Efficacy of a Direct Instruction Approach to Promote Early Learning

Jennifer Lee Salaway

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EFFICACY OF A DIRECT INSTRUCTION APPROACH TO PROMOTE EARLY LEARNING

A Dissertation
Submitted to the School of Education

Duquesne University

In partial fulfillment of the requirements for
the degree of Doctor of Philosophy

By
Jennifer Lee Salaway

May 2008
DUQUESNE UNIVERSITY
SCHOOL OF EDUCATION
Department of Counseling, Psychology and Special Education

Dissertation

Submitted in Partial Fulfillment of the Requirements
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School Psychology Doctoral Program

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EFFICACY OF A DIRECT INSTRUCTION APPROACH TO PROMOTE EARLY LEARNING

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ABSTRACT

EFFICACY OF A DIRECT INSTRUCTION APPROACH TO PROMOTE EARLY LEARNING

By

Jennifer Lee Salaway

May 2008

Dissertation Supervised by Dr. Kara E. McGoey

This study examined the effectiveness of Direct Instruction (DI) as an enhancement to a Developmentally Appropriate Preschool (DAP) curriculum in the form of increased pre-academic, language, and early literacy competencies for high-risk preschool children. Sixty-one preschool children were randomly assigned to either a DI-Add-On group or DAP-Only group. The children were administered the Kaufman Survey of Early Academic and Language Skills (K-SEALS; Kaufman & Kaufman, 1993) and Dynamic Indicators of Basic Early Literacy Skills (DIBELS; Good & Kaminski, 2002) prior to receiving the intervention and upon completion of the study. All of the children were also administered the DIBELS throughout the implementation of the DI intervention to monitor their progress throughout the curriculum. It was hypothesized that children receiving both DI and DAP would demonstrate greater attainment of pre-
academic, language, and early literacy skills than children who only participated in the DAP curriculum. The research questions were statistically analyzed by multivariate analysis of covariance and single subject data analysis. Results of the study confirmed the hypothesis. Children who received both DI and DAP demonstrated greater attainment of pre-academic, language, and early literacy skills than children who only participated in the DAP curriculum.
ACKNOWLEDGMENT

I would like to thank the chair of my dissertation, Kara McGoey, Ph.D., for her support, encouragement, and expertise throughout this process. I would also like to thank my committee members, Tammy Hughes, Ph.D. and Steve Bagnato, Ed.D., for their knowledge, support, and expertise. An additional thank you is given to Hoi Suen, Ed.D. for his statistical knowledge and willingness to share that knowledge. I would also like to express gratitude to the Heritage Health Foundation, Inc. for providing the opportunity and funding to conduct this research project at the 4 Kids Early Learning Center. Special thanks is given to Robert Grom, Barbara Willard, Suzanne Holm, and Sue Tokarsky for their support throughout the duration of the study. This dissertation is dedicated to them. Finally, I would like to take the opportunity to thank my husband and parents, without whom the completion of this journey would not have been possible.
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CHAPTER 1
INTRODUCTION

It is estimated that more than one in three children experience significant difficulties in learning how to read and millions of students in the United States are unable to read at grade level (Adams, 1990; Shaywitz, Escobar, Shaywitz, Fletcher, & Makuch, 1992). The Nation’s Report Card: Reading 2002 found that approximately 40% of eighth grade minority students were reading below a basic level (Grigg, Daane, Jin, & Campbell, 2003). Additionally, this report found that more than 50% of all children are unable to read at grade level (Grigg et al., 2003). These statistics are alarming and clearly support a need for empirically-supported literacy interventions.

Early reading problems are associated with a number of negative developmental outcomes for children. For example, 10 to 15% of children who have difficulty with reading drop out of high school and only 2% of those with reading difficulties complete a college degree (Whitehurst & Lonigan, 2002). Furthermore, half of adolescents and young adults with criminal records and substance abuse problems also experience reading difficulties (Whitehurst & Lonigan, 2002). Young children with poor early reading skills are likely to experience later academic difficulties and are more likely to require special education services. (Baydar, Brooks-Gunn, & Furstenberg, 1993; Francis, Shaywitz, Stuebing, Shaywitz, & Fletcher, 1996; Juel, 1988; Lentz, 1988; Stevenson & Newman, 1986; Tramontana, Hooper, & Selzer, 1988). Reading skills are imperative to children’s academic success and assist them in attaining knowledge in other areas (Cunningham & Stanovich, 1997; Echols, West, Stanovich, & Zehr, 1996; Morrison, Smith, & Dow-Ehrensberger, 1995).
It is clear that alarming numbers of children in the United States are struggling to learn how to read and are unable to read at grade level. Even more, early reading problems are linked to a number of negative outcomes for children, such as substance abuse, retention, referral to special education services, and difficulties with other academic subjects. Taken together, these findings support a need for evidence-based prevention and early reading intervention programs.

Significance of the Problem

The foundation for prolonged and firm literacy skills is laid early in a child’s life with both parents and early childhood teachers playing an integral role in development of those skills. Early childhood public policy and best practice standards emphasize the importance of empirically supported practices for teaching literacy skills to young children. Over the past several years, early childhood educators have attempted to translate research into practice to systematically help young children develop early language and literacy skills. Despite the national recognition of this problem, many national reports indicate American students continue to struggle with obtaining grade-level reading skills. This suggests the continued need for reading interventions, especially for early reading intervention programs that begin in preschool. Much effort has been given to examining the effectiveness of various types of reading instruction, as well as documenting the progress of children’s reading skills. The results of these national studies are reported in the following section.

Reading Instruction

After an extensive review of early learning literature, the NAS (2000) report concluded children’s early literacy skills are related to their language development.
Furthermore, the committee found that children display greater school readiness when their preschool programs include a variety of classroom structures and teaching methodologies (NAS, 2000). Upon conclusion of their literature review, the committee recommended that federal and state policies fund efforts to design and evaluate various curricula that incorporate evidence-based early learning and teaching strategies.

The National Reading Panel (2000) conducted a large scale study to determine the effectiveness of instructional reading approaches as well as determining their applicability to classroom teaching methods. Similar to the NAS (2000) report’s findings, the Panel found various instructional methods to have a positive impact on children’s reading skills, including direct instruction and transactional strategy instruction. Results of these studies stress the need for the application of empirically-supported reading interventions. However, much research is still needed in this area to determine effective instructional strategies for children considered to be “at-risk.”

Reading Progress

The National Assessment of Educational Progress (NAEP) committee assesses a wide range of subject knowledge, including reading skills, of American students during their fourth and eighth grade years. Results from The Nation’s Report Card: Reading 2005 found that Caucasian students scored higher than African American and Hispanic students at both grades 4 and 8. While results of this national assessment reported small gains in children’s reading achievement, the report found that over 50% of minority children in fourth grade and over 40% of minority children in eighth grade were unable to read at grade level (National Center for Educational Statistics (NCES, 2006). Similar results were reported for children who were eligible for free lunches. NAEP reported that
over 50% of fourth graders and over 40% of eighth graders eligible for free lunches do not read at basic grade level (NCES, 2006). Results of this national study emphasize the need for early teaching of reading skills to young children, especially those children considered at-risk for later academic difficulties and failure.

The NCES conducted a longitudinal study of 22,000 children beginning in their kindergarten year of school (West, Denton, & Germino-Hausken, 2000). Results of this large-scale study at found that children’s reading skills were related to the age at which they enter kindergarten, mother’s education level, family type, primary language spoken in their home, and race-ethnicity (West et al., 2000). Specifically, the study reported that children from two-parent families were more likely to score in the highest quartile of reading scores than children from single-mother families. The study also found that children whose primary language was English were more likely to score in the highest quartile of reading scores than children whose primary language at home was not English and that Caucasian children were more likely to have higher reading scores than African American and Hispanic children (West et al.). Overall the study reported that 66 percent of children at the beginning of kindergarten were capable of recognizing letters, 29 percent were proficient in understanding initial letter sounds, and 17 percent were skilled at understanding ending letter sounds (West et al.).

In terms of differences in specific reading skills, the study found that children with few risk factors were more likely to demonstrate higher proficiencies in letter recognition, understanding initial sounds, understanding ending sounds, and print familiarity (West et al., 2000). As stated, the researchers identified these risk factors as low level of maternal education, single-parent families, minority ethnicity, and families
who received public assistance. Results of this large scale study support the notion that children who are considered at-risk for lower achievement in kindergarten, including reading skills, may benefit from additional support in attainment of those skills in the preschool years.

Research has also focused on examining the effectiveness of literacy interventions in preschool classrooms. For example, research suggests that exposure to language and literacy in the classroom is beneficial to young children’s literacy development (Farran, Aydogan, Kang, & Lipsey, 2006). Specifically, these researchers found that children displayed higher engagement in reading materials in preschool classrooms that emphasized literacy in the physical environment. The study further reported that children’s involvement with reading materials greatly increased with the level of literacy materials present in the classroom and instruction (Farran et al., 2006).

Despite national emphasis on the attainment of early literacy skills, studies have shown that young children are not obtaining literacy competencies as expected. For example, in a national longitudinal study of kindergarten children, West and colleagues (2000) found that fewer than one third (29%) of kindergarten children are proficient in recognizing initial letter sounds. Early literacy research also suggests that children at-risk for attainment of literacy skills tend to perform below the norms on standard assessments of reading achievement (Neuman, 2006).

Some of the risk factors influencing the literacy development of children include limited education and economic resources of their parents and minority status within their communities. Results from the NCES report found that children with few risk factors were more likely to pass reading proficiency assessments than children who were
considered at-risk (West et al., 2000). Studies have shown that the effects of poverty on children’s literacy and language development are exacerbated when poverty is experienced early in life and when children experience persistent poverty (Klebanov, Brooks-Gunn, McCarton, & McCormich, 1998; Whitehurst, 1997). Moreover, research in this area suggests that high-quality preschool classrooms and interventions play an important role in the acquisition of early literacy skills for high risk children (Barnett, 1998; Ramey & Ramey, 2006).

The results of several national studies show that a greater percentage of at-risk children, specifically minority children, are reading below grade level when compared to peers of non-minority status. Differences in early literacy skills are observable even at a young age, in that kindergarten children with risk factors such as low level of maternal education, single-parent families, minority ethnicity, and family receives public assistance, showed lower proficiencies in basic early literacy skills than their peers who had fewer risk factors. In addition to the reports of these studies, others have related the classroom environment to children’s early literacy skills. For example, high-quality classrooms are positively related to children’s literacy skills development, especially for those children at-risk. These findings support the need for research on high-quality, evidence-based reading instruction for young children at-risk.

Results of several years of reading research have motivated national policy such as No Child Left Behind (2001), with its goal to provide resources for every child to learn how to read. Recent governmental early reading initiatives have emphasized the need for high quality early reading instruction for at-risk preschool children. The Bush Administration’s Good Start, Grow Smart initiative was developed to strengthen Head
Start programs, improve the federal-state partnership with early childhood programs, and communicate best practice standards and evidence-based practices to teachers, caregivers, and parents. The federally-funded *Early Reading First* program was created to assist early childhood programs in helping young children acquire school readiness skills, especially those children from low-income families. Early literacy research guides best practice standards guidelines for teaching reading and language skills in preschool classrooms. Ultimately, empirically supported best practice standards will positively impact early learning and literacy skills for all young children, including those considered to be high-risk for negative developmental outcomes. It follows that examination of the differential impact of specific types of reading instruction on high-risk children’s early literacy and language skills is needed.

**Theoretical Bases for the Study**

*Reading Development*

Multiple theories (Chall, 1996; Clay, 1991; Ehri, 1995; LaBerge & Samuels, 1974; Rumelhart, 1994) exist to explain how young children develop reading skills. Most theories propose that young children learn these skills both at home and at school, and that the skills are developmental in nature, that is, they build upon each other as children “master” each individual component of reading. Furthermore, most theories propose that children integrate the skills which then become more automated and fluent as children become proficient readers. While there is some debate regarding the developmental order of the attainment of these skills, several commonalities exist in the literature as to five essential component skills necessary for reading development: the alphabetic principle, phonemic awareness, oral reading fluency, vocabulary, and comprehension (National
Tables 1 through 4 display a framework for a typical reading developmental sequence for children from birth through third grade (Armbruster, Lehr, & Osburn, 2001).

Table 1

**Typical Reading Skills Sequence of Print Concepts**

<table>
<thead>
<tr>
<th>Print Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth-2</td>
</tr>
<tr>
<td>Shares books, looks at books</td>
</tr>
<tr>
<td>3-4 years</td>
</tr>
<tr>
<td>Knows print has meaning; Knows how to handle books</td>
</tr>
<tr>
<td>Pre-K</td>
</tr>
<tr>
<td>Understands that text is read from left to right and top to bottom</td>
</tr>
<tr>
<td>Kindergarten</td>
</tr>
<tr>
<td>Knows parts of books</td>
</tr>
<tr>
<td>1st Grade</td>
</tr>
<tr>
<td>Reads one-syllable words</td>
</tr>
</tbody>
</table>

Table 2

*Typical Reading Skills Sequence of the Alphabet System*

<table>
<thead>
<tr>
<th>Alphabet System: Phonemic awareness and phonics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3-4 years</strong></td>
</tr>
<tr>
<td><strong>Pre-K</strong></td>
</tr>
<tr>
<td><strong>Kindergarten</strong></td>
</tr>
<tr>
<td><strong>1st Grade</strong></td>
</tr>
<tr>
<td><strong>2nd Grade</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age</th>
<th>Typical Reading Skills Sequence of Vocabulary and Fluency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth-2</td>
<td>Engages in conversations with adults</td>
</tr>
<tr>
<td>3-4 years</td>
<td>Learns words for objects in the environment</td>
</tr>
<tr>
<td>Kindergarten</td>
<td>Sight reads high-frequency words; Uses new vocabulary in speech</td>
</tr>
<tr>
<td>1st Grade</td>
<td>Creates meaning while reading; Rereads decoded words to master texts; Uses new vocabulary in speech</td>
</tr>
<tr>
<td>2nd Grade</td>
<td>Continues to read with increasing speed; Uses context clues to decode words; Uses root prefixes and suffixes</td>
</tr>
<tr>
<td>3rd Grade</td>
<td>Reads at 114 words per minute; Build vocabulary through daily reading</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grade</th>
<th>Comprehension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth-2</td>
<td>Engages in conversations with adults</td>
</tr>
<tr>
<td>3-4 years</td>
<td>Relates personal experiences to stories read aloud</td>
</tr>
<tr>
<td>Pre-K</td>
<td>Answers open-ended questions about stories</td>
</tr>
<tr>
<td>Kindergarten</td>
<td>Makes predictions about stories; Answers questions about stories read aloud</td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; Grade</td>
<td>Follows simple written instructions; States information learned while reading</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; Grade</td>
<td>Summarizes stories: recalls details and main ideas, sequences events, identifies characters</td>
</tr>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt; Grade</td>
<td>Knows fact/opinion and explains cause/effect; Identifies confusing passages/words and asks clarifying questions</td>
</tr>
</tbody>
</table>


**Developmental Risk Factors for Reading Development**

Risk factors that impede a typical reading developmental sequence include child variables, family factors, and environmental variables such as early school experiences.

*Child risk factors.* Research suggests that individual cognitive impairments and sensory-related limitations are related to reading achievement (Snow, Burns, & Griffin, 1998). Hearing impairment has also been linked to reading difficulties, although the results of studies have not been conclusive as to the strength of the association (Snow et
al., 1998). Early language difficulties have also been related to later reading difficulties. In a review of the literature, Snow et al. reported that 40 to 75 percent of preschool children with early language delays later develop reading problems. While children with the most severe and persistent language delays were identified as most at-risk for reading difficulties, children with mild or moderate language delays are at greater risk for reading problems than their peers (Snow et al.). Other individual risk factors for reading development include attention problems and visual impairment.

From the available research, children with early language delays appear to be most at-risk for typical reading development. Shapiro and colleagues (1990) studied a cohort of infants and found that attainment of expressive language milestones made the strongest contribution to predicting later reading development. Similarly, another study reported that preschoolers’ mean utterance length and number of vocabulary words produced were significantly related to reading achievement in first through third grade (Walker, Greenwood, Hart, & Carta, 1994). Other studies have found receptive language vocabulary, expressive language ability, receptive language ability, and nursery rhyme recitation predicted performance on later reading tests (Bryant, Bradley, MacLean, & Crossland, 1989; Bryant, MacLean, Bradley, & Crossland, 1990). In a similar study, Scarborough (1991) found receptive language and expressive vocabulary skills to strongly predict reading outcomes at the end of second grade.

It is clear from the available, but limited research, that early language skills are strongly related to the attainment of early reading development. While other risk factors are predictors of reading development, early language delays appear to be the strongest predictors of early reading difficulties.
According to Lyon (2003), children who have difficulty in learning how to read demonstrate their difficulties in the early stages of reading development. For example, children show difficulty linking sounds, or phonemes, to letters and letter patterns (Lyon, 2003). In later stages of reading development, children display frequent starts, stops, and mispronunciations of letters and words, which in turn negatively impacts comprehension of words. According to Lyon, difficulties in decoding unfamiliar words and learning to recognize words fluently are the basis for most reading difficulties. At the initial stage of reading development, children demonstrate difficulties in reading by not understanding principles of phonemic awareness (2003).

In terms of specific reading skills, most young children experience difficulty understanding how sounds are related to letters, which may be a result of receptive language difficulties. This is an initial, vital skill in a typical reading development sequence, and impacts the later understanding of phonemes. When children do not learn this skill, they experience difficulty with phonological awareness, a strong predictor of later reading success.

*Family risk factors.* Family history of reading difficulties is one of the strongest predictors of reading difficulties for young children (Snow et al., 1998). The available research suggests that parents’ reading disabilities predict a higher than average rate of reading disabilities in their children (Scarborough, 1990). A family environment supportive of literacy is also indicative of successful reading development. For example, the following areas have been identified by reading theorists and researchers as important markers of reading development: value placed on literacy, press for achievement, availability and instrumental use of reading materials, reading with other children, and
opportunities for verbal interaction. The amount of verbal interaction in families is a strong predictor of children’s vocabulary development, which is associated with reading outcomes (Hart & Risley, 1995). Socioeconomic status has also been a consistent predictor of reading development, and is considered both an individual risk factor and family and community risk factor. Research suggests that the effects of SES are strongest when it is an indicator of school or community status, rather than individual status. In other words, a child of low SES attending a middle class school is less at-risk than a group of children of low SES attending a low SES school (Snow et al.).

School-based factors. The available research on school-based factors has studied the “effectiveness” of schools. “Ineffective” schools were described by lower rates of student time on task, less teacher presentation of new material, low rates of teacher communication of high expectations, little positive reinforcement, frequent classroom interruptions, more discipline problems, and a non-friendly classroom environment (Teddlie & Stringfield, 1993).

In summary, a variety of developmental risk factors exist to explain why some children experience difficulty in learning how to read. Early language delays appear to be the strongest predictor of later reading development. Individual child factors are exacerbated by family history of reading disabilities and home environments that do not encourage verbal interactions between members. Low SES and poor communities are also linked to later reading difficulties. At the school level, a combination of teacher practices and global student behavior and attitude appear to contribute to reading achievement.
Competing theoretical perspectives exist to explain early literacy instructional strategies. Four general approaches to reading instruction have been identified, ranging from direct instruction of skills to a whole language approach. Stahl and Hayes (1997) describe these approaches as existing along a continuum, ranging from explicit teacher-directed, task analytic instruction to a child-directed, holistic approach to instruction. For example, direct instruction of skills involves the use of contrived, scripted materials, whereas a holistic approach utilizes “natural” and “authentic” materials found in the child’s environment. Early literacy research suggests that a child-directed approach promotes pre-reading skills for typical and at-risk children while a direct instructional approach is necessary for children at-risk for typical reading skills development. These instructional methods are based on competing theoretical approaches to early literacy development. This study examined the integration of two competing theories of early literacy development, constructivism and behaviorism.

**Constructivism**

According to constructivism learning theory, children learn by constructing knowledge from the information they receive rather than directly receiving that information from others. Constructivism is largely based on the work of developmental theorists, Jean Piaget and Lev Vygotsky. Piaget’s theory of learning proposed that people are active processors of information, knowledge can be described in terms of structures that change with development, and cognitive development results from the interactions that children have with their physical and social environments (Ormrod, 1999). Piaget
proposed that for learning to occur, an individual must assimilate new information into existing cognitive structures (Ormrod, 1999).

Constructivism principles are also founded on the learning theory of Lev Vygotsky. He proposed that complex mental processes begin as social activities and as children develop, they gradually internalize the processes and can use them independently of those around them (Ormrod, 1999). Vygotsky further purported that children can accomplish more difficult tasks when they receive assistance from others with more advanced skills (Ormrod, 1999). Constructivism theory assumes learning is the result of activity and self-organization. The theory further proposes that as children struggle to make meaning of their experiences, central organizing principles are formed that can be generalized across experiences, as a continuous process throughout development (Fosnot & Perry, 2005).

Multiple, competing theories exist in the literature to describe the instructional strategies that facilitate young children's reading development. The theories range from direct, explicit instruction of skills, to a more child-initiated, active approach to instruction. The child-initiated approach to instruction is best understood by the theory of constructivism, which assumes children learn best by actively constructing their knowledge from the information they receive from others and their authentic experiences within their natural learning environment (i.e., home and classrooms).

Relevant Literature

Developmentally appropriate practice. Developmentally Appropriate Practice (DAP) principles are based on constructivism theory. The DAP model emphasizes child initiation of interactions, child selection of activities, and the use of materials considered
to be appropriate for the child’s developmental level (Bredekamp, 1987; Bredekamp & Copple, 1997). DAP guidelines also emphasize play as a necessary tool for young children’s cognitive development. DAP assumes children are active learners in their environment and draw upon experiences to construct knowledge and understanding of the world (Bredekamp, 1987; Bredekamp & Copple, 1997). The National Association for the Education of Young Children (NAEYC) has published recommended guidelines for early childhood teachers based on DAP principles of early learning.

Most studies of DAP programs have focused on typical children’s development, but some early learning research suggests that DAP preschool programs have a positive impact on high-risk young children’s overall development (Marcon, 1992; 1999; Stipek et al., 1998). Research also suggests that dramatic play in the preschool classroom positively impacts typical children’s language and literacy skills (Levy, Schafer, & Phelps, 1986; Levy, Wolfgang, & Koorland, 1992; Morrow, 1990; Pramling, 1991; Schrader, 1989; 1990). Marcon (1992; 1999) examined the effects of three different preschool models (child-initiated, academically-oriented, and middle-of-the-road) on high-risk preschool children’s language, self-help, social, motor, and adaptive development, as well as mastery of basic skills. The study reported that children in the child-initiated model displayed greater mastery of basic skills than children in the academically-oriented program (Marcon, 1999).

In summary, DAP instruction emphasizes child-centered learning by child initiation of interactions, child selection of activities, and developmentally appropriate instruction materials. Most of the research on DAP preschool programs has been conducted on typically developing children, and suggests that in general, DAP instruction
positively impact children’s overall development, while other studies have found DAP instruction had a positive impact on specific skills such as language, early literacy, self-help, social, motor, and adaptive skills.

Behaviorism

Behaviorism principles of learning assume individuals are passive learners and that learning results from systematic response to physical stimuli. Behaviorism theory assumes that learning processes involve observable stimulus and response sequences, internal cognitive processes are excluded from understanding the learning process, and learning results from environmental events (Ormrod, 1999). Furthermore, behaviorism assumes that children need external motivation to learn and are affected by reinforcement (Fosnot & Perry, 2005).

Direct Instruction (DI) is a behavioral approach to teaching. This model of teaching reading skills to young children relies strongly on behavioral theory principles. DI is proposed by various researchers to provide a rigorously developed, highly scripted method for teaching that is fast paced and provides constant interaction between teachers and students (Lindsay, 2002).

DI is strongly teacher-directed and uses small group, face-to-face instruction by teachers and aides with carefully articulated lessons in which cognitive and literacy skills are broken down into small units, sequenced deliberately and taught explicitly (Becker, 1977). DI is based on extensive task analysis of academic skills, which is used as a foundation for designing systematic explicit teaching programs with a goal of maximizing learning of early literacy in preschoolers. The DI is “direct” in that it is explicit, teacher-directed and fast paced. It uses highly structured presentations to
children with frequent opportunities for child response. It also provides very specific procedures for error correction, elicited imitation, elicited choral responding and highly scripted lessons (Dale, Jenkins, Mills, & Cole, 2005).

Relevant Literature

*Direct instruction.* DI has been found to be effective in teaching high-risk young children early literacy and language skills that have long-term positive effects on their academic skills (Cole, Dale, Mills, & Jenkins, 1993; Dale & Cole, 1988; Dale et. al, 2005; Mills, Dale, Cole, & Jenkins, 1995). Dale and colleagues have contributed to the DI literature by rigorously examining the differential impact of DI and other instructional methods on young children’s developmental outcomes over several years. Most recently, Dale and colleagues (2005) found DI to be effective in promoting and maintaining the early learning skills of high-risk preschoolers at ages 12 and 16 years.

Project Follow Through, one of the first large-scale longitudinal projects to examine the effectiveness of various preschool programs, evaluated the effects of different instructional models on the basic academic skills, cognitive skills, and affective skills of at-risk elementary children. The instructional models included a child-centered, constructivist approach and a teacher-directed, DI model for learning. Results of this study revealed that children receiving DI demonstrated significant gains in positive affect, basic skills, and conceptual reasoning (Becker, 1977; Becker, Engelmann, Carnine, & Rhine, 1981; Engelmann, Becker, Carnine, & Gersten, 1988). The study reported that children receiving DI demonstrated the highest student outcomes on measures of basic academic skills, cognitive skills, and affective skills (Becker, 1977; 2000; Becker et al., 1981; Engelmann et al., 1988).
Dale and colleagues began their seminal work by studying the effects of DI for students with developmental delays (Cole & Dale, 1986). These researchers examined the differential effects of DI and interactive language instruction on a sample of preschool children with language delays. Interactive language instruction emphasizes teacher modeling, natural learning contexts, child-initiated language production, variable instruction structure and sequencing, and the active role of the child in the learning process. Upon follow-up at 8 months, the authors found a significant increase in post-intervention language and cognitive assessment for both methods but did not report a significant differential treatment effect for the interventions. This study found both approaches to be successful in increasing delayed children’s language and cognitive skills, but did not find one method to have more of an impact than the other on their skills.

Cole, Mills, Dale, and Jenkins (1996) later investigated the differential impact of a direct language instructional model and a developmentally based model on the language skills and cognitive ability of preschool children with developmental delays. In the first part of their study, the researchers found a differential impact for intervention on the children’s post-test assessments. Higher performing children displayed higher gain scores from the developmental language model while lower functioning children demonstrated higher gain scores from the direct language instruction. The authors found similar effects when comparing a combined model of direct language instruction and developmental language instruction to developmental language instruction alone. The researchers reported higher performing children displayed higher gain scores from the developmental
language model while lower functioning children showed greater improvement after receiving the combined model instruction (Cole et al., 1996).

Mills et al. (1995) reported on the cognitive, academic, and social outcomes at age 9 for children who received alternative instructional methods in preschool confirmed previous findings that both programs are equally effective in promoting and maintaining early learning skills in high-risk preschoolers, but have differential effects for higher and lower functioning children. The results of this longitudinal study and the outcomes of students at 12 and 16 years of age (Dale et al., 2005) demonstrates that both approaches are equally effective in promoting and maintaining early learning skills in high-risk preschoolers, but have differential effects for higher and lower functioning children. Specifically, lower functioning children benefited more from the Mediated Learning approach and higher functioning children gained more from the DI approach (Dale et al.).

Most recently, Dale and colleagues (2005) reported the long-term effects of DI versus an alternative Mediated Learning approach to early education for children with mild cognitive, academic, socioemotional, or language delays. Similar to developmentally appropriate practice, Mediated Learning emphasizes cooperative problem solving between teacher and student with the teacher following the child’s lead throughout instruction. At the end of the first year of the project, preschool and kindergarten children in both groups demonstrated gains in academic skills and cognitive skills (Dale & Cole, 1988). The researchers reported differential effects for specific assessments but did not find a specific treatment effect for the child’s aptitude. At 1 year and 2 years post intervention, Cole, Mills, and Dale (1989) reported that children in both groups maintained or increased their cognitive and academic skills following instruction.
in the preschool and kindergarten. The authors also suggested differential effects for specific subscale assessments but did not find a specific treatment effect for child’s aptitude. In a subsequent analysis of children at the end of their first year in the project, Cole and colleagues (1993) found a treatment by interaction effect when children with prior preschool experience were excluded from the final analysis. The researchers reported that higher performing students gained more from DI whereas lower performing students gained more from Mediated Learning. While Dale and colleagues have extensively studied the differential impact of direct instruction and other types of instruction on preschoolers’ developmental outcomes, they have not examined the additive impact of direct instruction within a developmentally appropriate practice curriculum on preschoolers’ early literacy skills.

The results of these studies report mixed findings. Cole and Dale (1986) found both DI and an interactive language instruction approach to be equally successful in increasing delayed children’s language and cognitive skills. In a later study of children with developmental delays, Cole and colleagues (1996) found that higher performing children demonstrated a larger gain in skills from the developmental language model while lower functioning children demonstrated a larger gain in skills from the direct language instruction. In contrast, in a study of high-risk children, Mills et al. (1995) and Dale et al. (2005) found that lower functioning children benefited more from Mediated Learning, a child-centered approach, and higher-functioning children gained more from the DI approach. Results of these studies suggest that the effectiveness of DI depends on the pre-instructional skills of the child as well as the type of delay (language, global developmental, or at-risk).
Other researchers have examined various developmental outcomes for children who have received DI, including language outcomes (Waldron-Soler et al., 2002). These authors specifically examined the effects of DI in the form of *Language for Learning* curriculum on the receptive and expressive language skills of typically developing preschool children and children with developmental delays. Using a nonequivalent control group design, the researchers found that children with developmental delays receiving DI displayed greater improvement in expressive and receptive language skills than those children in the control group. The study also reported that typically developing children receiving DI displayed a significant increase in their receptive language skills compared to the children in the control group (Waldron-Soler et al.).

Other studies have examined receptive language skills of children in kindergarten following DI (Benner et al., 2002). The researchers studied the impact of DI in the form of *Language for Learning* on a general sample of kindergarten children using a quasi-experimental design. The study reported children receiving DI demonstrated higher post-test scores on a measure of auditory comprehension compared to children in the control group.

Researchers have also investigated the effects of DI for students from low-income or poor backgrounds (Schug, Tarver & Western, 2001; Weisberg, 1988). Schug and colleagues examined the effects of school-wide DI implementation among rural, suburban, and urban populations. Interviews with the teachers and school administration reported strong, positive effects of the DI approach, including increased skills in reading decoding, reading comprehension, attitudes toward reading, improved writing skills,
increased ability to focus and sustain attention, and overall improved student behavior (Schug et al., 2001).

Weisberg found that poverty-level children who received 2 years of DI in preschool and kindergarten demonstrated higher reading achievement scores than children who only received 1 year of DI at the end of kindergarten and at 1- and 2-year follow up assessments in first and second grade (1988). The study further reported that children receiving DI showed higher achievement in reading, math, and spelling measures than a non-DI comparison group.

In sum, previous research has examined the cognitive and speech outcomes for preschoolers (Waldron-Soler et al., 2002), receptive language skills in kindergarten following preschool DI (Benner et al., 2002), and effects of DI for students with developmental delays (Becker, 1977; Cole & Dale, 1986; Cole et al., 1996) and students from low-income or poor backgrounds (Schug et al., 2001; Weisberg, 1988). Results of these studies suggest that DI is effective in increasing the expressive and receptive language skills of typical preschoolers and preschoolers with developmental delays when compared to control groups. Moreover, results of these studies indicate that DI has a significant impact on the early reading, math, spelling, and achievement skills of children from low-income or poor backgrounds. While these studies have found DI to be effective for children of varying risk levels and types of delay, results of the studies conducted by Dale and colleagues (Cole & Dale, 1986; Cole et al 1996; Dale et al., 2005; Mills et al., 1995) suggest that the effectiveness of DI depends on the pre-instructional skills of the child as well as the type of delay (language, global developmental, or at-risk).
DI has been studied in older children, but comparatively fewer studies have been conducted on preschoolers. Moreover, minimal research exists which studied the enhancement effect of DI when combined with typical early childhood curricula that are developmentally appropriate. While some evidence exists to support the effectiveness of developmentally appropriate practice on early literacy development in preschool children, no studies have examined the effectiveness of the Direct Instruction method of teaching as an add-on to DAP curriculum.

Problem Statement

Both DI and DAP methods have been found to be effective techniques in teaching early literacy skills to young children, both typical and at-risk. However, few studies have examined the differential impact of DI and DAP and even fewer studies have investigated the additive effects of DI to DAP curriculum. Therefore, the purpose of this study was to integrate a DI module as an enhancement to DAP curriculum and to examine evidence of the effectiveness of the enhancement in the form of increased pre-academic, language, and early literacy competencies for high-risk children.

Research Questions and Hypotheses

1. Did participation in DI result in greater overall acquisition of academic skills (number naming and number recognition, and letter and word naming and recognition) for high-risk children than participation in DAP alone?

Hypothesis 1: Children who participated in DI and DAP demonstrated greater attainment of academic skills (number naming and number recognition, and letter and word naming and recognition) than those children who participated in DAP only curriculum.
2. Did participation in DI result in greater overall acquisition of language skills (expressive communication and receptive communication skills) for high-risk children than participation in DAP alone?

Hypothesis 2: Children who participated in DI and DAP demonstrated greater attainment of language skills (expressive communication and receptive communication skills) than those children who participated in DAP only curriculum.

3. Did participation in DI result in greater overall acquisition of early literacy skills (letter naming fluency and initial sounds fluency) for high-risk children than participation in DAP alone?

Hypothesis 3: Children who participated in DI and DAP demonstrated greater attainment of early literacy skills (letter naming fluency and initial sounds fluency) than those children who participated in DAP only curriculum.
CHAPTER 2

REVIEW OF THE LITERATURE

Historical Background

*Reading Instruction*

Reading instruction is the most important subject in the history of American education and remains at the forefront of contemporary education and reform efforts. The history of reading instruction is paralleled by the political and social zeitgeist of the time. In the 16th and 17th centuries, motives for teaching reading were religious and religious materials were frequently used as reading instructional tools. Children were taught to read by the alphabetical method and oral reading instruction. At that time, early schools employed the alphabetical method which was characterized by memorization of the alphabet, and recognition of the letters. On the other hand, oral reading instruction occurred informally during family and religious gatherings, when sacred texts were read to children.

As the separation of church from state government emphasis prevailed in the early 18th century, the public education system was developed. Throughout most of this century, educational goals focused on building national strength and making good citizens (Smith, 2002). As such, instructional materials included patriotic books while teaching methods emphasized pronunciation, enunciation and fluent oral reading development. In the late 18th century, the national goal to improve educational methods and materials was influenced by the aim to “promote intelligent citizenship” (Smith, 2002). The content of instructional materials included materials and objects familiar to children and for the first time, contained pictures. In addition, the word method was
introduced as an instructional strategy while the alphabet-phonetic method continued to prevail in classrooms (Smith, 2002).

In the early 19th century, reading instruction was influenced by cultural development. Instructional materials consisted of professional books and supplemental readers. Instructional methods included the sentence and story method as well as phonetic methods. The sentence and story methods were characterized by teachers telling stories or rhymes to children until they were memorized, then children read and analyzed the text into separate words and phrases. On the other hand, phonetic methods emphasized teaching children the sounds of letters and combinations of letters as an initial reading step. Interest in reading research and reading disability also emerged during this time. In the following decades, an emphasis on scientific investigation in reading ensued. The aim of reading instruction was to teach efficient silent reading skills to help individuals meet the practical needs of life (Smith, 2002). Teachers’ manuals were developed to assist silent reading instruction. Also around this time in history, speeded reading, remedial reading instruction, and individualized instruction were introduced into the public school system (Smith, 2002). Continued research and intensive application of research progressed into the 1930’s and the concept of reading readiness was introduced. From 1935-1950, the emphasis on reading instruction paralleled the two World Wars. During these decades, interest in reading research output and instructional manuals was reduced. Social value was placed on reading instruction and reading skills were related to democracy. Interest in reading disabilities peaked and for the first time, language was related to reading (Smith, 2002).
Reading instruction in the 1950’s and 1960’s was influenced by expanding knowledge and technological advances. Reading programs that included different ethnic groups were introduced into public education settings in response to persistent problems of teaching at-risk children. The concept of programmed reading instruction was introduced in the 1960’s, which relied heavily on psychological principles of behaviorism. Reading instruction continued to focus on basal reading programs that emphasized phonics and comprehension. Also in this decade, reading educators began to discuss and examine the relationship between linguistics and reading instruction. Federal programs began funding reading research that focused on comparing different teaching methodologies. During the next three decades influences on reading instruction included psycholinguistics, cognitive psychology principles, sociolinguistics, and literary theory. Application of these perspectives took form in focus on comprehension, literature-based reading, process writing, integrated instruction, and the whole language approach (Smith, 2002). The last two decades have also seen a shift in reading research ideology. In the 1980’s and mid-1990’s, qualitative methods were widely used in educational research. However, in the late 1990’s and beyond, reading researchers returned to utilizing quantitative, experimental methods focusing on the effectiveness of various instructional strategies (Smith, 2002). In the last few years, reading educators have voiced concern over extreme positions and are moving toward advocating for balanced approaches to instruction.

*Early Childhood Education*

Formalized early childhood education began in the United States in the late 18th century with the kindergarten movement. In the early 1920’s, professional researchers
and educators initiated organization of nursery school programs for young children (NAEYC, 2001). While federal support was available during the establishment of nursery school programs, these programs were not incorporated into the public education system (Peters, Neisworth, & Yawkey, 1985). Rather, professional organizations were developed to oversee program supervision, staff training, and quality practices. In 1929, a multidisciplinary group formed to create The National Association for Nursery Education (NANE) to manage the quality of the programs.

During the mid 19th century, the day-care movement began as a child-welfare service for the care and protection of children (Peters et al., 1985). Professional organizations including NANE continued to be actively involved in the development and implementation of nursery school and daycare programs (NAEYC, 2001). Federal funding was given to daycare programs during the second World War but was withdrawn after the war ended. As more women entered the workforce, the need for daycare programs rose in the 1980’s and daycare evolved into several forms that varied by funding and orientation, including family day-care homes, extended day-care homes, and day-care centers (Peters et al.).

In the 1960’s, the compensatory education movement began in response to social reform as well as an increase in knowledge about child development (Peters et al., 1985). Project Head Start was founded and implemented in 1965 as an enrichment program for at-risk young children and brought public education onto preschool education. Also during this decade, NANE reorganized as the National Association for the Education of Young Children (NAEYC). During the 1980’s, as more families sought daycare and preschool programs, NAEYC responded to the increasing need for quality education.
services by planning and implementing an accreditation system for early childhood programs (NAEYC, 2001). In the 1990’s the organization began to issue position statements regarding standards for early childhood education, focusing on curriculum content and assessment in early childhood programs (NAEYC, 2001). In 1996, NAEYC adopted a position statement on Developmentally Appropriate Practice (DAP) to guide and set standards for early childhood programs.

*Developmentally Appropriate Practice*

According to NAEYC, DAP principles were defined as a result of professional decision making about the well-being and education of young children based on the following three kinds of information and knowledge: 1) child development and learning, 2) individualized child strengths, needs, and interests, and 3) social and cultural contexts of children (Bredekamp & Copple, 1997). For example, early childhood teachers who applied DAP principles made daily decisions based on the knowledge of how their students develop and learn, the needs and strengths of the individual students and families they worked with, and the social and cultural context (Bredekamp & Copple, 1997). At the time of inception, DAP guidelines were created to address the increasing number of children who did not meet kindergarten readiness standards of narrowly defined academic skills and were subsequently grade-retained or refused enrollment (Bredekamp & Copple, 1997). Specifically, DAP curriculum was developed to counteract emphasis on rote learning and large group instruction of specific academic skills in preschool, including DI programs.

The DAP model emphasized child initiation of interactions, child selection of activities, and the use of materials considered to be appropriate for the child’s
developmental level (Bredekamp, 1987; Bredekamp & Copple, 1997). Guidelines also emphasized play as a necessary tool for young children’s cognitive and early academic development. DAP assumed children were active learners in their environment and drew upon experiences to construct knowledge and understanding of the world (Bredekamp, 1987; Bredekamp & Copple, 1997).

In 1998, NAEYC and the International Reading Association adopted a joint position statement that applied DAP principles to young children’s early literacy skills (NAEYC, 1998). According to this position statement that combined both research and “expert opinion” of the members of the organization, DAP principles applied to early literacy consisted of using a variety of teaching strategies based on the individual needs of the child (NAEYC, 1998). Specifically, DAP reading instruction built on what children already knew, and were able to do, and provided knowledge, skills, and positive attitudes for learning (NAEYC, 1998). In addition, DAP reading instruction taught children the technical skills of reading as well as the application of these skills to enhance their thinking and reasoning abilities (NAEYC, 1998).

DAP reading activities included reading aloud to children, enhancing children’s exposure to and concepts about print, and literacy themed dramatic play (NAEYC, 1998). Reading aloud to children while adhering to DAP principles involved children as active participants in reading, asking predictive and analytic questions while reading during small group reading activities, and helping children relate stories to their own experiences through conversations (Bus, van IJzendoorn, & Pellegrini, 1995; Dickinson & Smith, 1994; Karweit & Wasik, 1996; Snow, Tabor, Nicholson, & Kurland, 1995; Whitehurst et al, 1994).
Applying DAP to young children’s attainment of early reading skills also involved exposure to print within the natural classroom environment (Clay, 2001; Stanovich & West, 1989). “Big Books” were frequently used by teachers to help children distinguish print concepts and features, including looking at print for story meaning and that reading progresses from left to right across the page (NAEYC, 1998). Moreover, teachers demonstrated print concepts to young children by pointing to individual words, drawing attention to the first line in a book, and helping children identify letters and sounds (NAEYC, 1998). The physical arrangement of the classroom also increased the time children spend looking at books (Morrow & Weinstein, 1986; Neuman & Roskos, 1997). Strategic location of the classroom library and frequent field trips to the community library increased children’s interest in books (NAEYC, 1998). In addition, children learned about print from the signs, labels, and objects in the classroom environment (NAEYC, 1998).

DAP strategies also incorporated dramatic play with books and print materials to help children naturally learn reading skills (Morrow, 1990; Vukelich, 1994; Neuman & Roskos, 1993). For example, the classroom library helped children develop an appreciation of reading (NAEYC, 1998). Literacy themed dramatic play included play settings such as a restaurant, post office, shoe store, veterinary hospital, and camp sites (Vukelich, 1994). Print materials in the play environment were an integral part of increasing children’s exposure to early reading. According to NAEYC, play-based literacy activities exposed children to a variety of print experiences and processes for later reading instruction (1998).
Direct Instruction

Direct Instruction (DI) has evolved over the past several years to become a research-based effective model of instruction for children of all ages (Marchand-Martella, Slocum, & Martella, 2004). It is one model of evidence-based instruction that is often used to teach young children at risk for later school success. DI is a behavioral approach to teaching that relies strongly on behavioral theory principles. It is proposed by various researchers to provide a “rigorously developed, highly scripted method for teaching that is fast paced and provides constant interaction between teachers and students” (Lindsay, 2004).

Siegfried Engelmann

In the early 1960’s, Siegfried Engelmann proposed a departure from the typical early childhood education programs for at-risk children. Engelmann’s proposal was based on the following assertions from the few empirical studies available at the time: at-risk preschool children demonstrated delayed school readiness skills compared to same-aged peers, at-risk children must “catch up” in their early school readiness skills before entering kindergarten, progression of skills must occur at a faster rate than typical development, typical preschool programs could be expected to provide learning opportunities above normal rates, and typical programs were not able to produce above normal gains in all developmental domains (Bereiter & Engelmann, 1966).

Upon review of the limited studies available at the time, Engelmann proposed that preschool children from low socio-economic backgrounds consistently performed below average on measures of intellectual ability, language skills, and reasoning ability when compared to children from middle class socio-economic backgrounds (Bereiter &
Engelmann, 1966). He also proposed that at-risk children fall behind when they start school rather than “catch up” to their same-aged peers. Furthermore, as children enter secondary education settings, the differences become more dramatic. Children from “poor” backgrounds tended to drop out of school at a higher rate and consistently perform lower on achievement measures (Bereiter & Engelmann).

Engelmann concluded that if at-risk children were already behind their same-aged peers when starting kindergarten they must learn at a faster than normal rate if they were to “catch up” to their peers (Bereiter & Engelmann, 1966). To do this, he proposed that the learning experiences be intense, concentrated, and compressed into a small amount of time without losing their effectiveness (Bereiter & Engelmann). Engelmann further concluded that early childhood programs should primarily focus on academic objectives and nonacademic objectives take a secondary emphasis. In this way, at-risk children would receive focus and rapid learning from their teachers. He also specified that language skills are the core deficit at-risk children demonstrate, and that if these skills are not remedied, children will likely not “catch up” in other areas of delay (Bereiter & Engelmann).

Engelmann purported that typical preschool programs were not well suited to teach academics in a rapid and focused manner to at-risk children. For example, typical, child-centered programs focused on providing “experiences” to children, rather than emphasizing achievement of specific goals in an ordered sequence of activities (Bereiter & Engelmann, 1966). In his experience, he observed that preschool programs for at-risk children were modeled after upper-middle-class early childhood programs and failed to meet the needs of those children.
These assumptions and findings led Engelmann to develop his educational philosophy of teaching specific academic goals to at-risk preschool children as “direct teaching or instruction” (Bereiter & Engelmann, 1966). He explained this method of teaching as a drastic change from the typical preschool setting and likened the method to typical elementary school classroom teaching strategies. Engelmann believed teachers should carefully plan activities which directly focus on the learning objectives and explicitly teach the concepts to children through maximized exposure, practice, and correction. He characterized the direct instruction method by the following: deliberately planned lessons, drilled exercise, provisions for practice and feedback, and performance criteria for children (Bereiter & Engelmann).

Deliberately planned lessons that addressed a variety of student responses included scripts for teachers to use when teaching specific concepts. Engelmann recommended that teachers follow a rigid, repetitive presentation pattern and phrase statements rhythmically to reduce the number of unrecognized mistakes in student responses. In addition to these strategies, the direct instruction method required teachers to frequently ask questions during lessons in order to focus a child’s attention onto specific parts of a sentence or process (Bereiter & Engelmann, 1966).

According to Engelmann, the direct instruction method also encouraged teachers to prevent incorrect responses. Teachers also needed to be clear when providing feedback to children regarding the accuracy of their responses. Cues played a crucial role in direct instruction lessons. Engelmann described the purpose of cues as a method to introduce “an element that is not essential to the understanding of the concept but that makes the processing of the concept easier” (Bereiter & Engelmann, 1966).
Engelmann’s educational philosophy for at-risk children also proposed specific goal development to obtain age-appropriate skills. He proposed that specific discrete educational goals and objectives did not naturally occur in the preschool environment and therefore must be explicitly taught to young children. Specifically, Engelmann proposed 15 tasks that an at-risk preschooler should be able to perform by the end of preschool to be successful for kindergarten. He described these tasks as ranging from the ability to distinguish words from pictures to being able to perform specific kinds of “if-then” deductions. Table 5 describes each of these tasks.
<table>
<thead>
<tr>
<th>Goal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ability to use both affirmative and <em>not</em> statements in reply to the question “What is this?” “This is a ball. This is not a book.”</td>
</tr>
<tr>
<td>2</td>
<td>Ability to use both affirmative and <em>not</em> statements in response to the command “Tell me about this ____ (ball, pencil, etc.)” “This pencil is red. This pencil is not blue.”</td>
</tr>
<tr>
<td>3</td>
<td>Ability to handle polar opposites (“If it is not ____, it must be ____”) for at least four concept pairs, e.g., big-little, up-down, long-short, fat-skinny.</td>
</tr>
<tr>
<td>4</td>
<td>Ability to use the following prepositions correctly in statements describing arrangements of objects: on, in, under, over, between. “Where is the pencil?” “The pencil is under the book.”</td>
</tr>
<tr>
<td>5</td>
<td>Ability to name positive and negative instances for at least four classes, such as tools, weapons, pieces of furniture, wild animals, farm animals, and vehicles. “Tell me something that is a weapon.” “A gun is a weapon.” “Tell me something that is not a weapon.” “A cow is not a weapon.”</td>
</tr>
<tr>
<td>6</td>
<td>Ability to perform simple <em>if-then</em> deductions. The child is presented a diagram containing big squares and little squares. All the big squares are red, but the little squares are of various other colors. “If the square is big, what do you know about it?” “It’s red.”</td>
</tr>
<tr>
<td>Goal</td>
<td>Description</td>
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<tr>
<td>7</td>
<td>Ability to use <em>not</em> in deductions. “If the square is little, what else do you know about it?” “It is not red.”</td>
</tr>
<tr>
<td>8</td>
<td>Ability to use <em>or</em> in simple deductions. “If the square is little, then it is not red. What else do you know about it? “It’s blue <em>or</em> yellow.”</td>
</tr>
<tr>
<td>9</td>
<td>Ability to name the basic colors, plus white, black, and brown.</td>
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<tr>
<td>10</td>
<td>Ability to count aloud to 20 without help and to 100 with help at decade points (30, 40, etc.).</td>
</tr>
<tr>
<td>11</td>
<td>Ability to count objects correctly up to ten.</td>
</tr>
<tr>
<td>12</td>
<td>Ability to recognize and name the vowels and at least 15 consonants.</td>
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<tr>
<td>13</td>
<td>Ability to distinguish printed words from pictures.</td>
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<tr>
<td>14</td>
<td>Ability to rhyme in some fashion to produce a word that rhymes with a given word, to tell whether two words do or do not rhyme, or to complete unfamiliar rhyming jingles like “I had a dog, and his name was Abel; I found him hiding under the ____.”</td>
</tr>
<tr>
<td>15</td>
<td>A sight-reading vocabulary of at least four words in addition to proper names, with evidence that the printed word has the same meaning for them as the corresponding spoken word. “What word is this?” “Cat.” “Is this a thing that goes ‘Woof-woof’?” “No, it goes ‘Meow.’”</td>
</tr>
</tbody>
</table>
The application of the direct instruction method was first studied by Engelmann with a sample of 15 preschool children he described as “severely deprived” (Bereiter & Engelmann, 1966). Prior to receiving direct instruction, the children demonstrated a one-year developmental delay in language skills. After 9 months of direct instruction in language skills, the children displayed language skills and IQ scores within the normal range of development. Furthermore, the children demonstrated second grade level math skills and first grade level reading skills (Bereiter & Engelmann, 1966).

Later in his career, Engelmann purported his instructional method was appropriate as a broad approach for teaching academic skills to all children. He proposed that the method is applicable to all instructional problems, including teaching basic academic skills to at-risk preschool children and advanced skills to unmotivated older students. After subsequent years of experience and research on the effectiveness of DI, Engelmann and his colleagues proposed three assumptions underlying this model of teaching (Engelmann, Becker, Carnine, & Gersten, 1988). These assumptions included: 1) all children can be taught, 2) the learning of basic skills and their application in higher-order skills was essential to intelligent behavior, and 3) the disadvantaged child must be taught at a faster rate to catch up with higher class peers (Engelmann et al. 1988).

Engelmann also described shared characteristics of DI for use with any instructional environment: carefully scripted presentations, teacher-directed and fast-paced presentations, children grouped according to their abilities, choral responding, signals used to obtain responses from children, individual turns taken during lessons, corrective feedback provided to children, and positive reinforcement (Engelmann, 1980).
**Carefully designed curriculum.** The DI curriculum was designed to teach several, small subsets of skills in order for children to learn the whole set of skills (Engelmann et al. 1988). For example, children who received DI language curriculum were taught object names, object classes, object properties, and relational terms. Therefore, the students used these skills to learn to make complete statements and to describe their environment (Engelmann et al.).

**Efficient teaching techniques.** The DI curriculum included explicit instructions for what the teacher says and does during classroom instruction (Engelmann et al., 1988). The scripts were intended to provide teachers with directions, sequences of examples, and sequences of sub-skills and wordings (Engelmann et al.). The scripts were also used to help teachers improve the quality of their instruction (Engelmann et al.).

The curriculum and training program also emphasized the systematic use of positive reinforcement to help children become and stay motivated to learn (Engelmann et al., 1988). Reinforcement strategies included praise, point systems, and games. The reinforcement techniques were also expected to increase student-engaged learning time.

DI lessons were taught in small groups. In this way, teachers were able to recognize and spend time with lower performing students. When students gave incorrect responses, the teacher provided immediate corrective feedback as well as the process for how to arrive at the answer (Engelmann et al., 1988).

DI was characterized by behavioral principles to increase teacher efficiency and student learning time. DI was highly scripted, fast-paced, and teacher-directed. Specifically, Engelmann developed DI as an instructional method to teach at-risk children. Out of Engelmann’s educational philosophy, work with at-risk preschoolers,
and intense longitudinal educational research studies, came a specific curriculum that applied DI principles to various subjects: DISTAR (Direct Instruction System for Teaching Arithmetic and Reading). The curriculum was later renamed to capture more skills, including language (Direct Instruction System for Teaching and Remediation). Presently the curriculum is used in a variety of educational settings. School systems have adopted DI as a district-wide instructional method and curriculum while some schools have used DI curriculum as a compensatory education program.

In summary, DI and DAP are conflicting models of instruction. DI utilizes teacher-directed lessons, in which the child’s learning is dependent on the adults’ instruction. On the other hand, DAP instruction is child-initiated, where children are considered active participants in the learning process. These two curriculum models have long been debated in the field of early child education as to which promotes better academic outcomes for children.

Engelmann’s original work created controversy because it directly opposed Piaget’s constructivist theory, the predominant theory of learning and development at the time. For example, Engelmann’s method of teaching did not follow Piaget’s developmental theory that children should not be instructed until they reach specific developmental levels of “readiness.” Other critics of DI have described the method as harmful and detrimental to children (Schweinhart & Weikart, 1997). To date, early childhood professionals argue against the benefits of using direct instruction strategies in preschool classrooms. Some early childhood professionals continue to describe direct instruction as harmful and developmentally inappropriate for young children.
Relevant Theory

Reading Development

Multiple theories (Chall, 1996; Clay, 1991; Ehri, 1995; LaBerge & Samuels, 1974; Rumelhart, 1994) exist to explain how young children develop reading skills. Most theories propose that young children learn these skills both at home and at school, and that the skills are developmental in nature, that is, they build upon each other as children “master” each individual component of reading. Furthermore, most theories propose that children integrate the skills which then become more automated and fluent as children become proficient readers. While there is some debate regarding the developmental order of the attainment of these skills, several commonalities exist in the literature as to five essential component skills necessary for reading development: the alphabetic principle, phonemic awareness, oral reading fluency, vocabulary, and comprehension (National Reading Panel, 2000).

Alphabetic Principle

Understanding the alphabetic principle means that children know that printed letters represent phonemes (Armbuster et al., 2001). Before young children learn this principle, they need to display letter knowledge, the ability to distinguish and identify the letters of the alphabet, and phonological awareness, the knowledge that spoken words are made of smaller units of sounds (Byrne & Fielding-Barnsley, 1989). In 3- and 4-year old children, letter knowledge skills are observable when children notice the letters in their names. In preschool, children with typical letter knowledge skills can sing the alphabet song and name and identify at least 10 letters of the alphabet. Kindergarten children are able to recognize all 26 upper and lower letters of the alphabet. Finally, as children enter
first grade, letter knowledge skills are developed into pre-spelling skills, and children know that words have correct spellings (Armbruster et al.).

Phonological awareness is a broad term that includes identifying and manipulating larger parts of spoken language into smaller segments, such as words, syllables, onsets and rhymes, and phonemes (Armbruster et al., 2001). Three and 4-year old children demonstrate phonological awareness by paying attention to sounds in words and hearing the rhythm of language. Preschool aged children with typically developing phonological awareness skills know that words are made of sounds and are able to identify and rhyme simple words. In kindergarten, these skills develop by children demonstrating the ability to identify words with the same beginning sounds and know that the letters in each word correspond to sounds. First-grade children are able to identify syllables in words, blend sounds into words, and change sounds by adding, deleting, or substituting phonemes. Finally, in second grade, children with typically developing reading skills are able to read words with one and two syllables and attempt to read larger words using phonics knowledge (Armbruster et al.).

**Phonemic Awareness**

Phonemic awareness is the understanding that the sounds of spoken language work together to make words (Armbruster et al., 2001). Specifically, phonemic awareness involves identifying and manipulating the individual sounds in words. As phonemic awareness is a sub-skill of phonological awareness, children develop phonemic awareness skills in a similar sequence to phonological awareness skills, as described in the preceding section. Specific phonemic awareness skills are demonstrated when children recognize and produce the individual sounds in a word. This is an emerging skill
in preschool, where children are able to identify the first sound of a word. This skill becomes more fully developed in kindergarten, as children are able to identify phonemes in words and segment three-and four-phoneme words into their individual phonemes. Kindergarten children are able to recognize the same sounds in different words. In first grade, children with typical phonemic awareness skills can listen to a sequence of separately spoken phonemes and combine the phonemes to form a word. First grade children are also able to break words into separate sounds and change sounds by adding, deleting, or substituting phonemes. Finally, in second grade, children with typically developing reading skills are able to read words with one and two syllables and attempt to read larger words using phoneme awareness skills (Armbruster et al.).

*Oral Reading Fluency and Vocabulary*

Fluency is the ability to read a text accurately and quickly (Armbruster et al., 2001). For young children, vocabulary knowledge is a precursor to fluency. Three- and 4-year old children demonstrate vocabulary knowledge by learning words for various objects in their environment. In preschool, children learn and use new words and create longer sentences. Kindergarten children with typically developing fluency and vocabulary skills are able to sight read high frequency words and use new vocabulary words in their conversations with others. First grade children demonstrate preliminary fluency by creating meaning out of written words and rereading decoded words to master simple texts. First grade children with typically developing vocabulary skills know that words have antonyms and synonyms. In second grade, children continue to read with increasing speed, and in third grade, children with typical fluency skills are able to read 114 words per minute. In regard to vocabulary development, second grade children use
context clues to decode new words and have knowledge of roots, prefixes, and suffixes.

Third grade children continue to increase their vocabulary knowledge through daily reading (Armbruster et al.).

**Comprehension**

The foundation for comprehension skills is laid early in life, through exposure to adult conversations, and as language develops, participation in conversations (Armbruster et al., 2001). Three- and 4-year old children display pre-comprehension skills by relating personal experiences to stories read aloud to them. In preschool, children are able to answer open-ended questions about stories read aloud to them, such as why, how, and what? As their early comprehension skills develop, children in kindergarten demonstrate the ability to make predictions about stories and answer questions about stories read aloud. In first grade, typical early readers follow simple written directions and state information they learned while reading. Second graders are able to summarize stories by recalling details and main events, sequencing events, and identifying characters. Finally, in third grade, children demonstrate on-target comprehension skills by differentiating between fact and opinion and explaining cause and effect, and identifying confusing passages or words and asking clarifying questions (Armbruster et al.).

**Print Concepts**

Concepts of print refers to a broad understanding of the applications of print rather than specific knowledge about letters (Snow et al., 1998). For example, 3- and 4-year old children demonstrate knowledge of print concepts by understanding that print has meaning and by knowing how to handle books, turning one page at a time. In preschool, children are able to understand that text is read from left to right and top to
bottom. Finally, in kindergarten, children demonstrate print knowledge by knowing the various parts of books (Armbruster et al., 2001). Knowledge of print concepts has also been linked to reading ability in primary grades (Stuart, 1995).

Developmental Risk Factors for Reading Development

Risk factors that impede a typical reading developmental sequence include child variables, family factors, and environmental variables such as early school experiences.

Child risk factors. Research suggests that individual cognitive impairments and sensory-related limitations are related to reading achievement (Snow et al., 1998). Specifically, children with severe cognitive impairments typically develop low reading achievement. Other risk factors that impact children’s cognitive development and reading achievement include nutrition deficiencies, low birthweight, fetal alcohol syndrome, lead poisoning, and severe childhood pathology (Snow et al.). Hearing impairment, deafness, and chronic ear infections have also been linked to reading difficulties, although the results of studies have not been conclusive as to the strength of the association (Snow et al.; Wallace & Hooper, 1997; Waters & Doehring, 1990).

Other individual risk factors for reading development include attention problems. In a longitudinal study of children with attention problems, Shaywitz and colleagues (1994; 1995b) found that reading disabilities frequently occur with children who have attention problems. Even more, the authors reported that the frequency increases as children develop. For example, the authors found that 31 percent of first grade children with attention problems also are diagnosed with a reading disability, and over 50 percent of ninth grade children with attention problems are diagnosed with a reading disability.
Early speech and language difficulties have also been linked to later reading difficulties. Aram and Hall (1989) followed a group of preschoolers with speech and language disorders and found that between 40 and 75 percent of those children developed reading problems. Stothard and colleagues (1998) reported on the follow up results of a longitudinal study of 71 adolescents with a preschool history of speech language impairment. The authors found that children whose language skills had improved over time demonstrated similar scores on vocabulary and language comprehension tests but lower scores on phonological processing and literacy skill tests when compared to a control group (Stothard, Snowling, Bishop, Chipchase, & Kaplan, 1998). The authors further reported that children who continued to demonstrate language impairment showed significant difficulties on assessments of spoken language, written language, and vocabulary knowledge (Stothard et al., 1998). Similarly, in a longitudinal study of 43 preschoolers with and without specific language impairments, Stark et al. (1984) found that at 8-years-old, children with specific language impairment demonstrated reading impairment. In another follow-up study of preschool children with early language delays, Scarborough and Dobrich (1990) found that while these children developed typical language skills at the end of 3 years, the majority demonstrated severe reading disabilities. Finally, in a follow up to a longitudinal study of 113 preschoolers with and without language impairment, Bishop and Adams (1990) reported that children whose language skills had improved demonstrated typical literacy skills but children with
persistent language difficulties showed reading difficulties in the areas of reading fluency and comprehension.

From the available research, children with early language delays appear to be most at-risk for typical reading development. Shapiro and colleagues (1990) studied a cohort of 240 infants and found that attainment of expressive language milestones made the strongest contribution to predicting later reading development. Specifically the authors reported that a composite measure of the infants’ language and linguistic development predicted presence of a reading disability with high sensitivity and specificity. This study is notable in that these children did not demonstrate a language disorder; rather their overall expressive language developed at a slower rate than typical peers and still were at risk for later reading achievement. Similarly, another study reported that preschoolers’ mean utterance length and number of vocabulary words produced were significantly related to reading achievement in first through third grade (Walker, Greenwood, Hart, & Carta, 1994). While this study did not examine the specific relationship between early language and later reading development, the authors reported finding moderate correlations between the preschool early language measures and reading achievement scores in first through third grade. Other studies have found receptive language vocabulary, expressive language ability, receptive language ability, and nursery rhyme recitation predicted performance on later reading tests (Bryant, Bradley, MacLean, & Crossland, 1989; Bryant, MacLean, Bradley, & Crossland, 1990). In both of these studies, the authors reported that preschoolers’ nursery rhyme knowledge was positively related to their phonological awareness skills, and in turn, their phonological awareness skills were positively related to their reading progress.
In summary, research suggests that early language impairment in preschool is a strong predictor of reading difficulties in primary grades. Even preschool children with mild or moderate language delays demonstrate risk for typical reading skill acquisition when compared to peers with typical language development. While other individual child risk factors such as cognitive ability, hearing difficulties, and attention problems, are predictors of reading development, early language delays appear to be the strongest predictors of early reading difficulties.

According to Lyon (2003), children who have difficulty in learning how to read demonstrate their difficulties in the early stages of reading development. For example, children show difficulty linking sounds, or phonemes, to letters and letter patterns (Lyon, 2003). In later stages of reading development, children display frequent starts, stops, and mispronunciations of letters and words, which in turn negatively impacts comprehension of words. According to Lyon, difficulties in decoding unfamiliar words and learning to recognize words fluently are the basis for most reading difficulties. At the initial stage of reading development, children demonstrate difficulties in reading by not understanding principles of phonemic awareness (2003).

In terms of specific reading skills, most young children experience difficulty understanding how sounds are related to letters, which may be a result of receptive language difficulties. This is an initial, vital skill in a typical reading development sequence, and impacts the later understanding of phonemes. When children do not learn this skill, they experience difficulty with phonological awareness, a strong predictor of later reading success.
Family risk factors. Family history of reading difficulties is one of the strongest predictors of reading difficulties for young children (Snow et al., 1998). Scarborough (1991) conducted a longitudinal study of two groups of 44 children, beginning at age 30 months. The groups were determined by family history of reading disability and then by the children’s reading status at the end of second grade. The author reported that the reading disability group performed lower on all dependent measures, specifically in comprehension and expressive syntax measures, until age 5 when their skills increased to that of the control group, suggesting family history is a predictor of early literacy difficulties. Similarly, in another study of two groups of 66 children, one with family history of reading disability and one without, Scarborough (1989) reported that reading ability at the end of second grade was predicted by family history of reading problems, as well as individual differences in vocabulary, phonological awareness, and early literacy skills of children at age 5. Findings from this study suggest that both family history and individual child factors predict subsequent reading ability.

A family environment supportive of literacy is also indicative of successful reading development. For example, the following areas have been identified by reading theorists and researchers as important markers of reading development: value placed on literacy, press for achievement, availability and instrumental use of reading materials, reading with other children, and opportunities for verbal interaction. In a study of 41 2-year-old children and their mothers, DeBaryshe (1993) found that age of onset of home reading routines strongly predicted oral language skills, suggesting that the age at which parents begin reading to their children is related to their subsequent language and reading development. Similarly, Scarborough and colleagues (1991) found that 22 preschoolers
who later experienced reading difficulties had less frequent home literacy-related experiences (parent-child reading, adult reading, child solitary book reading) than those children who demonstrated on target reading skills at the end of second grade. In another study of home literacy environment, Mason (1980) reported that when parents helped their 4-year-old children attend to letters, signs, and labels and gave them opportunities to read, spell, and print words, children demonstrated increased letter and sign-recognition and letter-sound knowledge.

The amount of verbal interaction in families is also a strong predictor of children’s vocabulary development, which is associated with reading outcomes (Hart & Risley, 1995). In a two and a half year study of 42 families, the authors reported that low SES and middle class families provided the same type of early language experiences for their children, but the quantity of verbal interactions in middle class families was far greater. Specifically, these authors found that the amount of verbal interaction in the home environment correlates with 4-year old children’s vocabulary skills: low verbal interaction is positively related to low vocabulary skills (Hart & Risley, 1995).

Socioeconomic status (SES) has also been a consistent predictor of reading development, and is considered both an individual risk factor and family and community risk factor. While associations have been made between reading achievement and SES for individual children, research suggests that the effects of SES are strongest when it is an indicator of school or community status, rather than individual status. For example, in a meta-analysis of 174 studies, White (1982) reported an average correlation of .23 between reading achievement and SES. Likewise, Walberg and Tsai (1985) reported a correlation of .22 between reading achievement scores on the National Assessment of
Educational Progress assessments and SES for a sample of over one thousand children. Finally, Horn and O’Donnell (1984) reported a correlation of .31 between SES and reading achievement measures in a longitudinal study of over 200 children. These studies suggest that the strength of the relationship between SES and reading achievement is small when examining individual differences in SES, and appear to be stronger when SES is an indicator of community or school status.

The research on familial risk factors indicates that parental history of reading disability is a strong predictor of reading difficulties in young children. Home literacy environment characteristics, especially the amount of verbal interaction between family members, are also a predictor of reading achievement for young children, specifically vocabulary skills. While SES has been linked to individual reading achievement, the effects are strongest when SES is indicative of the child’s school and/or community.

School-based factors. The available research on school-based factors has studied the “effectiveness” of schools, in conjunction with community SES. In their longitudinal study of the effectiveness of schools, the Louisiana School Effectiveness Study, Teddlie and Stringfield (1993) found the following common factors of ineffective schools: lower rates of student time on task, less teacher presentation of new material, low rates of teacher communication of high expectations, little positive reinforcement, frequent classroom interruptions, more discipline problems, and a non-friendly classroom environment, despite their community SES. While these characteristics of ineffective schools have been linked to poor student reading achievement elsewhere in the literature (see Howes and Hamilton, 1992; Howes and Matheson, 1992; Birch and Ladd, 1997),
there is no available research on effective preschools and the subsequent impact on children’s reading development.

In summary, a variety of developmental risk factors exist to explain why some children experience difficulty in learning how to read. Early language delays appear to be the strongest predictor of later reading development. Individual child factors are exacerbated by family history of reading disabilities and home environments that do not encourage verbal interactions between members. Low SES and poor communities are also linked to later reading problems of children. At the school level, a combination of teacher practices and global student behavior and attitude appear to contribute to reading achievement.

Early childhood practice and research offer opposing perspectives as to the most appropriate and effective type of instruction for young children who are at-risk or demonstrate early language and literacy delays. Research suggests that explicit or direct instruction of early language and literacy skills (i.e., direct teaching of the alphabetic principle and/or phonemes) helps at-risk children learn and retain those skills. On the other hand, early childhood practice and policy proposes instructional strategies for at-risk children that are child-centered and developmentally appropriate (i.e., children learn the alphabetic principle through play-based experiences in their natural learning environments). This study examined whether the two approaches can be combined in the form of Direct Instruction as an enhancement to DAP curriculum, with an additive impact on high-risk children’s early academic, language, and literacy skills.
Behaviorism

Direct Instruction (DI) is a behavioral approach to teaching. Behaviorism principles of learning assume individuals are passive learners and that learning results from systematic response to physical stimuli. Behaviorism theory assumes that learning processes involve observable stimulus and response sequences, internal cognitive processes are excluded from understanding the learning process, and learning results from environmental events (Ormrod, 1999). Furthermore, behaviorism assumes that children need external motivation to learn and are affected by reinforcement (Fosnot & Perry, 2005).

Specifically, behavioral theory relies on three principles of learning: behavioral consequences contain three components – antecedents, behavior, and consequences; behavioral responses are based on antecedents and learning history; and effective teaching requires teacher control of antecedents and consequences (Wolery, Bailey, & Sugai, 1988). Antecedents are environmental events that are manipulated to set the stage for learning and include stimuli such as prompting and modeling. Consequences are the events that control behavior through environmental reinforcement contingencies. Positive and negative reinforcers are used to strengthen desirable behaviors while techniques such as extinction and punishment are used to weaken undesirable behaviors. Variables that are related to the effectiveness of consequences include the timing and schedule of the reinforcement. According to behavioral theory, behavior is most influenced by reinforcement that immediately follows (Peters et al., 1985). Furthermore, behavior theory purports reinforcers should be a natural outcome of the behavior being learned.
Applied to teaching, behavioral techniques consist of modeling desired behaviors, teacher prompts, modification of materials, and structuring the environment (Wolery et al., 1988). Modeling is frequently used by teachers to teach children the steps in more complex behaviors. Behaviorally oriented teachers may use verbal prompts, cues, or physical prompts to facilitate children’s desired behaviors. Teachers may also manipulate the learning environment through a reinforcement schedule. For example, teachers may provide continuous positive reinforcement when teaching a new desirable behavior to a child or use repeated drill exercises when building response maintenance.

Behavioral educational interventions also include positive reinforcement, extinction, and punishment. Generally, teachers using a behavioral approach to instruction develop educational and behavioral goals for students and identify specific antecedents and consequences for controlling the behaviors (Wolery et al., 1988). Learning objectives can be broken down into the following steps: child motivation, attention to task, acquisition of material, retention, generalization, and performance (Peters et al., 1985).

Bereiter and Engelmann (1966) combined the stimulus response approach to learning with behavioral objectives to create their Direct Instruction approach to learning. DI is strongly teacher-directed and uses small group, face-to-face instruction by teachers and aides with carefully articulated lessons in which cognitive and literacy skills are broken down into small units, sequenced deliberately and taught explicitly (Becker, 1977). DI is based on extensive task analysis of academic skills, which is used as a foundation for designing systematic explicit teaching programs with a goal of maximizing learning of early literacy in preschoolers. The DI is “direct” in that it is
explicit, teacher-directed and fast paced. It uses highly structured presentations to children with frequent opportunities for child response. It also provides very specific procedures for error correction, elicited imitation, elicited choral responding and highly scripted lessons (Dale et al., 2005).

Constructivism

In direct contrast to behaviorism, constructivism learning theory proposes children learn by constructing knowledge from the information they receive rather than directly receiving that information from others. Constructivism is largely based on the work of developmental theorists, Jean Piaget and Lev Vygotsky. Piaget’s theory of learning proposed that people are active processors of information, knowledge can be described in terms of structures that change with development, and cognitive development results from the interactions that children have with their physical and social environments (Ormrod, 1999). Piaget proposed that for learning to occur, an individual must assimilate new information into existing cognitive structures (Ormrod, 1999).

Constructivism principles are also founded on the learning theory of Lev Vygotsky. He proposed that complex mental processes begin as social activities and as children develop, they gradually internalize the processes and can use them independently of those around them (Ormrod, 1999). Vygotsky further purported that children can accomplish more difficult tasks when they receive assistance from others with more advanced skills (Ormrod, 1999). Constructivism theory assumes learning is the result of activity and self-organization. The theory further proposes that as children struggle to make meaning of their experiences, central organizing principles are formed that can be generalized across experiences, as a continuous process throughout
development (Fosnot & Perry, 2005). NAEYC developed DAP guidelines based on constructivist principles. For example, the model emphasizes child initiation of interactions and activities, and the use of materials appropriate for the child’s developmental level.

In sum, behaviorism and constructivism are conflicting theories of learning. Behaviorism principles assume children are passive learners while teachers explicitly teach skills in a carefully scripted, sequenced fashion. In contrast, principles underlying constructivism assume children are active learners while teachers facilitate learning through the natural context of the environment. These two competing theories of early literacy instruction laid the foundation for this investigation. This study examined a behavioral approach, DI, to teaching early literacy skills within a developmentally appropriate constructivist-oriented preschool classroom.

Empirical Literature

*Early DI Literature*

*Project Follow Through*

The effectiveness of DI as an instructional strategy for at-risk children was first investigated on a large-scale basis as part of Project Follow Through. The project, a longitudinal educational evaluation study, was established by the United States Office of Education in the early 1960’s to examine the differential effects of several educational models for at-risk children in primary grades. The project included 180 communities. Seven thousand children were evaluated per each year of the study. The educational models included parent education, behavior analysis, cognitive, developmental instruction, and direct instruction.
National longitudinal evaluation results of DI as one of the educational models of Project Follow Through indicated that children receiving DI made significant gains in measures of positive affect, basic academic skills, and conceptual reasoning (Becker, 1977; Becker et al., 1981; Engelmann et al., 1988). Twenty communities that participated in Project Follow Through used the DI model in their programs. Of these communities, 12 provided DI for 4 years, from kindergarten through third grade, and 8 communities provided DI for 3 years, from first through third grade. The communities consisted of low SES groups, and included both rural and urban settings. The following assessments were used to measure academic and social outcomes: the Wide Range Achievement Test (WRAT), the Metropolitan Achievement Test (MAT), and the Slosson Intelligence Test (SIT).

Results of the national evaluation showed that at-risk children receiving DI made significant gains on all subtests of the WRAT, including reading, math, and spelling (Becker, 1977; Becker et al., 1981; Engelmann, et al., 1988). The results also showed that after participating in DI for 3 years, low-income children demonstrated academic skills at or near the national normative levels (Becker, 1977; Becker et al.; Engelmann et al.). When compared to other educational models involved in Project Follow Through, the DI group showed more statistically and educationally significant differences on the MAT than any of the other models participating in the project. In summary, results of the wide-scale longitudinal study suggest that DI is an effective instructional strategy for children identified as at-risk for academic failure. Specifically, evaluation of the model shows that at-risk children receiving DI have demonstrated significant gains in vocabulary knowledge, reading decoding, solving math problems, and making logical
inferences (Becker 1977; Becker et al.; Engelmann et al.). Moreover, the gains made by the children reached national norms by the end of their participation in the project.

Follow-up studies of Project Follow Through have evaluated academic outcomes for children 3 years after the final year of the project. Results found strong consistent effects for reading decoding skills, spelling, and math problem solving skills for children who participated in DI as compared to children who did not receive DI (Becker & Gersten, 1982; Gersten, Keating, & Becker, 1988). Further follow-up studies of high school students who received DI in primary grades as part of Project Follow Through, when compared to students in a comparison group, demonstrated higher scores on standardized reading and math achievement tests, had fewer grade retentions, dropped out of school at a lower rate, and demonstrated a higher number of college application and acceptances than students in the comparison group (Gersten & Keating, 1987; Gersten, Keating, & Becker, 1988).

Experimental Design Studies

Following the inception of Project Follow Through, several studies have been conducted to evaluate the effectiveness of DI as an instructional strategy for a variety of learners, including at-risk preschoolers and young children with disabilities. Serwer, Shapiro, & Shapiro (1973) conducted the first randomized experiment to examine the effectiveness of three instructional approaches for 62 high-risk first grade students, as an add-on to the regular first grade reading curriculum. The students were randomly assigned to one of four groups: direct, indirect, combined, or control group. The DI group consisted of Engelmann’s Distar method whereas the indirect method consisted of perceptual motor activities. Children in the combined group received both treatments
while children in the control group received no specialized remediation instruction. The study found that students receiving indirect instruction in the form of perceptual motor activities performed significantly higher academic tests of handwriting and math while students receiving DI demonstrated significantly better scores on reading assessments (Serwer et al., 1973). However, the DI program used in the study, while utilizing Distar reading materials, did not adhere with many of the principles of direct instruction, which may have confounded the results of the study.

Also employing a randomized experimental design, Maggs and Morath (1976) examined the effectiveness of DI in the form of Distar Language curriculum on 28 children, ages 6 to 14, identified as “moderately to severely retarded.” Upon completion of the 2-year program, the DI group performed significantly higher on the outcome measures of cognitive skills as compared to the group receiving an alternative additive language program. However, this study did not implement treatment fidelity throughout the program.

Finally, Lloyd and colleagues (1980) utilized an experimental design to investigate the impact of DI for 23 intermediate students diagnosed with learning disabilities. The authors found that students receiving DI curriculum in reading demonstrated significantly higher scores on reading achievement and intelligence tests than students in the comparison group. This study is flawed in that the authors did not implement treatment fidelity throughout the intervention. Additionally, the study included a behavior management component to DI that is not fully described in the method section, which may have impacted the implementation of the curriculum and subsequent results.
In sum, early experimental design studies investigating the effectiveness of DI have been conducted with children in primary grades with mild to moderate cognitive delays and older children with learning disabilities. While these studies reported overall improvement in reading, achievement, and cognitive skills for children receiving DI, the methodology employed in the studies was often flawed, as many did not implement treatment fidelity throughout implementation of DI. This study improved upon previous experimental design studies by incorporating treatment fidelity of the intervention throughout the implementation phase.

Quasi-Experimental Design Studies

Other early evaluation studies of the effectiveness of DI utilized quasi-experimental designs. For example, Gersten and Maggs (1982) examined the effectiveness of DI in the form of Distar Language and Reading programs over a 5-year period on a small sample of pre-adolescent and adolescent children identified as “moderately retarded.” Using the standardization sample from norm-referenced tests as a comparison group, the authors reported that children receiving DI made significant gains on outcome measures of intelligence, as well as gaining at a faster rate than their comparison peers (Gersten and Maggs, 1982). While the investigators implemented treatment fidelity procedures, they did not employ a control group for comparison.

Weisberg (1988) examined the effectiveness of DI in the form of Distar curriculum for 109 at-risk preschoolers and kindergarten children. Children were categorized into three different groups: limited reading group, 1-year reading group, and 2-year reading group. Children in the limited reading group received only a small portion of Distar lessons while children in the 1-year and 2-year group completed a larger portion
of the lessons. The comparison group consisted of children enrolled in a preschool program that emphasized a Structure-Cognitive Model and low-income children attending a public kindergarten classroom who did not previously attend preschool. Children’s cognitive and academic skills were assessed by both individual and group administered norm-referenced assessments and Continuous Progress Tests. Results of the study found that children receiving DI for 2 years demonstrated higher normative gains in all academic content areas than children only receiving DI programming for 1 year. Even more, the 2-year group retained their gains over the 1-year group at follow-up in first and second grade, as a greater number of children in the 2-year group demonstrated above grade level reading skills. Both DI groups demonstrated higher achievement scores as compared to same-aged peers in a non-DI preschool program.

Following Engelmann’s original DI evaluation research with preschool children, Dale and colleagues began their seminal work by studying the effects of DI for students with developmental delays (Cole & Dale, 1986). These researchers examined the differential effects of DI and interactive language instruction on a sample of 44 preschool children with language delays. Interactive language instruction emphasizes teacher modeling, natural learning contexts, child-initiated language production, variable instruction structure and sequencing, and the active role of the child in the learning process. Children were randomly assigned to classrooms using either DI or interactive instruction. Standardized language measures and a cognitive assessment were administered at pre- and post-test. Upon follow-up at 8 months, the authors found a significant increase in post-intervention language and cognitive ability for both methods but did not report a significant differential treatment effect for the interventions. While
both methods improved children’s language and cognitive ability, there was no difference reported between the groups on post-test measures.

Early studies of the effectiveness of DI on young children’s academic skills are flawed and present mixed findings. While most of the studies reported children who received DI demonstrated an increase in academic skills after intervention, the results of other studies found an improvement in academic skills for children receiving any type of remedial instruction. Moreover, several of the earlier studies were flawed in that they did not utilize a control group or random assignment. A number of these studies also did not implement treatment fidelity throughout the intervention.

Current DI Literature

Dale and colleagues continued their seminal work on the effectiveness of DI by conducting a longitudinal study on the differential impact of DI versus a Mediated Learning approach to early language instruction. Similar to developmentally appropriate practice, Mediated Learning emphasizes cooperative problem solving between teacher and student with the teacher following the child’s lead throughout instruction. Over a 4-year intervention period, the study included 206 preschool and kindergarten children. The subjects were given pre- and post-assessments once a year, and were subsequently assessed at 1-year intervals during the follow up phase. At the end of the first year of the project, preschool and kindergarten children in both groups demonstrated gains in academic skills and cognitive skills (Dale & Cole, 1988). The researchers reported differential effects for specific assessments but did not find a specific treatment effect for the child’s aptitude. For example, children receiving DI demonstrated greater gains on the Test of Early Language Development and the Basic Language Concepts tests while
children receiving Mediated Learning demonstrated higher gains on the McCarthy Verbal and Memory Scales and Mean Length of Utterance (Dale & Cole, 1988).

Upon completion of the 4-year study, the investigators did not find a significant main effect for program type (Cole et al., 1991; Cole et al., 1993). However, the researchers did find an aptitude by treatment interaction effect. Higher performing students gained more language skills from DI whereas lower performing students demonstrated larger gains in language skills from Mediated Learning (Cole et al, 1991.; Cole et al., 1993).

At 1 year and 2 years post intervention, Cole et al (1989) reported that children in both groups maintained or increased their cognitive and academic skills following instruction in the preschool and kindergarten. The authors also suggested differential effects for specific subscale assessments but did not find a specific treatment effect for children’s aptitude. In general, children who received Mediated Learning showed higher gains on the Stanford-Binet Intelligence Scale and children who received DI demonstrated larger gains on the Peabody Individual Achievement Test (Cole et al.).

Mills et al (1995) reported on the cognitive, academic, and social outcomes at age 9 for 141 children who received DI and Mediated Learning instructional methods in preschool. The follow-up study confirmed previous findings that both programs were equally effective in promoting and maintaining early learning skills in high-risk preschoolers, but have differential effects for higher and lower functioning children. Consistent with the earlier studies, students with higher aptitudes in the DI program and lower aptitudes in the Mediated Learning program demonstrated higher scores on the follow-up assessments (Mills et al.). The results of this follow-up study and the outcomes
of students at 12 and 16 years of age (Dale et al., 2005) demonstrates that both approaches are equally effective in promoting and maintaining early learning skills in high-risk preschoolers, but have differential effects for higher and lower functioning children. Specifically, lower functioning children benefited more from the Mediated Learning approach and higher functioning children gained more from the DI approach (Dale et al.).

In a separate investigation from their longitudinal study, Cole et al (1996) examined the differential impact and relative effectiveness of a direct language instructional model and a developmentally based model on the language skills and cognitive ability of a sample of nearly 60 preschool children with developmental delays. The first study compared a direct language facilitation program to a developmentally based language program on 52 preschoolers’ language and cognitive skills. In the first part of their study, the researchers found a differential impact for intervention on the children’s post-test assessments. Higher performing children displayed higher gain scores from the developmental language model while lower functioning children demonstrated higher gain scores from the direct language instruction. The second study examined the differential impact of the developmental language program and a combined model of developmental language and direct language instruction on 55 preschoolers’ language and cognitive skills. The authors found effects similar to the first study. The researchers reported higher performing children displayed higher gain scores from the developmental language model while lower functioning children showed greater improvement after receiving the combined model instruction (Cole et al.). However, in this study the DI model varied from “pure” DI instruction in that it allowed for teacher selection of
appropriate stimulus materials and individualized language goals in contrast to using predetermined scripted lessons.

Recent studies of the effectiveness of DI have examined various developmental outcomes for children, including language outcomes (Waldron-Soler et al., 2002). These researchers specifically examined the effects of DI in the form of Language for Learning curriculum on the receptive and expressive language skills of 28 typically developing preschool children and 8 children with developmental delays. Using a nonequivalent control group design, the researchers found that children with developmental delays receiving DI displayed greater improvement in expressive and receptive language skills than those children in the control group. The study also reported that typically developing children receiving DI displayed a significant increase in their receptive language skills compared to the children in the control group. However, this study did not implement DI in instructional groups as intended by the authors of the curriculum, nor did the study utilize a comparison/control group within the same setting as the children who received DI.

Other studies have examined receptive language skills of children in kindergarten following DI (Benner et al., 2002). The researchers studied the impact of DI in the form of Language for Learning on a general sample of 45 kindergarten children using a quasi-experimental design. The study reported children receiving DI demonstrated higher post-test scores on a measure of auditory comprehension compared to children in the control group. Similar to early studies of DI, this study did not collect treatment fidelity data nor did the study utilize a comparison/control group within the same setting as the children who received DI.
Researchers have also investigated the effects of DI for students from low-income or poor backgrounds (Schug et al., 2001). Schug and colleagues examined the effects of school-wide DI implementation among rural, suburban, and urban populations. Interviews with the teachers and school administration reported strong, positive effects of the DI approach, including increased skills in reading decoding, reading comprehension, attitudes toward reading, improved writing skills, increased ability to focus and sustain attention, and overall improved student behavior (Schug et al.). However, this study is limited in its methodology in that it lacked an experimental design and rigorous research methodology.

In sum, recent research has examined the cognitive and speech outcomes for preschoolers (Waldron-Soler et al., 2002), receptive language skills in kindergarten following preschool DI (Benner et al., 2002), and effects of DI for students with developmental delays (Cole & Dale, 1986; Cole et al., 1996) and students from low-income or poor backgrounds (Schug et al., 2001). Longitudinal studies have examined the differential effectiveness of DI and alternative instructional methods in preschool and kindergarten on subsequent academic achievement (Cole et al., 1989; Cole et al., 1993; Dale & Cole, 1988; Dale et al., 2005).

Results of the current DI research present with mixed findings. For example, some studies reported that DI is effective in increasing at-risk children’s academic and language skills (Benner et al., 2002; Schug et al., 2001; Waldron-Soler et al., 2002). Other studies found that a developmental language instruction was more effective than DI for higher performing preschoolers with developmental delays (Cole & Dale, 1986; Cole et al., 1996). In direct contrast to those studies, some research supports that higher
performing children with developmental delays demonstrate more academic gains after receiving DI than lower performing children (Cole et al., 1989; Cole et al., 1993; Dale & Cole, 1988; Dale et al., 2005).

Examination of the previous DI research with preschoolers is minimal and contains methodological flaws. Most of the preschool research includes samples of children identified as developmentally delayed. While some studies randomly assigned children to groups, few utilized an experimental design with a control group for comparison purposes. Very few studies collected treatment fidelity data. Some studies lacked rigor by only using teacher and administration interviews as measures of child outcomes. Additionally, none of the existing studies implemented progress monitoring probes throughout the intervention. Moreover, no studies exist which examined the “value-added,” enhancement effect of DI when combined with typical early childhood curricula that are developmentally appropriate.

This study built upon previous investigations of the effectiveness of DI as well as improved upon the methodology used in previous studies. The sample included typically developing preschoolers who are considered at-risk for academic success and early literacy skill attainment. This study utilized an experimental design with a control group for comparison purposes. Treatment fidelity data was collected to ensure the intervention was being implemented in the most reliable and valid manner as intended. Dependent measures were chosen for their usefulness in providing reliable and valid specific child outcomes in a preschool setting. The study also implemented individual progress monitoring throughout the intervention.
While DAP is promoted and advocated by early childhood professionals, researchers, and national organizations, few studies have rigorously examined the effectiveness on children’s developmental outcomes. However, some evidence does exist to support that preschool classrooms using developmentally appropriate practice result in greater academic outcomes for preschool children (Levy et al., 1986; Levy et al., 1992; Marcon, 1992; 1999; Morrow, 1990; Pramling, 1991; Schrader, 1989; 1990; Stipek et al., 1998; 1999; Stipek et al., 1995). Specifically, DAP research has focused on dramatic play and child-centered environments.

Early learning research suggests that dramatic play in the preschool classroom positively impacts children’s language and early literacy skills. In a single case, multiple-baseline design across kindergarten children, Levy and colleagues (1986; 1992) found a relationship between enriched sociodramatic play and increased language skills. Similarly, Schrader (1989; 1990) found that preschool teachers using symbolic play as a method for teaching early literacy skills resulted in improved written language skills for preschoolers. Morrow (1990) reported that preschool children engaged in more literacy behaviors when teachers guided literacy themed play. The study also reported that children engaged in more literacy behaviors when literacy materials were added to the dramatic play center (Morrow, 1990).

The research on the effectiveness of DAP on preschoolers’ pre-academic skills is limited and flawed. While some evidence exists to support the effectiveness of DAP as an instructional approach for teaching early literacy skills to young children, other studies have reported inconsistent results for the effectiveness of DAP (Van Horn & Ramey,
In a longitudinal study of former Head students, Van Horn and Ramey (2003) found that DAP classrooms accounted for little or no variation in children’s academic performance. Even more, a review of the studies investigating DAP revealed methodological and analytical flaws (Van Horn, Karlin, Ramey, Aldridge, & Snyder, 2005). Specifically, these authors found no evidence for consistent effects of DAP on cognitive or academic outcomes and only a few studies reporting positive effects for DAP would have remained significant if the data analysis had been conducted appropriately.

Comparison of DAP and DI Programs

Relatively few studies have examined the differential effects of DI and DAP preschool programs. Stipek and colleagues (1995) examined the differential impact of a child-centered preschool and kindergarten program and a didactic, academic oriented program on 227 young children’s basic academic skills. Programs were identified as either child-centered or didactic based on classroom observations and information gathered from the programs. Children in the program that emphasized basic skills demonstrated significantly higher scores on letter/reading achievement tests than children in the child-centered program. However, children enrolled in the child-centered program demonstrated higher scores on a number skills achievement test and motivational measures. While this study found significant differential effects for DAP and didactic instruction, the study did not implement DI as a curriculum. Rather, classrooms were identified as either child-centered or didactic based on classroom observations and interviews with staff. Moreover, the study is flawed in that it did not utilize an experimental design.
Stipek and colleagues (1998) further investigated the effect of two different kindergarten and preschool classroom environments on preschoolers’ cognitive skills. The classrooms were characterized as either basic-skills-oriented in a less positive social environment (similar to DI) or as de-emphasizing basic skills in a more positive social environment (similar to DAP). The study reported that children in the basic-skills-oriented classroom did not demonstrate as much of a gain on measures of letter knowledge and reading achievement, nor on cognitive assessments, as did the children in the classrooms that de-emphasized basic skills (Stipek et al., 1998). However, among a small sample, the investigators reported that children receiving didactic instruction for two years demonstrated higher reading skills than children receiving developmentally appropriate instruction for two years. Similar to the preceding study, DI was not implemented as a curriculum.

Huffman and Speer (2000) investigated the impact of DAP on the academic achievement skills of 113 kindergarten and first grade children enrolled in a Head Start program. The researchers found that children’s math and reading achievement skills were significantly higher in classrooms characterized as more developmentally appropriate than children in less developmentally appropriate classrooms. Specifically, the study reported children in classrooms rated as more developmentally appropriate demonstrated significantly higher scores on measures of letter/word identification and applied problems (Huffman & Speer, 2000). Again, classrooms in this study were characterized by observation, and DI was not implemented as a specific curriculum.

Marcon (1992; 1999) examined the differential impact of three curriculum models on a large sample of 4-year-olds attending preschool in an urban setting. Based on
teachers’ responses to The Pre-K Survey of Beliefs and Practices, the classroom models were characterized as child-initiated, academically directed, and middle-of-the-road. The study reported that children in the child-initiated classroom models demonstrated greater mastery of basic academic skills than children attending the other classrooms (Marcon, 1999). Further, the results of this study indicated that children in the middle-of-the-road classroom demonstrated significantly lower scores on all of the measures as compared to children in the other classrooms (Marcon, 1999). However, all outcome measures used in this study were teacher ratings of children’s skills. While teachers’ ratings of children’s skills are fairly accurate, it is possible that the teacher’s beliefs influenced their ratings. Moreover, this study did not implement DI as a curriculum.

Even fewer studies have examined the long-term differential effects of DI and DAP preschool programs (Karnes, Schwedel, Allan, & Williams, 1983; Miller, Dyer, Stevenson, & White, 1975; Schweinhart & Weikart, 1997). Taken together, the results of these studies support the short-term effectiveness of DI. However, long-term benefits of the programs are mixed.

One of the first comparison studies conducted in the field, precipitating Project Follow Through, examined the differential effects of four preschool programs on the cognitive, motivational, and perceptual development of children attending Head Start (Miller et al., 1975). The preschool programs included two child-centered approaches, Montessori and Traditional Head Start methods, and two behavioral teacher-directed approaches, including Direct Instruction. At the end of the first year of the study, students in teacher-directed programs demonstrated significantly higher overall scores on
cognitive measures than students in child-centered programs (Miller et al.). However, long-term results of this study found a general decline in cognitive skills for all children.

Karnes and colleagues (1983) gathered longitudinal data on children attending five experimental preschool programs, including two child-centered programs, two “structured” programs, including DI, and a traditional nursery school program. Significant gains in IQ scores and verbal functioning were reported at the end of preschool for children who participated in the structured programs. However, these gains appeared to diminish after children entered primary school, and the differences were non-existent upon graduation from high school (Karnes et al., 1983).

Schweinhart and Weikart (1997) conducted a longitudinal study investigating the effects of a Head Start child-initiated curriculum (High/Scope), DI curriculum, and Nursery School preschool program on 68 at-risk children’s subsequent cognitive and academic outcomes. Follow-up outcomes were reported for children at ages 10, 15, and 23. At age 15, the authors reported that the DI group committed twice as many misconduct acts than the High/Scope group. At age 23, the study reported that the DI group displayed three times as many felony arrests as the other groups. Also at age 23 follow up, children receiving DI in preschool experienced significantly more years of special education than children in the other programs. No differences in literacy skills were reported. (Schweinhart & Weikart, 1997). The authors also reported more positive social outcomes for children in the High/Scope curriculum and Nursery School program than for those children receiving DI. However, this longitudinal study is flawed in many ways. The initial assignment of children to groups was not randomized. Initial group
differences based on background characteristics were found in long-term outcomes, confounding the results.

In conclusion, early literacy research suggests that early language impairment in preschool is a strong predictor of reading difficulties in primary grades. Even preschool children with mild or moderate language delays demonstrate risk for typical reading skill acquisition when compared to peers with typical language development. Furthermore, research suggests that both DI and DAP instructional approaches are linked to improved academic and cognitive outcomes for preschoolers, especially those children at-risk for later academic difficulties. Some studies have found DI is effective in increasing at-risk children’s academic and language skills (Benner et al., 2002; Schug et al., 2001; Waldron-Soler et al., 2002). Other studies found that a developmental language instruction was more effective than DI for higher performing preschoolers with developmental delays (Cole & Dale, 1986; Cole et al., 1996). In direct contrast to those studies, some research supports that higher performing children with developmental delays demonstrate more academic gains after receiving DI than lower performing children (Cole et al., 1989; Cole et al., 1993; Dale & Cole, 1988; Dale et al., 2005).

While the research on DAP is limited, some studies have found a relationship between teacher’s use of DAP in the classroom and children’s academic skills. Previous research has linked teacher’s use of dramatic play to increased language skills (Levy et al., 1986; Levy et al., 1992). Other researchers have found a direct link between teacher’s facilitation of children’s symbolic play and their improved written language skills (Schrader, 1989; 1990). Morrow (1990) reported that children’s literacy behaviors increased when teachers guided their play with literacy themes.
Even fewer studies have compared the differential effects of DI and DAP. Some studies have found more positive academic outcomes for children receiving DAP curriculum when compared to academically-oriented preschool programs (Huffman & Speer, 2000; Marcon 1992; 1999; Stipek et al., 1998; Stipek et al., 1995). Other longitudinal studies have reported long-term positive academic outcomes for children receiving DI in preschool when compared to children in DAP programs (Becker, 1997; Gersten & Keating, 1987; Gersten et al., 1988; Miller et al. 1975). In direct contrast, Schweinhart and Weikart (1997) reported more long-term negative academic and social outcomes for children receiving DI in preschool when compared to children receiving DAP curriculum instruction. Other researchers reported that the differential effects of DI and DAP preschool instruction faded as children entered primary school and beyond (Karnes et al., 1983).

Previous research on the effectiveness of DI and DAP on at-risk preschoolers’ academic outcomes is mixed and presents with methodological flaws. For example, most studies comparing the two types of instruction did not implement DI as a curriculum. Rather, these programs were identified as academically-oriented, basic skills oriented, or developmentally inappropriate. Programs were considered using DAP based on observations conducted by researcher. Moreover, the design of most of the previous studies is flawed in that control groups were not used for comparison purposes, random assignment was not utilized, and treatment fidelity data was not collected.

In summary, relatively few studies have compared the differential effects of DI and DAP curriculum, or the combined effectiveness, on preschoolers’ academic and cognitive outcomes. Even fewer studies have examined the impact of DI as an additive...
enhancement to DAP curriculum. Therefore, this study filled a gap in the early childhood literacy literature by integrating a DI module as an enhancement to DAP curriculum and provided evidence of the effectiveness of the enhancement in the form of increased early literacy and preacademic competencies for high-risk children. The study built upon previous investigations as well as improved upon the methodology used in previous studies. DI was implemented as a curriculum, and treatment fidelity data was collected. The intervention was implemented in a NAECY-accredited preschool program that consistently applied DAP strategies in the classroom. The sample included typically developing preschoolers who were considered at-risk for academic success and early literacy skill attainment. This study utilized an experimental design with a control group for comparison purposes. Dependent measures were chosen for their usefulness in providing reliable and valid specific child outcomes in a preschool setting. The study also implemented individual progress monitoring throughout the intervention.
CHAPTER 3

METHOD

Participants

A total number of 61 preschool children were enrolled in the study. Statistical power analysis was conducted based on previous studies cited in the review of the literature section using the dependent measures of this study. It was determined that a sample of 52 children would yield sufficient power (.78) for a credible test of significance. However, the preschool program obtained consent for 61 children, so all children were considered potential subjects for the study. The preschool program that participated in the study was located in an urban, at-risk community. Any child entering the preschool program was considered a potential subject for the study. At the start of the intervention, the targeted children were between the ages of 3 and 5.5 years with a mean age of 52 months. Most of the families attending the preschool program qualified for low-income assistance. The racial, gender, and ethnic characteristics of the subject population reflected the demographics of the surrounding area, which was considered an at-risk community as it is a seriously impoverished area. Subjects were recruited in an attempt to reflect the demographics of the surrounding community. No exclusion criteria were based on race, ethnicity, or gender. Subjects who were identified as receiving Early Intervention services with Individualized Education Plans, and did not place into the first Direct Instruction lesson based on placement test results, were withdrawn from the study by the researcher.

Potential subjects were identified by parent consent through the provision of information about the study through teachers and staff of the preschool program. The
preschool program directors distributed and collected consents from parents and teachers. All potential subjects required parent contact and consent due to the age of the subjects. Parents were informed of the nature of the research, the risks, and the potential benefits of study participation, and their rights as a research subject prior to obtaining their signature on the informed consent document. Informed consent was obtained prior to pre-testing procedures. Approval from the Duquesne University Institutional Review Board (IRB) was obtained prior to obtaining informed consent. See Tables 6, 7, and 8 for frequencies and percentages of subject characteristics.

Table 6

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>32</td>
<td>52.5%</td>
</tr>
<tr>
<td>Female</td>
<td>29</td>
<td>47.5%</td>
</tr>
<tr>
<td>Total</td>
<td>61</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 7

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>12</td>
<td>19.7%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1</td>
<td>1.6%</td>
</tr>
<tr>
<td>Black</td>
<td>42</td>
<td>68.9%</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
<td>9.8%</td>
</tr>
<tr>
<td>Total</td>
<td>61</td>
<td>100%</td>
</tr>
</tbody>
</table>
Table 8

*Age Frequencies*

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-years old</td>
<td>22</td>
<td>36.1%</td>
</tr>
<tr>
<td>4-years old</td>
<td>27</td>
<td>44.3%</td>
</tr>
<tr>
<td>5-years old</td>
<td>12</td>
<td>19.7%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>61</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

The average length of intervention was 4.62 months, with a range of 1 to 6 months. A total of 42 students did not receive the planned 6-month intervention. These children withdrew from the study prior to receiving all of the intervention due to voluntary withdrawal from the preschool program, including transition to kindergarten. Table 9 shows a frequency count and percentages for the length of intervention for all students.
Table 9

*Length of Intervention in Months*

<table>
<thead>
<tr>
<th>Length of Intervention</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 month</td>
<td>1</td>
<td>1.6%</td>
</tr>
<tr>
<td>2 months</td>
<td>4</td>
<td>6.6%</td>
</tr>
<tr>
<td>3 months</td>
<td>11</td>
<td>18.0%</td>
</tr>
<tr>
<td>4 months</td>
<td>4</td>
<td>6.6%</td>
</tr>
<tr>
<td>5 months</td>
<td>22</td>
<td>36.1%</td>
</tr>
<tr>
<td>6 months</td>
<td>19</td>
<td>31.1%</td>
</tr>
<tr>
<td>Total</td>
<td>61</td>
<td>100%</td>
</tr>
</tbody>
</table>

A total of 45 subjects received all post-test measures. A total of 15 subjects received some combination of post-test measures, as several children withdrew from the preschool program without the researcher’s knowledge. Only 2 subjects did not receive any of the post-test measures, as they withdrew without the researcher’s knowledge. Mean substitution of the scores on the variable was used as a method to handle missing data since data was missing at random (Stevens, 2002).

**Measures**

The dependent measures were chosen for their usefulness in providing clinically relevant and authentic specific outcome information in the preschool setting.

*Kaufman Survey of Early Academic and Language Skills*

The Kaufman Survey of Early Academic and Language Skills (K-SEALS) provided information on early language, cognitive competencies, and early academic skills (Kaufman & Kaufman, 1993). The assessment gave normative information on
children aged 3 years 0 months to 6 years 11 months. The K-SEALS had three subtests: Vocabulary, Numbers, Letters & Words, and the Articulation Survey. The items on the Vocabulary subtest and Numbers, Letters & Words subtest were arranged into two language scales: Expressive Language scale and Receptive Language scale. The K-SEALS yielded one composite score, the Early Academic & Language Skills composite, which was comprised of the items on the Vocabulary and Numbers, Letters & Words subtests. For this study, the K-SEALS provided pre- and post-test measures of academic skills and language skills in preschool children, specifically number naming and number recognition, letter and word naming and recognition, expressive communication skills, and receptive communication skills.

Reliability

Split-half reliability. Reliability coefficients for the Early Academic & Language Skills composite ranged from .91 to .96 with a mean reliability of .94 (Kaufman & Kaufman, 1993). The Expressive Language scale and Receptive Language scale each had an average reliability of .90 (Kaufman & Kaufman, 1993). The mean reliability coefficients for the three subtests were .88 (Vocabulary), .94 (Numbers, Letters & Words), and .89 (Articulation Survey) (Kaufman & Kaufman, 1993).

Test-retest reliability. Test-retest coefficients were reported as follows: .94 (Early Academic & Language Skills composite), .87 (Vocabulary), .92 (Numbers, Letters & Words), .90 (Articulation Survey), .93 (Expressive Language scale), and .90 (Receptive Language scale) (Kaufman & Kaufman, 1993).

Intercorrelations. Reliability coefficients between the Vocabulary subtest and Numbers, Letters & Words subtest ranged between .47 to .67 with a mean reliability
coefficient of .59 (Kaufman & Kaufman, 1993). Reliability coefficients between the Expressive Skills scale and Receptive Skills scale ranged from .81 to .91 with an average reliability coefficient of .86 (Kaufman & Kaufman, 1993). Reliability coefficients for Number Skills with Letter & Word Skills ranged from .71 to .81 with a mean reliability coefficient of .77 (Kaufman & Kaufman, 1993).

Validity

Concurrent validity. Concurrent validity analyses have been conducted using intelligence and achievement tests as criteria. The K-SEALS Early Academic & Language Skills composite score was strongly correlated (low .80s) with the Kaufman Assessment Battery for Children Achievement composite score (K-ABC; Kaufman & Kaufman, 1983a, 1983b), the Stanford- Binet Intelligence Scale-Fourth Edition Verbal Reasoning scale standard score and test composite score (SB-IV; Thorndike, Hagen, & Sattler, 1986). The K-SEALS Early Academic & Language Skills composite score was moderately correlated (.55 to .65) with other K-ABC sub-scale scores and SB-IV sub-scale score (Thorndike et al., 1986). The K-SEALS Early Academic & Language Skills composite score yielded low correlations (low .30s to low .50s) with the Metropolitan Achievement Test standard score (MAT; Prescott, Balow, Hogan, & Farr, 1985), and the Metropolitan Readiness Tests standard score (MRT; Nurss & McGauvran, 1976).

Concurrent validity analyses have also been conducted using language and cognitive screening tests as criteria. Moderate correlations (.66 to .73) existed between the K-SEALS language and composite scale scores and the Peabody Picture Vocabulary Test-Revised standard score (PPVT-R; Dunn & Dunn, 1981) and the Bracken Basic Concepts Scale standard score (BBCS; Bracken, 1984) (Kaufman & Kaufman, 1993).
Predictive validity. Predictive validity analyses have been conducted using intelligence, language, and achievement tests as the criteria. The K-SEALS Early Academic & Language Skills composite score correlated .80 with the K-ABC Achievement scale and .76 with the PPVT-R standard score (Kaufman & Kaufman, 1993). Additionally, the K-SEALS Early Academic & Language Skills composite score correlated .60 with the Stanford Achievement Test standard score (SAT; Gardner, Rudman, Karlsen, Merwin, 1982) and .57 with the Otis-Lesson School Ability Test standard score (Otis & Lennon, 1982).

Predictive validity analyses have also been conducted using teachers’ ratings as the criteria. Teachers’ ratings included the following assessments: Teacher’s Rating of Academic Performance (TRAP; Gresham, Reschly, & Carey, 1987) and the System to Plan Early Childhood Services (SPECS; Bagnato & Neisworth, 1990). Median predictive validity coefficients for the K-SEALS standard scores and teachers’ ratings were reported as follows: .47 (Vocabulary), .57 (Numbers, Letters & Words), .58 (Receptive Skills), .57 (Expressive Skills), .49 (Number Skills), .53 (Letter & Word Skills), and .61 (Early Academic & Language Skills composite).

Dynamic Indicators of Basic Early Literacy Skills

The Dynamic Indicators of Basic Early Literacy Skills (DIBELS) were a set of standardized, individually administered fluency measures of early literacy development (Good & Kaminski, 2002). DIBELS assessed phonological awareness, alphabetic understanding, and alphabet automaticity and fluency (Good & Kaminski, 2002). DIBELS contains seven measures: Initial Sounds Fluency, Letter Naming Fluency, Phoneme Segmentation Fluency, Nonsense Word Fluency, Oral Reading Fluency, Retell
Fluency, and Word Fluency. This study used Initial Sounds Fluency (ISF) and Letter Naming Fluency (LNF) to assess early literacy and pre-reading skills. The ISF subtest measured the ability to identify, isolate, and pronounce the first sound of an orally presented word (Good & Kaminski, 2002). The LNF subtest assessed the skill to rapidly name upper and lower case letters of the alphabet and was an indicator of risk for reading failure (Good & Kaminski, 2002). For this study, the DIBELS provided pre- and post-test measures of early literacy skills in preschool children, specifically letter naming fluency and initial sounds fluency. Additionally, the DIBELS was used to monitor individual child progress of the development of early literacy skills throughout implementation of the treatment program.

*Initial Sounds Fluency (ISF)*

*Validity.* The criterion-related validity of the kindergarten ISF with the SB-IV standard score ranged from .12 to .41 with a median coefficient of .28 (Good & Kaminski, 2002). The criterion-related validity of the kindergarten ISF with the Woodcock Johnson Psycho-Educational Battery-Revised Readiness cluster standard score (WJ-R; Woodcock & Johnson, 1989) ranged from .34 to .45 with a median coefficient of .40 (Good & Kaminski, 2002).

The concurrent-related validity of the kindergarten ISF with the SB-IV Abstract Visual standard score ranged from .15 to .31 with a median coefficient of .23 (Good & Kaminski, 2002). The predictive median validity coefficients of the kindergarten ISF were reported as follows: .41 with DIBELS Phoneme Segmentation Fluency measure, .29 with DIBELS Nonsense Word Fluency measure, and .37 with WJ-R cluster standard score (Good & Kaminski, 2002).
Reliability. The alternate-form reliability coefficient for the kindergarten ISF ranged from .51 to .73, with a median reliability coefficient of .61 in kindergarten (Good & Kaminski, 2002).

Letter Naming Fluency (LNF)

Validity. The median criterion-related validity of the kindergarten LNF with the WJ-R Readiness cluster standard score was .70 in kindergarten. The predictive validity of the kindergarten LNF with the DIBELS Nonsense Word Fluency measure ranged from .61 to .77, with a median validity coefficient of .72. The predictive validity of the kindergarten LNF with the WJ-R Total Reading cluster standard score ranged from .44 to .69, with a median coefficient of .66 (Good & Kaminski, 2002).

The median concurrent validity coefficient of the kindergarten LNF with the WJ-R Readiness cluster standard score was .70. The median concurrent validity coefficient of the kindergarten LNF with the SB-IV Verbal Reasoning standard score was .30. The median concurrent validity coefficient of the kindergarten LNF with the SB-IV Abstract Reasoning standard score was .25.

Reliability. The kindergarten alternate-form LNF reliability coefficient ranged from .86 to .92, with a median reliability coefficient of .89

Research Design

The study implemented a multiple baseline across children over a 1-year period. The design was a randomized, experimental-control group, cross-over scheme. Children were randomly assigned to either a Direct Instruction-Add-On (DI-Add-On) instructional group or a Developmentally Appropriate Practice-Only (DAP-Only) instructional group. The DI-Add-On group was the Experimental group and the DAP-Only group served as
the Control group. Using random assignment, 35 children were enrolled in the DI-Add-On group and 26 children were enrolled in the DAP-Only group. After six months of intervention, children who received DAP-Only were enrolled in the DI-Add-On for 6 months. Therefore, after participation in the DAP curriculum, first year “control” children “crossed-over” and received DI instruction. All children enrolled in the study still attending the preschool program received both methods of instruction (DI and DAP) by the end of the research.

Using R for randomization, O for observation/testing, and X for treatment, the following design was used.

Pretest-posttest control group design:

\[
\begin{align*}
\text{R (DI-Add-On)} & \quad \text{O} \quad \text{X} \quad \text{O} \quad \text{O} \quad \text{X} \quad \text{O} \\
\text{R (DAP-Only)} & \quad \text{O} \quad \text{O}
\end{align*}
\]

\[\text{-----------------------------} \rightarrow \text{TIME}\]

To meet the conditions of a true experimental design, the study used randomization in assigning students to the DI-Add-On instructional (Experimental) group and the DAP-Only group (Control). In order to minimize threats to internal validity, after participation in the DAP curriculum, “control” children “crossed-over” and received DI instruction. Additionally, early literacy skills as measured by the DIBELS were analyzed by a series of single subject AB designs created for each group. Baseline DIBELS data (A) were collected prior to intervention implementation. Intervention DIBELS data (B) were
collected for the experimental and control group subjects throughout intervention when subjects completed curriculum program assessments.

**Independent Variable**

The independent variable for this study was DI intervention. The DI intervention was in the form of DI Language for Learning curriculum, implemented by the preschool teachers with graduate student assistance. One teacher held a bachelor’s degree in Child Development with 25 years of teaching experience and the other preschool teacher held a bachelor’s degree in Elementary Education with 10 years of teaching experience. The graduate students were masters and doctoral candidates in school psychology. Treatment integrity of the intervention was evaluated through regular observations of the teachers during lessons by the Language for Learning curriculum trainer. Both preschool teachers received a score of 96 percent when observed by the curriculum trainer, indicating that the intervention was implemented with integrity. Table 10 displays characteristics of the DI intervention and DAP curriculum used in the study.
Table 10

*Characteristics of DI and DAP*

<table>
<thead>
<tr>
<th>DI</th>
<th>DAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language for Learning curriculum</td>
<td>Creative and COR curriculums</td>
</tr>
<tr>
<td>Carefully organized sequence of lessons</td>
<td>Child selection of activities</td>
</tr>
<tr>
<td>Teacher-directed</td>
<td>Child-initiated interactions</td>
</tr>
<tr>
<td>Elicited individual and group responses</td>
<td>Teacher supported</td>
</tr>
<tr>
<td>Fast-paced</td>
<td>Play as tool for learning</td>
</tr>
<tr>
<td>Highly structured and scripted presentations</td>
<td>Age appropriate materials</td>
</tr>
<tr>
<td>Small group instruction</td>
<td>Instruction based on child’s needs</td>
</tr>
</tbody>
</table>

*Dependent Variables*

The dependent variables for the study were as follows: Academic Skills, Language Skills, and Early Literacy Skills. Academic Skills was operationally defined as number naming and number recognition skills. Academic Skills was further operationally defined as letter and word naming and recognition. Language Skills was operationally defined as the expressing information to others and receiving or understanding the communication of others. Early Literacy Skills was operationally defined as letter naming fluency and recognition of initial sounds fluency.

*Procedures*

Parental consent was obtained from each child attending the preschool program. Consent for participation was given to all parents with clearly outlined benefits and risks to participation reviewed with the parents. Once consent was obtained, children were randomly assigned to either the experimental group (DI-Add-On) or Control group.
(DAP-Only) using a computerized random number generator. All children with informed consent received the pre-test assessments prior to the intervention. Graduate student research assistants and the researcher administered the K-SEALS and DIBELS pre-test assessments to all of the children. The Direct Instruction curriculum used as the intervention for the children and as an add-on to the regular DAP curriculum was called *Language for Learning* (Engelmann & Osborn, SRA McGraw-Hill Publishers, 1999). Two preschool teachers and three graduate student research assistants were trained on how to implement the curriculum by an educational consultant experienced in training and implementing Direct Instruction.

Once all of the children received pre-test measures, the *Language for Learning* curriculum was implemented by the trained teachers in the classroom 3 days a week, in the morning during small group activity. *Language for Learning* program assessments were administered to the children in the DI-Only group by the trained preschool teachers after completion of ten lessons. The DIBELS Initial Sounds Fluency measure was also administered to the children in the DI-Add-On group and DAP-Only group by trained preschool teachers, the researcher, and graduate student research assistants. DIBELS administration training for all preschool teachers was conducted by the researcher and graduate student research assistant.

After 6 months of programming and completion of the DI curriculum activities, all children with consent received the post-test assessments. Children who withdrew from the program prior to the end of the study were administered the post-test assessments before they left the program. Post-test assessments were administered using the procedures described previously for the administration of the pre-test assessments.
Following post-test assessment, children who received DAP-Only and were still attending the preschool program were enrolled in the DI-Add-On for 6 months.

Data Analysis

Multivariate Analysis

1. Did participation in DI result in greater overall acquisition of academic skills (number naming and number recognition, and letter and word naming and recognition) for high-risk children than participation in DAP alone?

Hypothesis 1: Children who participated in DI and DAP demonstrated greater attainment of academic skills (number naming and number recognition, and letter and word naming and recognition) than those children who participated in DAP only curriculum.

Statistical analysis of this research question included Multivariate Analysis of Covariance (MANCOVA). The following assumptions were examined prior to statistical analysis: multivariate normality (the observations on the dependent variables follow a multivariate normal distribution in each group); homogeneity of the covariance matrices (population covariance matrices for all of the dependent variables are equal); and independence of observations (Stevens, 2002). Additionally, the following assumptions were examined prior to analysis: linear relationship between the dependent variables and the covariate exists; homogeneity of the regression slopes; and the covariate is measured without error. For this research question, the MANCOVA was used to examine the difference in post-test scores between all subjects in the DI group and Control group on the K-SEALS Number Skills and Letter and Word Skills subtests. Pre-test scores were used as the covariates. The alpha level of significance was set at .05.
2. Did participation in DI result in greater overall acquisition of language skills (expressive communication and receptive communication skills) for high-risk children than participation in DAP alone?

Hypothesis 2: Children who participated in DI and DAP demonstrated greater attainment of language skills (expressive communication and receptive communication skills) than those children who participated in DAP only curriculum.

Statistical analysis of this research question included Multivariate Analysis of Covariance (MANCOVA). The following assumptions were examined prior to statistical analysis: multivariate normality (the observations on the dependent variables follow a multivariate normal distribution in each group); homogeneity of the covariance matrices (population covariance matrices for all of the dependent variables are equal); and independence of observations (Stevens, 2002). Additionally, the following assumptions were examined prior to analysis: linear relationship between the dependent variables and the covariate exists; homogeneity of the regression slopes; and the covariate is measured without error. For this research question, the MANCOVA was used to examine the difference in post-test scores between all subjects in the DI group and Control group on the K-SEALS Expressive Skills and Receptive Skills subtests. Pre-test scores were used as the covariates. The alpha level of significance was set at .05.

3. Did participation in DI result in greater overall acquisition of early literacy skills (letter naming fluency and initial sounds fluency) for high-risk children than participation in DAP alone?
Hypothesis 3: Children who participated in DI and DAP demonstrated greater attainment of early literacy skills (letter naming fluency and initial sounds fluency) than those children who participated in DAP only curriculum.

Statistical analysis of this research question included Multivariate Analysis of Covariance (MANCOVA). The following assumptions were examined prior to statistical analysis: multivariate normality (the observations on the dependent variables follow a multivariate normal distribution in each group); homogeneity of the covariance matrices (population covariance matrices for all of the dependent variables are equal); and independence of observations (Stevens, 2002). Additionally, the following assumptions were examined prior to analysis: linear relationship between the dependent variables and the covariate exists; homogeneity of the regression slopes; and the covariate is measured without error. For this research question, the MANCOVA was used to examine the difference in post-test scores between all of the subjects in the DI group and Control group on the DIBELS Letter Naming Fluency and Initial Sounds Fluency tests. Pre-test scores were used as the covariates. The alpha level of significance was set at .05.

Single Subject Data Analysis

The average initial sounds fluency score for each DIBELS ISF assessment was calculated and graphed for each group. Only children who received the intervention for the entire 6 months were included in the analysis (n=18). Data were analyzed using visual analysis (Kazdin, 1982) and percentage of nonoverlapping data points (Scruggs, Mastropieri, & Casto, 1987).
**Visual Analysis of the Graphed Data**

Four criteria were employed by the experimenter (Kazdin, 1982): (a) changes in mean level of performance across phases, (b) changes in level of performance from the end of one phase to the beginning of the next phase, (c) changes in trend or slope from one phase to the next, and (d) the latency of behavior change across phases.

**Percentage of Nonoverlapping Data**

To insure careful visual analysis, a metric involving the percentage of nonoverlapping data points was employed. The proportion of overlapping data between baseline and intervention is reported in Chapter 4. The less overlap, the more effective and reliable the intervention (Scruggs et al., 1987).

**Effect Size**

To obtain the magnitude of the effect of DI on the initial sounds fluency skills of the subjects, the effect size was calculated using Cohen’s $d$ (Allison & Gorman, 1993).
CHAPTER 4

Results

Descriptive Statistics

Descriptive statistics for the dependent variables are presented in Tables 11 through 13.

Table 11

*K-SEALS Pre-and Post-test Mean Scores and Standard Deviations for Pre-Academic Skills as a Function of Instructional Group*

<table>
<thead>
<tr>
<th>Group</th>
<th>Number Skills</th>
<th></th>
<th>Letter and Word Skills</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Test</td>
<td>Post-Test</td>
<td>Pre-Test</td>
<td>Post-Test</td>
</tr>
<tr>
<td></td>
<td>$M$ $SD$</td>
<td>$M$ $SD$</td>
<td>$M$ $SD$</td>
<td>$M$ $SD$</td>
</tr>
<tr>
<td>DI</td>
<td>9.26</td>
<td>2.73</td>
<td>11.00</td>
<td>2.38</td>
</tr>
<tr>
<td></td>
<td>4.91</td>
<td>3.58</td>
<td>8.00</td>
<td>2.91</td>
</tr>
<tr>
<td>Control</td>
<td>9.04</td>
<td>3.13</td>
<td>9.73</td>
<td>2.86</td>
</tr>
<tr>
<td></td>
<td>4.31</td>
<td>3.72</td>
<td>6.12</td>
<td>3.85</td>
</tr>
</tbody>
</table>

*Note.* $n=35$ for DI Group and $n=26$ for Control Group.

All mean scores reported in the table are raw scores.
Table 12

*K-SEALS Pre-and Post-test Mean Scores and Standard Deviations for Language Skills as a Function of Instructional Group*

<table>
<thead>
<tr>
<th></th>
<th>Expressive Language</th>
<th></th>
<th>Receptive Language</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Test</td>
<td>Post-Test</td>
<td>Pre-Test</td>
<td>Post-Test</td>
</tr>
<tr>
<td><strong>Group</strong></td>
<td><strong>M</strong></td>
<td><strong>SD</strong></td>
<td><strong>M</strong></td>
<td><strong>SD</strong></td>
</tr>
<tr>
<td>DI</td>
<td>17.37</td>
<td>4.66</td>
<td>21.11</td>
<td>3.89</td>
</tr>
<tr>
<td></td>
<td>21.46</td>
<td>5.55</td>
<td>27.34</td>
<td>4.16</td>
</tr>
<tr>
<td>Control</td>
<td>16.96</td>
<td>5.59</td>
<td>18.85</td>
<td>4.77</td>
</tr>
<tr>
<td></td>
<td>21.85</td>
<td>6.79</td>
<td>24.73</td>
<td>5.68</td>
</tr>
</tbody>
</table>

*Note. n=35 for DI Group and n=26 for Control Group.*

All mean scores reported in the table are raw scores.

Table 13

*DIBELS Pre-and Post-test Mean Scores and Standard Deviations for Early Literacy Skills as a Function of Instructional Group*

<table>
<thead>
<tr>
<th></th>
<th>Initial Sounds Fluency</th>
<th></th>
<th>Letter Naming Fluency</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Test</td>
<td>Post-Test</td>
<td>Pre-Test</td>
<td>Post-Test</td>
</tr>
<tr>
<td><strong>Group</strong></td>
<td><strong>M</strong></td>
<td><strong>SD</strong></td>
<td><strong>M</strong></td>
<td><strong>SD</strong></td>
</tr>
<tr>
<td>DI</td>
<td>7.24</td>
<td>6.73</td>
<td>14.46</td>
<td>11.94</td>
</tr>
<tr>
<td></td>
<td>8.49</td>
<td>9.31</td>
<td>18.31</td>
<td>12.07</td>
</tr>
<tr>
<td>Control</td>
<td>5.21</td>
<td>7.58</td>
<td>7.72</td>
<td>6.59</td>
</tr>
<tr>
<td></td>
<td>8.00</td>
<td>12.04</td>
<td>13.08</td>
<td>9.74</td>
</tr>
</tbody>
</table>

*Note. n=35 for DI Group and n=26 for Control Group.*

All mean scores reported in the table are raw scores.
Preliminary Statistical Analysis

Correlations between the dependent variables and covariates are presented in Tables 14 through Table 16.

Table 14

*Correlation Matrix for K-SEALS Pre-Academic Skills*

<table>
<thead>
<tr>
<th>Number skills pre-test</th>
<th>Letter and word skills pre-test</th>
<th>Number skills post-test</th>
<th>Letter and word skills post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number skills</td>
<td>--</td>
<td>.741**</td>
<td>.732**</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>.638**</td>
</tr>
<tr>
<td>pre-test</td>
<td></td>
<td>.625**</td>
<td>.732**</td>
</tr>
<tr>
<td>Letter and word</td>
<td>--</td>
<td>--</td>
<td>.764**</td>
</tr>
<tr>
<td>skills pre-test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number skills</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>post-test</td>
<td></td>
<td>.764**</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Letter</td>
<td>.</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>and word skills</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>post-test</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Correlation is significant at the .01 level.
### Table 15

**Correlation Matrix for K-SEALS Language Skills**

<table>
<thead>
<tr>
<th></th>
<th>Expressive pre-test</th>
<th>Receptive pre-test</th>
<th>Expressive post-test</th>
<th>Receptive post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expressive pre-test</td>
<td>--</td>
<td>.826**</td>
<td>.805**</td>
<td>.696**</td>
</tr>
<tr>
<td>Receptive pre-test</td>
<td>--</td>
<td>.643**</td>
<td>.662**</td>
<td></td>
</tr>
<tr>
<td>Expressive post-test</td>
<td></td>
<td></td>
<td>.863**</td>
<td></td>
</tr>
<tr>
<td>Receptive post-test</td>
<td></td>
<td></td>
<td></td>
<td>--</td>
</tr>
</tbody>
</table>

**Correlation is significant at the .01 level.**

### Table 16

**Correlation Matrix for DIBELS Early Literacy Skills**

<table>
<thead>
<tr>
<th></th>
<th>ISF pre-test</th>
<th>LNF pre-test</th>
<th>ISF post-test</th>
<th>LNF post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISF pre-test</td>
<td>--</td>
<td>.826**</td>
<td>.805**</td>
<td>.696**</td>
</tr>
<tr>
<td>LNF pre-test</td>
<td>--</td>
<td>.643**</td>
<td>.662**</td>
<td></td>
</tr>
<tr>
<td>ISF post-test</td>
<td></td>
<td>--</td>
<td>.863**</td>
<td></td>
</tr>
<tr>
<td>LNF post-test</td>
<td>.</td>
<td></td>
<td></td>
<td>--</td>
</tr>
</tbody>
</table>

**Correlation is significant at the .01 level.**
Statistical Analyses of the Research Questions

Research Question 1

1. Did participation in DI result in greater overall acquisition of academic skills (number naming and number recognition, and letter and word naming and recognition) for high-risk children than participation in DAP alone?

Hypothesis 1: Children who participated in DI and DAP demonstrated greater attainment of academic skills (number naming and number recognition, and letter and word naming and recognition) than those children who participated in DAP only curriculum.

Statistical analysis of this research question included Multivariate Analysis of Covariance (MANCOVA). The following assumptions were examined prior to statistical analysis: multivariate normality (the observations on the dependent variables follow a multivariate normal distribution in each group); homogeneity of the covariance matrices (population covariance matrices for all of the dependent variables are equal); and independence of observations (Stevens, 2002). Additionally, the following assumptions were examined prior to analysis: linear relationship between the dependent variables and the covariate exists; homogeneity of the regression slopes; and the covariate is measured without error. For this research question, the MANCOVA was used to examine the difference in post-test scores between all subjects in the DI group and Control group on the K-SEALS Number Skills and Letter and Word Skills subtests. Pre-test scores were used as the covariates. The alpha level of significance was set at .05.

Tests of Multivariate Assumptions

Multivariate normality. The size of the sample in each cell (n=35; n=26) ensured robustness to non-normality (Tabachnick & Fidell, 2007). Even with unequal sample
sizes and a small number of dependent variables, a sample size of 20 in the smallest cell should ensure robustness (Mardia, 1971).

**Homogeneity of the covariance matrices.** Box’s $M$ test for equality of the observed covariance matrices of the dependent variables across groups was not significant at $p > .001$. Therefore, the assumption that the variance-covariance matrices within each cell are sampled from the same population variance-covariance matrix and can be reasonably pooled to create a single estimate of error was met (Tabachnick & Fidell, 2007).

**Independence of observations.** The dependent variable observations in the study were independent. The subjects were randomly assigned to one of two groups. Additionally, the dependent measures were individually administered to each subject by the researchers (Stevens, 2002).

**Linearity.** Examination of bivariate scatterplots between all dependent variables and covariates indicated that each variable was reasonably normally distributed and linearly related.

**Homogeneity of the regression slopes.** Results of Roy-Bargmann stepdown analysis indicated no significant interaction between the independent variable and the covariates, $F (2, 4) = 1.14, p > .05$. These results indicated that the homogeneity of regression assumption was satisfied.

**Reliability of the covariates.** Examination of the correlation matrix indicated that the covariates were measured without error, and therefore reliable for analysis.
Multivariate Analysis

A 2-way between-subjects multivariate analysis of covariance was performed on two dependent variables that assessed pre-academic skills: number skills and letter and word skills. Adjustment was made for the pre-test scores: number skills and letter and word skills knowledge prior to the analysis.

With the use of Wilks’ criterion, a significant main effect was found for each covariate, approximate $F(2, 56) = 11.68, p<.01$, observed power = .99 for Number Skills pre-test and approximate $F(2, 56) = 10.11, p<.01$, observed power = .98 for Letter and Word Skills pre-test on the set of Pre-Academic Skills dependent variables. Additionally, using Wilks’ criterion, a significant main effect was found between groups on the set of dependent variables, approximate $F(2, 56) = 4.08, p<.05$, observed power = .70. There was a moderate association between Number Skills pre-test and the dependent variables, partial $\eta^2 = .29$ and between Letter and Word Skills pre-test and the Pre-Academic Skills dependent variables, $\eta^2 = .27$. Results of this analysis are summarized in Table 17.
Effects of the intervention on each dependent variable after adjustment for covariates were investigated by univariate tests of between subjects effects. Results of the univariate tests showed a significant difference between groups on both Number Skills, $F(1, 57) = 5.69, p < .05, \eta^2 = .10$, observed power = .65 and Letter and Word Skills, $F(1, 57) = 6.81, p < .05, \eta^2 = .11$, observed power = .73. Results of this analysis are summarized in Table 18.
Table 18

*Tests of Between-Subjects Effects on Pre-Academic Skills*

<table>
<thead>
<tr>
<th>Variable and Source</th>
<th>$df$</th>
<th>$F$</th>
<th>Partial $\eta^2$</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number skills post-test</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between groups</td>
<td>1</td>
<td>5.69*</td>
<td>.10</td>
<td>.65</td>
</tr>
<tr>
<td>Within groups</td>
<td>57</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Letter and word skills post-test</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between groups</td>
<td>1</td>
<td>6.81*</td>
<td>.11</td>
<td>.73</td>
</tr>
<tr>
<td>Within groups</td>
<td>57</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p<.05.

**Research Question 2**

2. Did participation in DI result in greater overall acquisition of language skills (expressive communication and receptive communication skills) for high-risk children than participation in DAP alone?

Hypothesis 2: Children who participated in DI and DAP demonstrated greater attainment of language skills (expressive communication and receptive communication skills) than those children who participated in DAP only curriculum.

Statistical analysis of this research question included Multivariate Analysis of Covariance (MANCOVA). The following assumptions were examined prior to statistical analysis: multivariate normality (the observations on the dependent variables follow a multivariate normal distribution in each group); homogeneity of the covariance matrices (population covariance matrices for all of the dependent variables are equal); and independence of observations (Stevens, 2002). Additionally, the following assumptions were examined prior to analysis: linear relationship between the dependent variables and
the covariate exists; homogeneity of the regression slopes; and the covariate is measured without error. For this research question, the MANCOVA was used to examine the difference in post-test scores between all subjects in the DI group and Control group on the K-SEALS Expressive Skills and Receptive Skills subtests. Pre-test scores were used as the covariates. The alpha level of significance was set at .05.

Tests of Multivariate Assumptions

Multivariate normality. The size of the sample in each cell (n=35; n=26) ensured robustness to non-normality (Tabachnick & Fidell, 2007). Even with unequal sample sizes and a small number of dependent variables, a sample size of 20 in the smallest cell should ensure robustness (Mardia, 1971).

Homogeneity of the covariance matrices. Box’s M test for equality of the observed covariance matrices of the dependent variables across groups was not significant at \( p > .001 \). Therefore, the assumption that the variance-covariance matrices within each cell are sampled from the same population variance-covariance matrix and can be reasonably pooled to create a single estimate of error was met (Tabachnick & Fidell, 2007).

Independence of observations. The dependent variable observations in the study were independent. The subjects were randomly assigned to one of two groups. Additionally, the dependent measures were individually administered to each subject by the researchers (Stevens, 2002).

Linearity. Examination of bivariate scatterplots between all dependent variables and covariates indicated that each variable was reasonably normally distributed and linearly related.
Homogeneity of the regression slopes. Results of Roy-Bargmann stepdown analysis indicated no significant interaction between the independent variable and the covariates, $F(2, 4) = 2.27, p > .05$. These results indicated that the homogeneity of regression assumption was satisfied.

Reliability of the covariates. Examination of the correlation matrix indicated that the covariates were measured without error, and therefore reliable for analysis.

Multivariate Analysis

A 2-way between-subjects multivariate analysis of covariance was performed on two dependent variables that assessed language skills: expressive language skills and receptive language skills. Adjustment was made for the pre-test scores: expressive language skills and receptive language skills prior to the analysis.

With the use of Wilks’ criterion, a significant main effect was found for each covariate, approximate $F(2, 56) = 22.04, p < .01$, observed power = 1.0 for Expressive Language Skills pre-test and approximate $F(2, 56) = 4.80, p < .05$, observed power = .78 for Receptive Language Skills pre-test on the set of Language Skills dependent variables. Additionally, using Wilks’ criterion, a significant main effect was found between groups on the set of dependent variables, approximate $F(2, 56) = 5.18, p < .01$, observed power = .81. There was a moderately high association between Expressive Language Skills pre-test and the Language Skills dependent variables, partial $\eta^2 = .44$ and a low association between Receptive Language Skills pre-test and the Language Skills dependent variables, $\eta^2 = .15$. Results of this analysis are summarized in Table 19.
Effects of the intervention on each dependent variable after adjustment for covariates were investigated by univariate tests of between subjects effects. Results of the univariate tests showed a significant difference between groups on both Expressive Language Skills, $F(1, 57) = 9.40, p<.01, \eta^2 = .14$, observed power = .85 and Receptive Language Skills, $F(1, 57) = 8.49, p<.01, \eta^2 = .13$, observed power = .82. Results of this analysis are summarized in Table 20.
Table 20

*Tests of Between-Subjects Effects on Language Skills*

<table>
<thead>
<tr>
<th>Variable and Source</th>
<th>df</th>
<th>$F$</th>
<th>Partial $\eta^2$</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expressive language skills post-test</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between groups</td>
<td>1</td>
<td>9.40**</td>
<td>.14</td>
<td>.85</td>
</tr>
<tr>
<td>Within groups</td>
<td>57</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receptive language skills post-test</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between groups</td>
<td>1</td>
<td>8.49**</td>
<td>13</td>
<td>.82</td>
</tr>
<tr>
<td>Within groups</td>
<td>57</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**p<.01.

Research Question 3

3. Did participation in DI result in greater overall acquisition of early literacy skills (letter naming fluency and initial sounds fluency) for high-risk children than participation in DAP alone?

Hypothesis 3: Children who participated in DI and DAP demonstrated greater attainment of early literacy skills (letter naming fluency and initial sounds fluency) than those children who participated in DAP only curriculum.

Statistical analysis of this research question included Multivariate Analysis of Covariance (MANCOVA). The following assumptions were examined prior to statistical analysis: multivariate normality (the observations on the dependent variables follow a multivariate normal distribution in each group); homogeneity of the covariance matrices (population covariance matrices for all of the dependent variables are equal); and independence of observations (Stevens, 2002). Additionally, the following assumptions were examined prior to analysis: linear relationship between the dependent variables and
the covariate exists; homogeneity of the regression slopes; and the covariate is measured without error. For this research question, the MANCOVA was used to examine the difference in post-test scores between all of the subjects in the DI group and Control group on the DIBELS Letter Naming Fluency and Initial Sounds Fluency tests. Pre-test scores were used as the covariates. The alpha level of significance was set at .05.

Tests of Multivariate Assumptions

Multivariate normality. The size of the sample in each cell (n=35; n=26) ensured robustness to non-normality (Tabachnick & Fidell, 2007). Even with unequal sample sizes and a small number of dependent variables, a sample size of 20 in the smallest cell should ensure robustness (Mardia, 1971).

Homogeneity of the covariance matrices. Box’s $M$ test for equality of the observed covariance matrices of the dependent variables across groups was significant at $p<.01$. Results of this test indicate the assumption that the variance-covariance matrices within each cell are sampled from the same population variance-covariance matrix and can be reasonably pooled to create a single estimate of error was violated. Due to the assumption violation and unequal sample sizes, Pillai’s criterion was used to evaluate multivariate significance (Tabachnick & Fidell, 2007).

Independence of observations. The dependent variable observations in the study were independent. The subjects were randomly assigned to one of two groups. Additionally, the dependent measures were individually administered to each subject by the researchers (Stevens, 2002).
**Linearity.** Examination of bivariate scatterplots between all dependent variables and covariates indicated that each variable was reasonably normally distributed and linearly related.

**Homogeneity of the regression slopes.** Results of Roy-Bargmann stepdown analysis indicated no significant interaction between the independent variable and the covariates, $F (2, 4) = 1.44, p > .05$. These results indicated that the homogeneity of regression assumption was satisfied.

**Reliability of the covariates.** Examination of the correlation matrix indicated that the covariates were measured without error, and therefore reliable for analysis.

**Multivariate Analysis**

A 2-way between-subjects multivariate analysis of covariance was performed on two dependent variables that assessed early literacy skills: initial sounds fluency and letter naming fluency. Adjustment was made for the pre-test scores: initial sounds fluency and letter naming fluency prior to the analysis.

With the use of Pillai’s Trace, a significant main effect was found for each covariate, approximate $F (2, 56) = 4.02, p < .05$, observed power = .70 for Initial Sounds Fluency pre-test and approximate $F (2, 56) = 10.33, p < .01$, observed power = .98 for Letter Naming Fluency pre-test on the set of Early Literacy Skills dependent variables. Additionally, using Pillai’s Trace, a significant main effect was found between groups on the set of dependent variables, approximate $F (2, 56) = 3.78, p < .05$, observed power = .67. There was a low association between Initial Sounds Fluency pre-test and the Early Literacy Skills dependent variables, partial $\eta^2 = .13$ and a moderate association between Letter Naming Fluency pre-test and the Early Literacy Skills dependent variables, $\eta^2 =$
.27. It is important to note that for this analysis, Wilk’s criterion yielded the same results as Pillai’s criterion when evaluating multivariate significance. Results of this analysis are summarized in Table 21.

Table 21

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>F</th>
<th>Partial η²</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial sounds fluency pre-test (covariate)</td>
<td>2</td>
<td>4.02*</td>
<td>.13</td>
<td>.70</td>
</tr>
<tr>
<td>Letter naming fluency pre-test (covariate)</td>
<td>2</td>
<td>10.33**</td>
<td>.27</td>
<td>.98</td>
</tr>
<tr>
<td>Group</td>
<td>2</td>
<td>3.78*</td>
<td>.12</td>
<td>.67</td>
</tr>
<tr>
<td>Error</td>
<td>56</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p<.05. **p<.01.

Effects of the intervention on each dependent variable after adjustment for covariates were investigated by univariate tests of between subjects effects. Results of the univariate tests showed a significant difference between groups on Initial Sounds Fluency, $F(1, 57) = 5.79, p<.05$, $\eta^2 = .10$, observed power = .66 but not Letter Naming Fluency, $F(1, 57) = 3.67, p>.051$, $\eta^2 = .06$, observed power = .47. Results of this analysis are summarized in Table 22.
Table 22

Tests of Between-Subjects Effects on Early Literacy Skills

<table>
<thead>
<tr>
<th>Variable and Source</th>
<th>df</th>
<th>F</th>
<th>Partial $\eta^2$</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial sounds fluency post-test</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between groups</td>
<td>1</td>
<td>5.79*</td>
<td>.10</td>
<td>.66</td>
</tr>
<tr>
<td>Within groups</td>
<td>57</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Letter naming fluency post-test</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between groups</td>
<td>1</td>
<td>3.67</td>
<td>.06</td>
<td>.47</td>
</tr>
<tr>
<td>Within groups</td>
<td>57</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*p&lt;.05.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Single Subject Data Analysis

The average initial sounds fluency score for each DIBELS ISF assessment was calculated and graphed for each group. Only children who participated in the study for the entire 6 months were included in the analysis (n=18). Data was analyzed using visual analysis (Kazdin, 1982), percentage of nonoverlapping data points (Scruggs, Mastropieri, & Casto, 1987), and effect size (Allison & Gorman, 1993).

Visual Analysis of the Graphed Data

Four criteria were employed by the experimenter (Kazdin, 1982): (a) changes in mean level of performance across phases, (b) changes in level of performance from the end of one phase to the beginning of the next phase, (c) changes in trend or slope from one phase to the next, and (d) the latency of behavior change across phases. Figure 1 presents the mean initial sounds fluency scores for the DI group and the Control group. Table 23 shows the initial sounds fluency scores for each subject.
Figure 1. Initial Sounds Fluency Mean Scores for DI and Control Group
<table>
<thead>
<tr>
<th>Participant</th>
<th>BL</th>
<th>PM 1</th>
<th>PM 2</th>
<th>PM 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>DI-1</td>
<td>18.46</td>
<td>0</td>
<td>15</td>
<td>17.78</td>
</tr>
<tr>
<td>DI-2</td>
<td>3</td>
<td>0</td>
<td>11.61</td>
<td>17.14</td>
</tr>
<tr>
<td>DI-3</td>
<td>6.5</td>
<td>8.57</td>
<td>14</td>
<td>13.17</td>
</tr>
<tr>
<td>DI-4</td>
<td>2.37</td>
<td>0</td>
<td>4.62</td>
<td>-</td>
</tr>
<tr>
<td>DI-5</td>
<td>0</td>
<td>0</td>
<td>11.05</td>
<td>-</td>
</tr>
<tr>
<td>DI-6</td>
<td>2</td>
<td>8.89</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>DI-7</td>
<td>0</td>
<td>7.5</td>
<td>10.34</td>
<td>-</td>
</tr>
<tr>
<td>DI-8</td>
<td>7.06</td>
<td>14.69</td>
<td>9.8</td>
<td>18.95</td>
</tr>
<tr>
<td>DI-9</td>
<td>24</td>
<td>26.25</td>
<td>16.6</td>
<td>30</td>
</tr>
<tr>
<td>DI-10</td>
<td>3.16</td>
<td>0</td>
<td>16.96</td>
<td>12</td>
</tr>
<tr>
<td>DI-11</td>
<td>6.67</td>
<td>0</td>
<td>9.09</td>
<td>11.16</td>
</tr>
<tr>
<td>C-1</td>
<td>4.93</td>
<td>0</td>
<td>8.57</td>
<td>14.47</td>
</tr>
<tr>
<td>C-2</td>
<td>0</td>
<td>11.54</td>
<td>6</td>
<td>8.06</td>
</tr>
<tr>
<td>C-3</td>
<td>0</td>
<td>0</td>
<td>5.9</td>
<td>7.5</td>
</tr>
<tr>
<td>C-4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>C-5</td>
<td>2.61</td>
<td>2.93</td>
<td>4.5</td>
<td>11.54</td>
</tr>
<tr>
<td>C-6</td>
<td>4.44</td>
<td>0</td>
<td>5.17</td>
<td>4.29</td>
</tr>
<tr>
<td>C-7</td>
<td>0</td>
<td>0</td>
<td>10.91</td>
<td>4.86</td>
</tr>
<tr>
<td>C-8</td>
<td>9.09</td>
<td>5.67</td>
<td>0</td>
<td>-</td>
</tr>
</tbody>
</table>

Note. BL = baseline; PM = progress monitoring.
Changes in means. Across the DI group, the initial sounds fluency mean score was 6.66 (range, 0 to 18.46) during the baseline condition. Across the Control group, the mean initial sounds fluency score was 2.63 (range, 0 to 9.09) during the baseline condition. During the intervention phase, the mean initial sounds fluency score increased for the DI group to a score of 11.67 (range, 0 to 26.25) and increased slightly for the Control group to a score of 5.00 (range, 0 to 14.47).

Changes in level. Visual inspection of the DI group mean initial sounds fluency scores across phases did not show an immediate change in level from the baseline to the first intervention data point. Visual inspection of the Control group mean initial sounds fluency scores across phases did not show an immediate change in level from baseline to the first intervention data point.

Changes in trend. Examination of the regression linear trend line for the DI group and Control group mean initial sounds fluency scores across phases showed systematic increase from week 20 to week 26 for both groups. Further examination of the regression linear trend line for both groups indicated that the DI group had a better linear trajectory.

Latency of change. Visual inspection of the DI group mean initial sounds fluency scores across phases did not show an immediate evident change in initial sounds fluency skills between the baseline and the intervention phase. Examination of the graph showed that an evident change in the DI group’s mean initial sounds fluency scores occurred in week 20 of the intervention phase. Visual inspection of the Control group mean initial sounds fluency scores across phases showed an evident change in initial sounds fluency skills between the baseline and week 26 of the intervention phase.
**Percentage of Nonoverlapping Data**

To insure careful visual analysis, a metric involving the percentage of nonoverlapping data points was employed. The less overlap, the more effective and reliable the intervention (Scruggs et al., 1987). Visual inspection of the graph showed 67% of the data points were nonoverlapping (above the baseline data point).

**Effect Size**

To obtain the magnitude of the effect of DI on the initial sounds fluency skills of the subjects, the effect size was calculated using Cohen’s \( d \) (Allison & Gorman, 1993). The effect size for the DI group was .90, indicating a large effect size for the intervention (Cohen, 1992).
CHAPTER 5
Discussion

Summary of Results

Previous research has found both DI and DAP teaching methods to be effective techniques in teaching early literacy skills to young children, both typical and at-risk. However, few studies have examined the differential impact of DI and DAP and even fewer studies have investigated the additive effects of DI to DAP curriculum. The purpose of this study was to integrate a Direct Instruction module as an enhancement DAP curriculum and to examine evidence of the effectiveness of the enhancement in the form of increased pre-academic, language, and early literacy competencies for high-risk children. In general, the results of the study support the hypotheses. Children who received the DI Add-On demonstrated greater attainment of pre-academic skills, language skills, and early literacy skills than children who only participated in the DAP curriculum.

Summary of the Research Questions

The first research question examined the impact of DI on high-risk children’s overall acquisition of academic skills. Specifically this question hypothesized that children who participated in both DI and DAP would demonstrate greater attainment of number naming skills, number recognition skills, letter and word naming skills, and letter and word recognition skills than children who only participated in the DAP curriculum.

Analysis of this research question indicated that all children participating in the project demonstrated a statistically significant increase in their pre-academic skills after receiving the DI intervention for 6 months. After taking their pre-test scores into account,
children who received both DI and DAP demonstrated statistically significant higher pre-academic skills than children who only received the DAP curriculum at the conclusion of the intervention. Specifically, the children who received both DI and DAP showed statistically significant higher scores than the DAP only group on measures of number naming and number recognition, and letter and word naming and recognition. Moreover, examination of the correlation matrix showed strong correlations between the pre-test and post-test measures, suggesting that DI had an additive impact to the DAP curriculum. Therefore, the results support the hypothesis of the first research question.

The second research question examined the impact of DI on high-risk children’s overall acquisition of language skills. Specifically this question hypothesized that children who participated in both DI and DAP would demonstrate greater attainment of expressive communication skills and receptive communication skills than children who only participated in the DAP curriculum.

Analysis of this research question indicated that all children participating in the project demonstrated a statistically significant increase in their language skills after receiving the DI intervention for 6 months. After taking their pre-test scores into account, children who received both DI and DAP demonstrated statistically significant higher language skills than children who only received the DAP curriculum at the conclusion of the intervention. Specifically, the children who received both DI and DAP showed statistically significant higher scores than the DAP only group on measures of expressive communication and receptive communication. Moreover, examination of the correlation matrix showed strong correlations between the pre-test and post-test measures,
suggesting that DI had an additive impact to the DAP curriculum. Therefore, the results support the hypothesis of the second research question.

The third research question examined the impact of DI on high-risk children’s overall acquisition of early literacy skills. Specifically this question hypothesized that children who participated in both DI and DAP would demonstrate greater attainment of letter naming fluency skills and initial sounds fluency skills than children who only participated in the DAP curriculum.

Analysis of this research question indicated that all children participating in the project demonstrated a statistically significant increase in their early literacy skills after receiving the DI intervention for 6 months. After taking their pre-test scores into account, children who received both DI and DAP demonstrated statistically significant higher early literacy skills than children who only received the DAP curriculum at the conclusion of the intervention. Specifically, the children who received both DI and DAP showed statistically significant higher scores than the DAP only group on a measure of initial sounds fluency. Moreover, examination of the correlation matrix showed strong correlations between the pre-test and post-test measures, suggesting that DI had an additive impact to the DAP curriculum. However, the results showed that there was no difference on letter naming fluency between the two groups. This particular finding supports the effectiveness of the DAP curriculum on children’s letter naming fluency skills, but suggests that DI did not have an additive impact to DAP on the specific skills for this sample of children Therefore, the results partially support the hypothesis of the third research question.
The results of the study demonstrated that DI is an effective addition to DAP curriculum for at-risk preschoolers. While some children learn best through initiating their own learning experiences, others need explicit instruction of pre-academic, language, and early literacy skills. This study suggests that direct instruction of those skills may be the most effective way to teach children who are at risk for delay or later failure based on environmental factors.

In summary, high-risk children who received both the DI intervention and DAP curriculum demonstrated statistically significant attainment of pre-academic skills, language skills, and early literacy skills than children who only participated in the DAP curriculum for six months. Specifically, the children who received both DI and DAP instruction showed statistically significant improvement in their number naming and number recognition skills, letter and word naming and recognition skills, expressive communication and receptive communication skills, and initial sounds fluency skills as compared to children who only received the DAP curriculum.

Single Subject Analysis

The average initial sounds fluency score for each DIBELS assessment (pre-test, progress monitoring, and post-test) was calculated and graphed for each group. Visual analysis of the graph showed that the DI group demonstrated a greater increase in their average initial sounds fluency score than the DAP only group over the course of the intervention, suggesting that the DI group made consistent change above expected learning throughout the intervention. Analysis of the graph showed that while both the DI group and DAP group demonstrated a systematic change in their average initial sounds fluency score between week 20 and week 26 of the intervention, the DI group showed a
greater change over time. Visual analysis further showed that the DI group’s average initial sounds fluency score showed an evident change in week 20 of the intervention phase while the Control group’s average initial sounds fluency score showed an evident change in week 26 of the intervention phase. In other words, the DI group’s average score greatly increased at the mid-point of the intervention, while the Control group’s average score greatly increased toward the end of the intervention.

Results of the visual inspection of the graphs indicate that children receiving both DI and DAP instruction showed greater, more consistent, and earlier change in their average initial sounds fluency skills than children who only received DAP instruction. Single subject analysis of the data also demonstrated that the DI intervention was effective and reliable.

Conclusions

Relevant Literature

Comparison of DAP and DI programs. Findings from this study are both convergent and divergent with previous studies that examined the short-term differential effects of DI and DAP preschool programs. For example, similar to this study, Stipek and colleagues (1995) found that children participating in an academically-oriented program demonstrated significantly higher scores on letter skills and literacy skills assessments when compared to children who attended a DAP-only preschool.

On the other hand, results of this study are divergent with those reported by Stipek (1995). The study found that children in a DAP preschool program demonstrated significantly higher scores on number skills achievement tests that children who participated in an academically-oriented program while this study found that children
who received both DAP and DI intervention demonstrated significantly higher number naming and number recognition skills than children who only participated in the DAP curriculum.

In another study of the differential effects of DAP and DI, Stipek and colleagues (1998) found that preschool children participating in DAP showed higher gains on letter knowledge and reading achievement than children who participated in a program that emphasized basic skills. However, the results of this study found that children receiving both DI and DAP showed higher letter naming and recognition skills than children who only received DAP.

Similar divergent findings were reported by Huffman and Speer (2000), who found that children’s math and reading achievement skills were significantly higher in a classroom characterized as more developmentally appropriate than children in less developmentally appropriate classrooms whereas this study reported that children receiving both DAP and DI had higher number naming and recognition skills and early literacy skills than children only receiving DAP.

Results of this study found that high-risk children who received both DI and DAP demonstrated higher increases in academic, language, and early literacy skills than children who only received DAP curriculum, suggesting that DI can be successfully implemented as an add-on to DAP curriculum with remarkable benefits to at-risk children. These findings are divergent with those reported by Marcon (1992; 1999), who found that children in a “middle-of-the-road” classroom (combination of child-initiated and academically-directed) demonstrated lower scores on all measures of basic academic
skills than children who only participated in a child-initiated classroom and children who only participated in an academically-oriented program.

A possible explanation for the divergent findings between this study and others (Huffman & Speer, 2000; Marcon, 1992; 1999; Stipek et al., 1995; Stipek et al., 1998) was that neither DI nor DAP implemented as a curriculum in the latter studies. For example, in the studies conducted by Stipek (1995; 1998), classroom environments were rated by external observers and teacher interviews as either basic-skills oriented or child-centered. Treatment integrity data was not collected on any the implementation of the programs in any of the previous studies comparing the short-term effects of DI and DAP. Therefore, it is not clear how well each of these types of programs were implemented in the classrooms. Moreover, each of these studies contained methodological flaws. For example, none of the studies utilized an experimental design, as this study did.

In direct contrast to the divergent findings discussed above, other earlier studies of the differential effects of DI and DAP are convergent. For example, one of the first comparison studies conducted in the field found children in teacher-directed preschool programs, including DI, demonstrated significantly higher overall scores on cognitive measures than students in child-centered programs (Miller et al., 1975). Similarly, Karnes and colleagues (1983) found significant gains in IQ scores and verbal functioning at the end of preschool for children who participated in structured preschool programs, including DI, than children in child-centered programs. Taken together, these results are similar to those found in the present study; children who received the DI intervention had higher academic, language, and early literacy skills than children who did not.
In summary, results of the present study are both convergent and divergent with the relevant literature. While some studies found children receiving DAP curriculum to show better academic and early literacy skills than children participating in an academically-oriented curriculum, others found that children attending DI preschool programs showed improved academic and language skills than children in child-centered preschool programs. Results of the present study support findings from the latter studies, suggesting that DI is an effective intervention for improving the academic, early literacy, and language skills of high-risk children. The results of this study may also be readily generalized to similar populations (i.e., those at-risk due to environmental and ecological factors) because of the study’s experimental design.

Perhaps the most important finding of this study is that children who received the DI intervention also participated in DAP curriculum, suggesting that DI is an effective add-on intervention for at-risk children already receiving DAP instruction. Both groups of children showed an increase in their academic, language, and early literacy skills, but children in the DI group demonstrated a greater increase, suggesting that DI can be successfully implemented in a NAEYC-accredited preschool program that consistently applies DAP strategies in the classroom, and have significant benefits for high-risk children. Even more, DI was implemented in the DAP setting with a high amount of integrity, based on treatment integrity checklists, reinforcing the suggestion that DI as a curriculum can be successfully implemented in a DAP program. The divergent findings between this study and previous findings may be attributed to the lack of rigor in which DI was implemented in previous studies and the lack of experimental design in most of those studies.
**Relevant Theory**

Results of this study support current developmental theory regarding early literacy. Previous findings strongly suggest that early language delays appear to be the strongest predictor of later reading difficulties. Findings from this study are similar. The DI curriculum implemented in this study was language-based and the results found that the curriculum had a significant, positive impact on both the early language and early literacy skills of young children.

The results of this study also imply that behaviorism and constructivism, two competing theories of early literacy instruction, can be blended together to create a positive early learning experience for children at-risk for the development of early academic skills. To date, early childhood professionals argue against the benefits of using direct instructional strategies in preschool classrooms, stressing that DI is developmentally inappropriate for young children. This study found that both DI and DAP are effective instructional strategies for young children, and that DI has an additive impact in terms of early academic, language, and literacy skills for young children who are at-risk for the development of these skills. This may be attributed to the individual and diverse learning styles of young children. For example, some children clearly learn through initiating their own learning experiences while others need explicit instruction from their teachers.

**Limitations**

While the study was implemented according to the methodological design, some limitations do exist. Treatment integrity checklists were only conducted by the DI trainer on two occasions during implementation of the intervention. Ideally, treatment integrity
checklists would have been conducted bi-weekly for the first month of the intervention, and then monthly for the duration of the intervention.

Related to the implementation of the intervention, a further limitation of the study was that five different teachers conducted the lessons. Due to unpreventable scheduling difficulties, two DI groups had three different teachers conducting their lessons throughout the intervention. Moreover, treatment integrity checklists were only completed for the two teachers who taught the majority of the lessons. Even though all teachers received the same training, having multiple teachers conducting the same group lessons may have interfered with the treatment implementation. For example, all teachers may not have followed the script in the same manner.

Another limitation to the study included the transient nature of the preschool population. For example, 42 students did not receive the planned 6-month intervention due to voluntary withdrawal from the preschool program, including transition to kindergarten, and the average length of intervention was 4.62 months. Of more concern was the number of children who unexpectedly withdrew from the preschool program without the researcher’s knowledge. A total of 15 children received some combination of post-test measures and 2 children did not receive any of the post-test measures.

A third limitation of the study involved the initial placement of children in the Language for Learning curriculum. At the start of the DI intervention, all children in the DI group began at Lesson 1 of the curriculum. DI groups were formed based on classrooms. Feedback from the DI teachers and DI program assessments indicated that many of the children were performing well beyond their placement in the curriculum. As a result, children received a second placement test after the first month and a half of the
intervention, and were then placed into a new starting lesson in the curriculum according to those assessments. Subsequently, new DI sub-groups were formed based on these placement test results. In other words, children were grouped based on their placement test results rather than which classroom they attended at the preschool.

Finally, breaks in treatment occurred sporadically throughout the intervention due to the unavailability of the teachers. While substitute teachers attempted to teach whenever these occurred, several lessons were rescheduled due to the teacher’s unavailability. However, this limitation did not appear to impact the results of the study.

In summary, several limitations to the study exist. However, these limitations do not impact the study’s generalizability to similar populations. For example, most high risk preschool populations are transient, and this limitation would be expected in replication studies with similar populations. In previous studies of the impact of DI and DAP, treatment integrity was not implemented. This study improves upon previous studies in that treatment integrity checklists were conducted twice by the DI trainer. Even though the checklists were only conducted twice, both DI teachers received the highest ratings on the checklist by the examiner. Lastly, the demographics of this population and surrounding community are reflective of similar high-risk populations in urban settings.

Recommendations for Future Research

While findings from this study are conclusive and provide empirical support for both DI and DAP as effective curriculums for young children, future research in this area is still needed. For example, further studies are needed to determine which type of learners benefit most from the DI curriculum. In the current study, all children receiving DI made significant progress from pre-test to post-test, above typical developmental
expectations. However, the graphed data only showed the average scores of each group, not the individual scores for each child. Future research studies should attempt to discriminate which children actually benefit the most from the DI curriculum (i.e., at pre-test, children with low language skills, low academic skills, or low early literacy skills).

This study did not include any children with identified learning disabilities or delays. Future studies should include children with identified learning disabilities and/or language delays, and examine if DI has the same additive impact to DAP curriculum as it did in this study. These studies would also provide evidence for the effectiveness of DAP curriculum on children with significant learning problems, which has not been previously examined.

IDEIA (2004) outlines provisions for local educational agencies to use a Response to Intervention (RTI) framework for providing prevention and early intervention services to children. The RTI framework is most often used in school aged programs. However, policymakers and educational professionals have begun to advocate for universal screening and early intervention services delivered through a multi-tiered intervention approach in preschool. Future research may also want to explore how DI may be implemented in similar preschool settings as a Tier 2 intervention for children at-risk for language or early literacy skill development.

Results of this study have significant implications for the fields of school psychology and early childhood. Findings support the existing empirical evidence-base for the effectiveness of DI on high-risk preschooler’s early academic, language, and literacy skills, but also add new support to the effectiveness of DAP curriculum on these skills, and the additive effects of DI combined with DAP curriculum. Most importantly,
the study affirmed that DI can be successfully implemented in a NAEYC-approved preschool setting that consistently applies DAP principles to all aspects of learning. These results should influence the decisions made by school psychologists working in the field of early childhood regarding the instructional needs of children at-risk for early academic, language, and literacy skills development.
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Appendix

Bivariate Scatterplots of Dependent Variables and Covariates
Group: Control Group

EVAL1 Letter and Word Skills Raw Score

EVAL2 Letter and Word Skills Raw Score
Group: DI Group

EVAL2 Letter and Word Skills Raw Score

EVAL1 Letter and Word Skills Raw Score
Group: DI Group

EVAL 1 Letter and Word Skills Raw Score vs. EVAL 1 Number Skills Raw Score
Group: DI Group

EVAL1 Number Skills Raw Score

EVAL2 Letter and Word Skills Raw Score
Group: DI Group

EVAL1 Receptive Language Skills raw score vs. EVAL2 Receptive Language Skills raw score
Group: Control Group

EVAL1 Receptive Language Skills raw score

EVAL1 Expressive Language Skills raw score

0 5 10 15 20 25 30 35

(Scatter plot showing the relationship between EVAL1 Receptive Language Skills and EVAL1 Expressive Language Skills for the Control Group.)
Group: DI Group

EVAL1 Receptive Language Skills raw score vs. EVAL1 Expressive Language Skills raw score.
EVAL2 Receptive Language Skills raw score

EVAL2 Expressive Language Skills raw score

Group: DI Group
Group: Control Group

EVAL1 Expressive Language Skills raw score vs. EVAL2 Receptive Language Skills raw score.

Scores range from 5 to 35 for EVAL2 and from 5 to 30 for EVAL1.

There is a trend indicating that higher EVAL2 scores are associated with higher EVAL1 scores.
Group: DI Group

EVAL2 Receptive Language Skills raw score

EVAL1 Expressive Language Skills raw score

10 15 20 25 30 35

10 15 20 25 30 35
Group: Control Group

EVAL1 Receptive Language Skills raw score

EVAL2 Expressive Language Skills raw score
Group: Control Group

DIBELS LNF Pre-Test Score

DIBELS ISF Pre-test Score

0  20  40
DIBELS LNF Pre-Test Score
Group: DI Group

DIBELS LNF Pre-Test Score

DIBELS ISF Pre-test Score

DIBELS LNF Pre-Test Score
Group: Control Group
Group: DI Group

DIBELS ISF Pre-test Score vs. DIBELS LNF Post-Test Score

- DIBELS LNF Post-Test Score
- DIBELS ISF Pre-test Score

Group: DI Group

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Group: DI Group

![Graph showing the relationship between DIBELS LNF Pre-Test Score and DIBELS ISF Post-Test Score for the DI Group. The x-axis represents the DIBELS LNF Pre-Test Score, ranging from 0 to 40, and the y-axis represents the DIBELS ISF Post-Test Score, ranging from 0 to 40. The scatter plot includes various data points indicating the performance improvement from pre-test to post-test for the DI Group.](image-url)