 2 alternative model development began with the hypothesized main effects model and proceeded to identify the model of best fit. This process was repeated three times, once for each of the outcome variables: phonemic awareness, alphabet knowledge, and word reading. Other than the treatment variable, nonsignificant variables \((p > .05)\) were removed from a model one variable at a time. Consideration was also given to inclusion of interaction effects. The hypothesized main effects model for this study was: \(\text{Early Reading Skill Outcome Variable} = \beta_{00} + \beta_{10}(\text{Time}_i) + \beta_{01}(\text{Tx}_i) + \beta_{02}(\text{fidelity}_i) + \beta_{03}\)
(genderi) + β_{04} (ethnic categoryi) + β_{05} (ESLi) + β_{06} (SESi) + β_{11} (Tx_i * Time_{it}) + β_{12} (fidelity_i * Time_{it}) + β_{13} (gender_i * Time_{it}) + β_{14} (ethnic category_i * Time_{it}) + β_{15} (ESL_i * Time_{it}) + β_{16} (SES_i * Time_{it}) + error.

Phonemic Awareness Models

Results of the hypothesized main effects model for phonemic awareness show the differences between writing instructional groups to be nonsignificant ($t = -.242, p = .809$). All predictor variables in the main effects model were statistically nonsignificant, with the exception of ethnic category ($t = -9.796, p = .0001$) or English as a second language ($t = -5.55, p = .0001$). However, there was no difference in achievement in relation to this student variable or interaction effects with the writing instruction, therefore, isolated significance of this predictor variable is not of importance for the purpose of this study. Results of the main effects model and significance tests for each predictor variable are summarized in Table 25.

Other than the predictor for writing instructional group, nonsignificant predictor variables ($p > .05$) were removed from the main effects models one variable at a time. The predictor variable of gender was the first variable removed based on the highest $p$ value of .82. Removal of this variable only slightly affected the predictor variable of writing instruction, lowering the $p$ value from .810 to .792. Following was the removal of the predictor variable for SES and then for fidelity of implementation. The resulting model had three remaining predictor variables: treatment, time by treatment, and ethnic category or ESL. As the predictor variables for ethnic category and ESL were moderately correlated ($r = .556$), these two variables were examined alternatively in the model. The
predictor variable for writing instructional group remained nonsignificant with the Ethnic Category predictor \((t = 11.456, p = .605)\) or with the ESL predictor \((t = .668, p = .504)\). In accordance with the purpose of this study, this variable was also eliminated at the next step, leaving a model with only two predictor variables, writing instructional group (Tx) and time by treatment. Steps of removal of nonsignificant variables for this model analysis are shown in Table 26.

Results of multilevel models for phonemic awareness indicated that the predictor variable for writing instructional group was not associated with higher achievement in phonemic awareness, even when accounting for various predictor variables. Table 27 provides the results of the multilevel model analyses for the alternative model that includes the variable of interest to this study, writing instructional group. Table 28 shows the results of the unconditional growth model.

**Alphabet Knowledge Models**

Results of the hypothesized main effects model for alphabet knowledge show the differences between writing instructional groups to be nonsignificant \((t = -.390, p = .697)\). All predictor variables in the main effects model were statistically nonsignificant, with the exception of ethnic category \((t = -2.392, p = .0001)\) or English as a second language \((t = -2.429, p = .0001)\). However, there was no difference in achievement in relation to this student variable or interaction effects with the writing instruction. Once again, isolated significance of this predictor variable is not of importance for the purpose of this study. Results of the main effects model for alphabet knowledge and significance tests for each predictor variable are summarized in Table 29.
As with the model analyses for phonemic awareness, nonsignificant predictor variables ($p > .05$) were removed from the alphabet knowledge main effects model one variable at a time. The predictor for writing instructional group was not removed because it is the variable of interest for this study. Results of alternative model also indicated that the predictor variable for writing instructional group was not associated with higher achievement in alphabet knowledge. Table 30 provides the results of the alternative model that includes the variable of interest to this study. Table 31 shows the results of the unconditional growth model.

Table 25

*Standardized Results for Phonemic Awareness Main Effects Model*

<table>
<thead>
<tr>
<th>Fixed Effect</th>
<th>Coefficient</th>
<th>SE</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
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<td>.75</td>
<td>3.36</td>
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</tr>
<tr>
<td>Time</td>
<td>2.54</td>
<td>.15</td>
<td>16.70</td>
<td>.0001</td>
</tr>
<tr>
<td>Writing Instruction (Tx)</td>
<td>-.02</td>
<td>.06</td>
<td>-.24</td>
<td>.809</td>
</tr>
<tr>
<td>Time by Tx</td>
<td>.08</td>
<td>.12</td>
<td>.66</td>
<td>.510</td>
</tr>
<tr>
<td>Fidelity</td>
<td>-.06</td>
<td>.06</td>
<td>-.92</td>
<td>.358</td>
</tr>
<tr>
<td>Gender</td>
<td>.01</td>
<td>.06</td>
<td>.23</td>
<td>.820</td>
</tr>
<tr>
<td>Ethnic Category</td>
<td>-.43</td>
<td>.04</td>
<td>-9.80</td>
<td>.0001</td>
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<tr>
<td>ESL</td>
<td>-.42</td>
<td>.08</td>
<td>-5.55</td>
<td>.0001</td>
</tr>
<tr>
<td>SES</td>
<td>-.05</td>
<td>.06</td>
<td>-.78</td>
<td>.436</td>
</tr>
</tbody>
</table>
Table 26

*Nonsignificant Variables Removed from Phonemic Awareness Main Effects Model*

<table>
<thead>
<tr>
<th>Predictor variables still in model</th>
<th>Variable Removed</th>
<th>p value of Tx (Value Before Removal)</th>
<th>(After Removal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tx, Time, Tx*Time, Fidelity, ESL/Ethnic Category, SES</td>
<td>Gender (.820)</td>
<td>.792</td>
<td></td>
</tr>
<tr>
<td>Tx, Time, Tx*Time, Fidelity, ESL/Ethnic Category</td>
<td>SES (.437)</td>
<td>.784</td>
<td></td>
</tr>
<tr>
<td>Tx, Time, Tx*Time, Ethnic Category</td>
<td>Fidelity (.313)</td>
<td>.605</td>
<td></td>
</tr>
<tr>
<td>Tx, Time, Tx*Time, Ethnic Category</td>
<td>Ethnic Category (.0001)</td>
<td>.605</td>
<td></td>
</tr>
<tr>
<td>Tx, Time, Tx*Time, ESL</td>
<td>ESL (.0001)</td>
<td>.504</td>
<td></td>
</tr>
<tr>
<td>Tx, Time, Tx*Time,</td>
<td>ESL (.559)</td>
<td>.832</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>Tx (.832)</td>
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</table>

Table 27

*Standardized Results for Phonemic Awareness Alternative Model*

<table>
<thead>
<tr>
<th>Fixed Effect</th>
<th>Coefficient</th>
<th>SE</th>
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<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1.51</td>
<td>.13</td>
<td>11.46</td>
<td>.0001</td>
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<tr>
<td>Time</td>
<td>2.53</td>
<td>.16</td>
<td>16.16</td>
<td>.0001</td>
</tr>
<tr>
<td>Writing Instruction (Tx)</td>
<td>-.02</td>
<td>.10</td>
<td>-.21</td>
<td>.832</td>
</tr>
<tr>
<td>Time by Tx</td>
<td>.08</td>
<td>.12</td>
<td>.66</td>
<td>.513</td>
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</table>
### Table 28

*Standardized Results for Phonemic Awareness Growth Model*

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<tr>
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<th>Coefficient</th>
<th>SE</th>
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<th>p</th>
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</thead>
<tbody>
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<td>13.91</td>
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</tr>
<tr>
<td>Time</td>
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<td>.23</td>
<td>11.61</td>
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### Table 29

*Standardized Results for Alphabet Knowledge Main Effects Model*

<table>
<thead>
<tr>
<th>Fixed Effect</th>
<th>Coefficient</th>
<th>SE</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1.49</td>
<td>.83</td>
<td>1.95</td>
<td>.051</td>
</tr>
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<td>Time</td>
<td>1.86</td>
<td>.10</td>
<td>18.95</td>
<td>.0001</td>
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<td>Writing Instruction (Tx)</td>
<td>-.03</td>
<td>.06</td>
<td>-.39</td>
<td>.697</td>
</tr>
<tr>
<td>Time by Tx</td>
<td>-.01</td>
<td>.07</td>
<td>-.21</td>
<td>.833</td>
</tr>
<tr>
<td>Fidelity</td>
<td>-.01</td>
<td>.06</td>
<td>-.15</td>
<td>.881</td>
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<tr>
<td>Gender</td>
<td>-.03</td>
<td>.05</td>
<td>-.33</td>
<td>.741</td>
</tr>
<tr>
<td>Ethnic Category</td>
<td>-.25</td>
<td>.10</td>
<td>-2.39</td>
<td>.017</td>
</tr>
<tr>
<td>ESL</td>
<td>-.24</td>
<td>.09</td>
<td>-2.43</td>
<td>.015</td>
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<td>SES</td>
<td>.00</td>
<td>.06</td>
<td>.06</td>
<td>.952</td>
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</table>
Table 30

*Standardized Results for Alphabet Knowledge Alternative Model*

<table>
<thead>
<tr>
<th>Fixed Effect</th>
<th>Coefficient</th>
<th>SE</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
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<td>.10</td>
<td>12.71</td>
<td>.0001</td>
</tr>
<tr>
<td>Time</td>
<td>1.83</td>
<td>.08</td>
<td>24.48</td>
<td>.0001</td>
</tr>
<tr>
<td>Writing Instruction (Tx)</td>
<td>-.02</td>
<td>.09</td>
<td>-.16</td>
<td>.870</td>
</tr>
<tr>
<td>Time by Tx</td>
<td>-.02</td>
<td>.07</td>
<td>-.25</td>
<td>.804</td>
</tr>
</tbody>
</table>

Table 31

*Standardized Results for Alphabet Knowledge Growth Model*

<table>
<thead>
<tr>
<th>Fixed Effect</th>
<th>Coefficient</th>
<th>SE</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1.25</td>
<td>.11</td>
<td>11.88</td>
<td>.0001</td>
</tr>
<tr>
<td>Time</td>
<td>1.81</td>
<td>.08</td>
<td>23.65</td>
<td>.0001</td>
</tr>
</tbody>
</table>

*Word Reading Models*

Results of the hypothesized main effects model for word reading show the differences between writing instructional groups to be nonsignificant ($t = -.211, p = .833$). All predictor variables in the main effects model were statistically nonsignificant, with the exception of ethnic category ($t = -9.008, p = .0001$). There was no difference in achievement in relation to this student variable or interaction effects with the writing instruction. As the purpose of this study was to control for student differences in relation to the predictor variables, significance of this predictor variable is not of importance for
the purpose of this study. Results of the main effects model for word reading and significance tests for each predictor variable are summarized in Table 32.

As with the model analyses for other outcome variables, nonsignificant predictor variables ($p > .05$) were removed from the main effects model one variable at a time. The predictor for writing instructional group was not removed because it is the variable of interest for this study. Results of alternative model also indicated that the predictor variable for writing instructional group was not associated with higher achievement in word reading. Table 33 provides the results of the alternative model that includes the variable of interest to this study. Table 34 shows the results of the unconditional growth model for word reading.

Table 32

<table>
<thead>
<tr>
<th>Fixed Effect</th>
<th>Coefficient</th>
<th>SE</th>
<th>t</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
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<td>.20</td>
<td>-3.31</td>
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</tr>
<tr>
<td>Time</td>
<td>1.69</td>
<td>.21</td>
<td>7.99</td>
<td>.0001</td>
</tr>
<tr>
<td>Writing Instruction (Tx)</td>
<td>-0.02</td>
<td>.09</td>
<td>-.21</td>
<td>.833</td>
</tr>
<tr>
<td>Time by Tx</td>
<td>.04</td>
<td>.09</td>
<td>.39</td>
<td>.701</td>
</tr>
<tr>
<td>Fidelity</td>
<td>-.03</td>
<td>.02</td>
<td>-1.74</td>
<td>.082</td>
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<tr>
<td>Gender</td>
<td>.02</td>
<td>.02</td>
<td>.98</td>
<td>.328</td>
</tr>
<tr>
<td>Ethnic Category</td>
<td>-.26</td>
<td>.03</td>
<td>-9.01</td>
<td>.0001</td>
</tr>
<tr>
<td>ESL</td>
<td>-.05</td>
<td>.04</td>
<td>-1.34</td>
<td>.181</td>
</tr>
<tr>
<td>SES</td>
<td>-.02</td>
<td>.02</td>
<td>-.94</td>
<td>.348</td>
</tr>
</tbody>
</table>
Table 33

*Standardized Results for Word Reading Alternative Model*

<table>
<thead>
<tr>
<th>Fixed Effect</th>
<th>Coefficient</th>
<th>SE</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-.71</td>
<td>.11</td>
<td>-6.45</td>
<td>.0001</td>
</tr>
<tr>
<td>Time</td>
<td>1.76</td>
<td>.01</td>
<td>29.77</td>
<td>.0001</td>
</tr>
<tr>
<td>Writing Instruction</td>
<td>.04</td>
<td>.06</td>
<td>.62</td>
<td>.533</td>
</tr>
<tr>
<td>Time by Tx</td>
<td>-.00</td>
<td>.04</td>
<td>-.05</td>
<td>.960</td>
</tr>
</tbody>
</table>

Table 34

*Standardized Results for Word Reading Growth Model*

<table>
<thead>
<tr>
<th>Fixed Effect</th>
<th>Coefficient</th>
<th>SE</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-1.00</td>
<td>.17</td>
<td>-6.07</td>
<td>.0001</td>
</tr>
<tr>
<td>Time</td>
<td>1.66</td>
<td>.22</td>
<td>7.47</td>
<td>.0001</td>
</tr>
</tbody>
</table>

*Summary of Multilevel Model Results*

Analysis of data collected from 151 kindergarten students over a sixteen-week period sought to investigate the effect of interactive writing instruction on kindergarten children’s acquisition of early reading skills. The outcome variable for this study was early reading skills as measured by phonemic awareness, alphabet knowledge, and word reading. Assessments with established validity and reliability were used to measure student achievement at four time points during the sixteen-week study.

The hypothesis for this study stated: Using a two-level model to hold constant student level differences, with the three identified components of early reading skills as
the outcome variables, the predictor variable for random assignment to interactive writing will not be statistically significant ($p < .05$). If this predictor variable proved statistically significant in the model for predicting early reading skills, then the argument that interactive writing instruction promotes development of early reading skills is strengthened.

**Writing Instruction Variables**

In this study, two predictor variables were associated with writing instruction: (1) random assignment to instructional group, and (2) fidelity of implementation of writing instruction. Two-level model analyses (repeated measures at Level 1 nested within students at Level 2) indicated that the predictor variable for writing instructional group was not associated with higher achievement in phonemic awareness, alphabet knowledge, or word reading, even when accounting for various predictor variables. This held true for the writing variable in the full main effects model for phonemic awareness, $t(144) = .24$, $p = .81$, and in the phonemic awareness alternative model with only the predictor of writing instruction, $t(149) = -.21, p = .83$. The writing variable was also nonsignificant in the alphabet knowledge full model, $t(144) = -.39, p = .70$, the alphabet knowledge alternative model, $t(149) = -.16, p = .87$, the word reading full model, $t(144) = -.21, p = .83$, and the word reading alternative model, $t(149) = .62, p = .53$. Therefore, writing instructional group was not found to be a significant predictor of growth in the three early reading skills evaluated in the multilevel analyses.

When fidelity of implementation of writing instruction was used as a predictor in the multilevel model, this variable was also not significantly related to students’ growth
of phonemic awareness, \( t(144) = -0.92, p = 0.36 \), alphabet knowledge, \( t(144) = -0.15, p = 0.88 \), and word reading, \( t(144) = -1.74, p = 0.08 \). Interaction of writing instruction and fidelity was also not significant for phonemic awareness \( t(143) = -0.76, p = 0.45 \), alphabet knowledge, \( t(143) = -0.23, p = 0.82 \), and word reading, \( t(143) = -0.69, p = 0.49 \).

Thus, results of all multilevel models indicated that the predictor variable for writing instructional group was not associated with higher achievement in phonemic awareness, alphabet knowledge, or word reading. Results of this study failed to reject the null hypothesis that using a two-level model to hold constant student level differences, with the three identified components of early reading skills as the outcome variables, the predictor variable for random assignment to interactive writing would not be statistically significant \((p < 0.05)\).

**Student Level Variables**

Student level variables were used in this study to control for possible effects on outcome measures in order to effectively evaluate the impact of writing instruction. Student level variables included gender, ethnicity/English as a second language status, and socioeconomic status. These predictor variables provided information for the second level in the multilevel model to control for student differences in the investigation of writing instructional methods.

**Gender.** When gender was used as a predictor in the multilevel model, this variable was not significantly related to students’ growth of early reading skills in phonemic awareness, \( t(144) = 0.23, p = 0.82 \), alphabet knowledge, \( t(144) = -0.33, p = 0.74 \), or word reading, \( t(144) = 0.98, p = 0.33 \).
Ethnicity. Students were grouped into two larger analytical categories for statistical analysis due to the limited number of participants in two of the four ethnic categories represented in the study. The two categories were identified as Asian/White (n=109) and Hispanic/Native American (n = 42). When ethnic category was used as a predictor in the multilevel model, this variable was significantly related to students’ growth in phonemic awareness, \( t(144) = -9.8, p < .001 \), alphabet knowledge, \( t(144) = -2.4, p = .02 \), and word reading, \( t(144) = -9.01, p < .001 \).

ESL. Information on students qualified to receive services as an English Language Learner was included as a predictor alternatively with the variable for ethnic category. This variable was independently related to student growth in phonemic awareness, \( t(144) = -5.55, p = .0001 \) and alphabet knowledge, \( t(144) = -2.429, p = .0001 \). It was not significantly related to growth in word reading, \( t(144) = -1.34, p = .18 \).

SES. Socioeconomic status, as measured by the proxy of eligibility for the Federal free and reduced priced meal program, was not significantly related to students’ growth of early reading skills in phonemic awareness, \( t(144) = -.78, p < .44 \), alphabet knowledge, \( t(144) = .06, p = .95 \), and word reading, \( t(144) = -.94, p < .35 \).

Classroom Level Explanatory Variables

In addition to student level variables, information was gathered on classroom literacy environment using two measures: (1) The Classroom Literacy Environment Profile (CLEP; Wolfersberger et al., 2004), and (2) the Early Language and Literacy Classroom Observation Toolkit, Research Edition (ELLCO; Smith et al., 2002a). Correlation of these two literacy environment scales was .956, \( p < .001 \). A decision was
made to use the results of the CLEP to represent classroom literacy environment because this instrument reflected 33 descriptors of literacy environment as compared to 13 descriptors for the ELLCO. Classroom literacy environment, as measured by the CLEP, was also not significantly related to students’ growth of phonemic awareness, $t(144) = .11, p < .91$, alphabet knowledge, $t(144) = 1.48, p = .14$, and word reading, $t(144) = .94, p < .35$.

Summary

This study investigated the effect of interactive writing instruction on kindergarten children’s acquisition of early reading skills. This study employed a repeated-measures experimental design involving 151 kindergarten student participants randomly assigned to a treatment or comparison group. Outcome measures of phonemic awareness, alphabet knowledge, and word reading were used to monitor acquisition of early reading skills.

Descriptive statistics showed consistent growth among four time points for phonemic awareness, alphabet knowledge, and word reading. However, results indicated that overall growth in phonemic awareness, alphabet knowledge, and word reading for students in the experimental group, interactive writing, was not statistically different from that of students in the control group, writing workshop. Furthermore, there was no statistically significance difference ($p < .05$) between the interactive writing group and the writing workshop group for any of the three outcome measures at any of the time points.
Additional analyses were completed using multilevel modeling to evaluate the impact of interactive writing on early reading skills as repeated outcome measures at four points in time (Level 1) were clustered within students (Level 2). Results of all multilevel models indicated that the predictor variable for writing instructional group was not associated with higher achievement in phonemic awareness, $t(144) = .24, p = .81$, alphabet knowledge, $t(144) = -.39, p = .70$, or word reading, $t(144) = -.21, p = .83$.

Results of this study indicated no differences for acquisition of early reading skills between students randomly assigned to interactive writing instruction and students randomly assigned to writing workshop instruction.
CHAPTER V
DISCUSSION

“Writing—the great art of communicating thoughts to the mind—is the great invention of the world . . . enabling us to converse with the dead, the absent, and the unborn, all at distances of time and space, and great not only in its direct benefits, but its great help to all other inventions.”

The purpose of this study was to investigate the effect of interactive writing instruction on kindergarten students' acquisition of early reading skills as indicated by:
(a) phonemic awareness, (b) alphabet knowledge, and (c) word reading. This study employed a repeated-measures experimental design involving 151 kindergarten student participants and 5 teacher participants randomly assigned to the writing instructional groups. Participants in the four treatment groups received instruction in interactive writing. Participants in the four comparison groups received instruction in writing workshop.

To monitor the development of growth in early reading skills, data were collected at four intervals during the sixteen-week study from all participants using valid, reliable outcome measures that included the Comprehensive Test of Phonological Processing (Wagner et al., 1999), the Observation Survey of Early Literacy Achievement Letter Identification Task (Clay, 2002), and the Test of Word Reading Efficiency (Torgesen et al., 1999). Additional data were collected for explanatory factors of potential importance including gender, ethnicity, socioeconomic status, classroom literacy environment, and fidelity of implementation of writing instruction.
Growth of Early Reading Skills

Writing is conspicuously absent in early literacy instruction even though the importance of the reading-writing relationship is clearly recognized (Halladay, et al., 2007). Teachers may be concerned that time dedicated to writing is time stolen from reading instruction (National Commission on Writing, 2003, 2006).

Interactive writing is a writing instructional strategy that helps students with guidance of a teacher focus on details of letters, sounds, and words (Pinnell & Fountas, 1998). It has been advocated in the field that interactive writing instruction builds upon the shared reading-writing knowledge base to impact student acquisition of early reading skills (Biddle, 2007; Brotherton & Williams, 2002; Button, 1996; Herb & Bufalino, 1997; McCarrer et al., 2000; Patterson et al., 2008; Pinnell & Fountas, 1998; Ritterskamp & Singleton, 2001; Rubadue, 2002; Sipe, 2001; Stachoviak, 1996; Williams & Lundstrom, 2007). This study sought to investigate this hypothesized impact. Because this study sought to test the reading-writing hypothesis, both the treatment and comparison groups needed to receive complementary forms of reading-writing instruction for an equivalent amount of total literacy instructional time. Consequently, this study focused upon the established importance of the reading-writing relationship and its posited effect on literacy development (Anderson et al., 1985; Chomsky, 1976; Clay, 1975, 2002; Durkin, 1966; Farnan & Dahl, 2003; Fitzgerald & Shanahan, 2000; Langer & Flihan, 2000; Loban, 1976; Pressley & Fingeret, 2007; Shanahan, 2006; Shatil et al., 2000; Squire, 1983; Tierney & Pearson, 1983).
This study did not seek to determine whether more time spent in reading or writing instruction alone might have led to less, equivalent, or greater beginning reading growth over time. Thus, the inclusion of a no-writing control group in this study was arguably an unethical research practice. Comparison of interactive writing against a status-quo control group was questionable due to the nature of writing instruction in many kindergarten classrooms. This comparison would have ultimately been an evaluation of interactive writing against a hodge-podge of writing activities that could range from tracing an individual alphabet letter to using ink and letter stamps to create words. Writing workshop is the most popular approach to writing instruction in the primary grades (Graham et al., 2005) and, therefore, was the most appropriate complement as the writing instructional method for the comparison group. Inclusion of these two methods of writing instructional resulted in a study of dedicated time to instruction of the reading-writing relationship.

Multilevel modeling was used to evaluate the impact of the reading-writing relationship as operationalized with interactive writing and writing workshop on the acquisition of early reading skills as repeated outcome measures at four points in time (Level 1) were clustered within students (Level 2). Results of all multilevel models indicated growth in early reading skills for the interactive writing group was equivalent with growth for the common writing instructional practice of writing workshop. Students in both the interactive writing group and the writing workshop group demonstrated equivalent growth over time for each of the three outcome measures, with no statistically significant difference between the interactive writing group and the writing workshop group for any of the outcome measures at any of the time points. Students demonstrated
satisfactory growth of the early reading skills of phonemic awareness, alphabet knowledge, and word reading when time was consistently dedicated to writing instruction.

**Phonemic Awareness**

Phonemic awareness was assessed using the Comprehensive Test of Phonological Processing (CTOPP; Wagner et al., 1999). Across the four administrations, CTOPP scores ranged from 0 to 56 on a possible scale of 0 to 60. The first assessment time point had five scores of zero the second assessment had only one score of zero. This outcome measure seemed to work reasonably well for this sample as less than 3% of the students demonstrated floor effects on the initial assessment; floor effects had almost diminished by the first month of kindergarten. Although participants were approaching the ceiling on the measure, no ceiling effects occurred. Furthermore, score were approximately normally distributed for this outcome measure.

Results of the two-level model analyses indicated that the predictor variable for writing instructional group was not associated with higher achievement in phonemic awareness. The hypothesized main effects model for phonemic awareness show the differences between writing instructional groups to be nonsignificant, $t(144) = -.242, p = .809$. The predictor variable for writing instructional group was also nonsignificant in the phonemic awareness alternative model that included only the predictor of writing instruction, $t(149) = -.21, p = .83$. Scores show student growth in phonemic awareness to be equivalent over time with no statistical significant difference between the interactive writing group and the writing workshop group for any of the time points.
Growth over time was significant in the hypothesized main effects model,
\[ t(144) = 17.05, p < .001; \] in the alternative model,
\[ t(149) = 16.17, p < .001; \] and in the unconditional growth model,
\[ t(150) = 11.61, p < .001. \] This indicates that although there was no difference between the interactive writing group and writing workshop group, students were indeed increasing in phonemic awareness over time. The average gain of mean scores of students on the phonemic awareness measure was 15 points, from a mean score at time one of 12.36 to a mean score at time four of 27.44. Growth between time points was consistent, with an average of 5.18 point increase between time points. In this study, interactive writing instruction and writing workshop were equally effective in promoting growth of phonemic awareness.

**Alphabet Knowledge**

Student knowledge of letter names and sounds was evaluated using the Letter Identification task, a subtest of Clay’s (2002) Observation Survey of Early Literacy Achievement. Across the four administrations, scores ranged from 0 to 108 on a possible scale of 0 to 108. The first assessment frame had 23 scores of 0, representing floor effects of the measure for 15.2% of the sample. There were 7 scores of 0 at time two (4.6%), and no scores of 0 at time three. Ceiling effects were also present at the initial assessment, occurring for 2 participants at times one and two (1.3% of the sample), 6 participants at time three (4%), and 16 participants at time four (10.6%). Scores were not normally distributed for this outcome measure. Skewness was exhibited in time points three (-1.289) and four (-2.450). Kurtosis was highest in time point four (6.888). Data transformations did not alleviate the problems with distribution. Therefore, this outcome
measure was not ideal for this study. Perhaps addition of a time element, allowing
students a specified amount of time to identify the letter names and sounds would have
resulted in a more normal distribution and fewer ceiling effects. However, this would also
compromise the ability to identify specific letters for which students knew the names and
sounds.

Results of the two-level model analyses indicated that the predictor variable for
writing instructional group was not associated with higher achievement in alphabet
knowledge. The hypothesized main effects model for alphabet knowledge show the
differences between writing instructional groups to be nonsignificant, \( t(144) = -0.390, \)
\( p = 0.697 \). The predictor variable for writing instructional group was also nonsignificant in
the alphabet knowledge alternative model that included only the predictor of writing
instruction, \( t(149) = -0.16, p = 0.87 \). Scores for both the interactive writing group and the
writing workshop group were equivalent over time for alphabet knowledge at all four
time points, with no statistical significant difference between groups. Growth over time
was significant in the hypothesized main effects model, \( t(144) = 18.95, p < .001 \); in the
alternative model, \( t(149) = 24.48, p < .001 \); and in the unconditional growth model,
\( t = 23.67, p < .001 \). This indicates that although there was no difference between the
interactive writing group and writing workshop group, there was growth over time for
alphabet knowledge. Student knowledge of letter names and sounds more than doubled
during the 16 week study, from an initial mean of 41.44 to 94.74, an average gain of 53
letter names and/or sounds. Growth of alphabet knowledge was consistent over time for
the group, averaging about 18 letter names or sounds per time point. Results of this study
indicated that interactive writing instruction and writing workshop were equally effective in promoting alphabet knowledge development.

*Word Reading*

Ability to read sight words and to decode unfamiliar words was measured using the Test of Word Reading Efficiency (TOWRE; Torgesen et al., 1999). It was assumed before testing that this outcome measure would result in floor effects for kindergarten students. However, this measure was included in the study in an attempt to capture growth of students who potentially might experience ceiling effects on the phonemic awareness and alphabet knowledge measures. As expected, score distributions for this measure were not normally distributed. There was a high rate of scores of zero at time point one, 86% of the sample. This measure did capture growth as this floor effect had decreased to only 31% of the sample at time point four. This measure was particularly effective for capturing growth of high-achieving students as the top 10% of students scored more than 1 standard deviation above the mean. The most extreme outlier resulted from one student reading 71 words in 90 seconds at the fourth time point, almost 5 standard deviations above the mean. It is likely that any word reading test at the kindergarten level would have resulted in floor effects. The advantage of this test was that due to the number of easier words included, early readers would able to identify more of the words, which would actually result in fewer floor effects over a shorter period of time.

Results of the two-level model analyses indicated that the predictor variable for writing instructional group was not associated with higher achievement in word reading.
The hypothesized main effects model for alphabet knowledge show the differences between writing instructional groups to be nonsignificant, $t(144) = -.21, p = .83$. The predictor variable for writing instructional group was also nonsignificant in the word reading alternative model that included only the predictor of writing instruction, $t(149) = .62, p = .53$. There was no statistically significant difference ($p < .05$) between the interactive writing group and the writing workshop group for word reading at any time point.

Growth over time was significant in the hypothesized main effects model, $t(144) = 7.988, p < .001$; in the alternative model, $t(149) = 29.77, p < .001$; and in the unconditional growth model, $t = 7.47, p < .001$. This indicates that although there was no difference between the interactive writing group and writing workshop group, there was growth over time for word reading. Word reading ability increased from a mean of 1.34 at time one to 9.36 at time four. As would be expected due to increased abilities in phonemic awareness and alphabet knowledge, the greatest period of increase for word reading ability was from time points three and four. Participants averaged an increase of 4.26 words between time points three and four as compared 1.14 words from time point one to time point two. Results of this study indicated that interactive writing instruction and writing workshop were equally effective in promoting word reading ability.

Comparison of Study Sample to National Normative Samples

Clearly dedicating time to writing instruction combined with reading instruction was not detrimental to student acquisition of early reading skills. In fact, student growth in early reading skills seemed to be particularly strong when reading and writing
instruction work in tandem. Comparison of the data collected during the four waves of the outcome measures from the study sample with the national normative samples from the outcome measures provided useful information for characterizing results of early reading growth found in this study.

At the beginning of the study, the phonemic awareness mean participant score placed students in this study as average, at the 55th percentile. Yet, by December, the mean participant score placed students as above average, at the 77th percentile. This was a growth from an initial $z$-score of .13 to a $z$-score of .71, an increase of 58% of a standard deviation as compared to the national normative sample in only 16 weeks. Growth in phonemic awareness was progressing at a rate above national normative scores.

Growth in alphabet knowledge revealed the same trend. Initial letter identification scores placed this sample at the third stanine of the OSELA letter identification and more than one standard deviation from the national normative sample mean of 39 ($SD = 15.7$). Yet, the mean score at time point four placed this sample at the fourth stanine and at the same mean as the normative mean 46.6 ($SD = 12.1$), growth of more than one standard deviation as compared with a national normative sample.

Acquisition of word reading ability also progressed at a rate which is above the national normative scores for the outcome measure. National normative scores for the TOWRE begin at age six years zero months, while the mean age of this sample was five years six months at the beginning of the study. Nevertheless, this national normative sample provided information on beginning readers for comparison (J. K. Torgesen, personal communication, January 28, 2008). The mean participant score for the mean age of participants placed this sample at the 17th percentile on the TOWRE national
normative scores at the first time point. The mean score for the mean age placed this sample at the 29th percentile at time four. Student scores at time one correlated to a $z$-score of -1.04 and $z$-score of - .62 at time four (Wagner et al., 1999, p. 31). Participant growth in word reading ability increased 42% of one standard deviation from the initial assessment to the fourth assessment.

Although there was no difference in early reading growth between the two reading-writing instructional groups, there was a difference in growth of early reading skills between this study’s sample and the samples for which national normative data were gathered on the three outcome assessments used in this study.

Clements et al. (2004) identified three factors that contribute independently to learning outcomes in early childhood instruction: individual factors, school factors, and program factors. Participants included in this study would not be recognized as extraordinary. Fifty-three percent of participants were male, forty-five percent female. Forty-three percent of participants qualify for free or reduced-price lunch status. Sixty-five percent of participants were White, non-Hispanic, 27% Hispanic, 7% Asian/Pacific Islander, less than 1% American Indian/Alaskan Native, and 0% Black, non-Hispanic. Twenty-one percent of participants were classified as English as a Second Language learners. It is important to note that participants in this study initially demonstrated scores equivalent to, or below, the national normative sample mean.

Data on school-related factors indicated classrooms and teachers included in the study to be representative of a typical kindergarten classroom. All participating teachers in this study had a bachelor’s degree in education with an early childhood endorsement; none of the teachers had a reading endorsement. The mean of years teaching
kindergarten was 3.41, $SD = .119$. Class size ranged from 19 to 21, with a mean of 20 students per kindergarten session ($SD = .84$). All classrooms followed a 9-month instructional schedule. Results of the CLEP and ELLCO show the classrooms to be in the average range for creating effective literacy classroom environments. Schools within the district were randomly selected for participation in the study and are therefore likely reflective of the district.

Program factors would also be considered typical to kindergarten instruction. Because this study investigated potential differences in early reading growth, consideration was given to reading program factors. All kindergarten teachers in the district used the same core reading program and dedicated the same amount of time, 90 minutes of reading-writing instruction, to literacy. Each participating teacher provided detailed information about their daily schedule as an additional check to ensure comparability in reading instruction. The core reading program used by the district is well known and widely-used; thus, classes that use this core reading program would likely have been included in the national norming samples of the instruments selected for use in this study.

Results of this study indicated that interactive writing and writing workshop, when consistently implemented in connection with on-going reading instruction, appear to be equally effective in promoting acquisition of early reading skills. In fact, dedicated time to a combination of reading and writing instruction significantly increases the rate of growth for the early reading skills of phonemic awareness, alphabet knowledge, and word reading. Although apparent differences in growth of early reading skills between the participants of this study and those of the large national norming samples could be the
result of some other factor besides the reading-writing instructional relationship, individual, school, and program factors indicated the study participants to be fairly typical of participants included in the national norming samples.

**Limitations**

There were two major limitations to this study: (1) non-normality of score distribution for the alphabet knowledge outcome measure and (2) lack of a third-level in the multi-level modeling.

Non-normality of score distribution was an area of concern for this study. Scores for the outcome measure for alphabet knowledge and word reading ability were not normally distributed. Non-normal distribution of the word reading measure was addressed through use of zero-inflated Poisson analyses. However, the distribution of the alphabet knowledge measure proved particularly challenging as each data point exhibited a different distribution. Data transformations did not alleviate the problems with distribution. Use of a different measure for alphabet knowledge may have resulted in a more normal distribution; latency combined with accuracy would be more likely to distribute student performance normally.

In the multilevel modeling, theoretically, a third level could have been modeled (classroom/teacher level), but due to the limited number of units at this level, this was not feasible because the number of classes was limited to only 8 kindergarten classes (half-day) with 5 kindergarten teachers. To model a third level, a minimum of 30 groups or classrooms is recommended (Kreft & de Leeuw, 1998; Maas & Hox, 2004). Therefore, variables related to the classroom (i.e., literacy environment) were treated as fixed
predictors at the second-level rather than specifying additional levels of analysis (Tabachnick & Fidell, 2007). The multilevel model accounted for classroom grouping through clustering.

Implications for Practice

The National Writing Commission (2003) reported that writing is a prisoner of time, completed during minutes stolen from more important subjects. At the very least this study has shown that dedicated time to writing instruction was not detrimental to student acquisition of early reading skills. Growth of phonemic awareness, alphabet knowledge, and word reading ability for study participants progressed at a satisfactory rate when characterized with participants in the outcome measure national norming samples. Participating teachers confirmed more time was spent on writing instruction than in previous years, providing previous daily schedules as verification. “We scheduled a consistent time for writing, which we didn’t make a priority in past years. Doing writing consistently was new for me.” All participating teachers expressed an increased belief in the importance of writing instruction. “I believe writing is an essential component in developing early literacy skills. The study encouraged me to do writing more often. I have vowed to incorporate more writing throughout the school year, starting from the first weeks of school.” Perhaps more teachers will be encouraged to dedicate time to daily writing instruction viewing this time not as stolen moments, but as an essential component of early literacy instruction.

Teacher participants in the study noticed improvements in student reading skills as a result of writing instruction. One teacher who taught an interactive writing group
stated, “Interactive writing has vastly improved my students’ capabilities in letter names, letter sounds, phonemic awareness, and word reading ability. There were a number of students who have greatly benefited from the writing time.” Another teacher who taught a writing workshop group reported, “Writing has enhanced those literacy skills being taught through reading instruction. I especially believe it impacted phonemic awareness and word reading for my students this year.”

Writing instruction seemed to help students focus on specific reading skills; “I saw more children using reading skills, like sounding out the words. Rather than just looking at the beginning sound and guessing, most children were looking at the entire word.” A teacher reported, “We reread every word we wrote together. I have never had a group that was so capable of reading their own writing to me.”

Teachers also reported writing instruction seemed to increase personal motivation to read: “Students were excited about reading their own writing or a sentence that we wrote together. Even my most struggling students found some success in the fact that they could read me what they wrote.” Another teacher emphasized, “Students are thrilled when they read a story they’ve written!” Writing “helped many students improve their abilities and gain more confidence in being able to read.”

Results of this study indicated that interactive writing and writing workshop, when consistently implemented, appear to be equally effective in promoting acquisition of early reading skills. Dedicated time to consistent writing instruction seemed to be the important factor. This would mean that teachers could choose from either interactive writing or writing workshop, or a combination of both, taking into account teaching styles and the instructional context. For some teachers, the shared experience of
interactive writing may more appropriately reflect their style of teaching; other teachers may value the time spent in the individual conferences of writing workshop. The method of writing instruction could also be adapted to best fit student needs. Interactive writing could be used for writing about topics when a common knowledge base is already in place or when a common knowledge base needs to be established. Writing workshop could be used to explore topics of personal interest or to evaluate student personal knowledge of a topic. Also, teachers in full-day kindergarten classrooms could use interactive writing as the daily mini-lesson, followed by supported independent writing, conferencing, sharing, and publication, all elements of writing workshop. With at least two methods of writing instruction to choose from, hopefully teachers will be more inclined to dedicate instructional time to writing in the kindergarten classroom. As one teacher emphatically stated, “I am more of an advocate for writing in kindergarten than I ever was!”

Conclusion

In summary, results of this study indicated that instruction grounded in the reading-writing relationship, namely interactive writing and writers’ workshop combined with existing reading instruction, led to equal growth in kindergarteners’ acquisition of early reading skills for all of the outcome measures at each of the four time points assessed. The growth effects obtained from the use of the reading-writing instructional treatments used in this study compared with the national normative samples from the outcome measures indicated that the reading-writing instruction significantly increased
the rate of growth for the early reading skills of phonemic awareness, alphabet knowledge, and word reading.
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APPENDICES
Appendix A

Intervention Validity Checklist/Instructional Log
Log of Interactive Writing Instruction

- Fill in the date.
- Record how long the lesson lasted.
- Place a check next to each component of interactive writing used that day.
- Collect one writing sample per week for portfolios.

<table>
<thead>
<tr>
<th>Day &amp; Date</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
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</thead>
<tbody>
<tr>
<td>Total length of lesson in minutes</td>
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<tr>
<td>Minutes spent in group writing</td>
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<tr>
<td>Minutes spent in independent writing (if any)</td>
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<tr>
<td>Component of Interactive Writing</td>
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<tr>
<td>Establish the topic</td>
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<td>(Please record the topic in this row)</td>
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<tr>
<td>Compose the sentence</td>
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<tr>
<td>Count the words in the sentence</td>
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<tr>
<td>Recall the word to be written and stretch the word to hear the sounds</td>
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<tr>
<td>Share the pen to write the text</td>
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<tr>
<td>Link words to known words, word wall, books, or resources in the room</td>
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<tr>
<td>Examine word construction through letter clusters and chunks</td>
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<td>Point out high frequency sight words</td>
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<tr>
<td>Point &amp; reread what has been written after each word</td>
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<tr>
<td>Maintain a correct model by revising &amp; proofreading</td>
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<tr>
<td>Involve all students by writing on whiteboards, in air, nonverbal signals, etc.</td>
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<tr>
<td>Display the writing for children to reread</td>
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<tr>
<td>The writing used for extension through addition of more text, art, etc</td>
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</tbody>
</table>

Briefly describe one of this week’s writing lessons.
Log of Writing Workshop Instruction

- Record information for the date and minutes of instruction.
- Briefly describe the component. (For example, a starting component might be: “Read aloud book *Wimberly Worries* to give students ideas for writing their own story.” A sharing component might be: “Students read their story to the rest of the class.”)
- Record approximately how many minutes were spent in each component of Writing Workshop.
- Collect one writing sample per week for portfolios.

<table>
<thead>
<tr>
<th>Day &amp; Date</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
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<tbody>
<tr>
<td>Total length of lesson in minutes</td>
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<tr>
<td>Minutes spent in independent writing</td>
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<td>Component of Writing Workshop</td>
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<tr>
<td>Starting Component &amp; Time</td>
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<td>Student Writing Time</td>
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<tr>
<td>Conferencing Time</td>
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<td>Sharing Time</td>
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</table>

Briefly describe one of this week’s writing lessons.
Appendix B

Intervention Validity Checklist/Observational Log
Interactive Writing Instruction
Observational Log Fidelity Checklist

- Place a check next to each component of interactive writing used that day, indicating level of use.

<table>
<thead>
<tr>
<th>Component of Interactive Writing</th>
<th>5 Ideal Use</th>
<th>3 Acceptable Use</th>
<th>1 Unacceptable Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish the topic</td>
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<tr>
<td>(Please record the topic in this row)</td>
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<tr>
<td>Compose the sentence</td>
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<tr>
<td>Count the words in the sentence</td>
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<tr>
<td>The writing used for extension through addition of more text, art, etc</td>
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</tbody>
</table>
Writing Workshop Instruction
Observation Fidelity Checklist

- Record approximately how many minutes were spent in each component of Writing Workshop.
- Briefly describe the component.
- Place a check next to each component of interactive writing used that day, indicating level of use.

<table>
<thead>
<tr>
<th>Minutes of Writing Instruction</th>
<th>Total Lesson</th>
<th>Mini Lesson</th>
<th>S. Write</th>
<th>Confer</th>
<th>Share</th>
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<tr>
<td>Minutes spent in group writing</td>
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<tr>
<td>Minutes spent in independent writing</td>
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<td>3 Acceptable Use</td>
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<td>Student Writing Time</td>
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<td>Conferencing Time</td>
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<td>Sharing Time</td>
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Appendix C

Writing Samples
Interactive Writing

Writing Names

My name is Evan.

My name is Kevon.
Writing Workshop

Letter “b” Sound