THE RELATIONSHIP BETWEEN LITERACY READINESS AND AUDITORY AND VISUAL PERCEPTION IN KINDERGARTENERS

by Kathleen Marie Schnobrich

The current study seeks to identify the relationship between the linguistic skills of auditory and visual perception and literacy readiness in kindergarteners. The purpose of the study was to address the following questions: a) Is auditory perception positively correlated with literacy readiness in kindergarteners? b) Is there a significant difference between the components of auditory perception (discrimination, comprehension, and memory) and literacy readiness in kindergarteners across subgroup means? c) Is visual perception positively correlated with literacy readiness in kindergarteners? d) Is there a significant difference between visual perception performance and auditory perception performance across subgroups? Thirty children were assessed, 10 within each subgroup, using the Test of Auditory Perception Skills and the Motor Free Visual Perception Test- Third Edition. Results indicated that literacy readiness skills are significantly, positively correlated with auditory perception, specifically auditory memory. Visual perception was determined not to be correlated with literacy readiness skills.
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A Thesis

Submitted to the
Faculty of Miami University
in partial fulfillment of
the requirements for the degree of
Masters of Arts
Department of Speech Pathology and Audiology
by
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2009

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Chapter I

Introduction

The premise that relationships exist with which to predict future school success based upon abilities present at the kindergarten level is a long-standing theory (Alexander & Entwisle, 1988). Recently, research has specifically identified associations among abilities at a kindergarten level that serve to predict future performance in literacy success at the third grade level (Foster & Miller, 2007). Literacy success is defined as using reading to access grade-level curriculum by gaining general knowledge and expanding vocabulary (Foster & Miller). Research has not yet come to a consensus on the extent of the relationships. Research has identified various linguistic skills that influence the acquisition and later success of reading (Foster & Miller). The predictive variables themselves are debated by professionals in the field to date; early information about literacy success in future grades, which in turn, predicts future school success. Early identification of delayed literacy skills may prevent future academic failure.

Literacy problems have been determined to be linked to an underlying linguistic deficit (Foster & Miller, 2007). Commonly associated reading deficits include phonological awareness, auditory perception, and visual perception. When a child demonstrates slow acquisition of these skills, the label at-risk is applied to signify the need for additional aid and academic support. Soon after a child realizes that he or she is not reading or performing as successfully as other peers, or as well as is expected, an emotional lag may occur, and the problem is amplified (Hayes & Pereira, 1972).

Students who are identified as at-risk and treated for literacy problems in the later elementary grades (third grade or later) have a poor chance of catching up to their typically developing peers (Foster & Miller, 2007). If children are identified as at-risk at an early age, prevention may be implemented and the child may avoid the social stigmatism of the delay as well as the need for future remediation (Catts, Fey, Zhang, & Tomblin, 2001). As research continues in this area, results are slowly being applied to effective intervention techniques. As Meeker (1969) explained, teaching the ability to learn should be judged to be as essential as the goal to succeed in the academic curriculum.
Significance of the Study

The responsibility of literacy remediation is evolving. Once considered a responsibility of the general education teacher, remediation developed into the responsibility of the specialized reading teacher (Foster & Miller, 2007). Today, speech-language pathologists have found the remediation of literacy and reading delay to be within the field’s professional scope of practice. In a profession bound by evidence-based practice, the literature is quickly evolving as well. Yet deficiencies in current knowledge still exist.

Auditory perception and visual perception serve as umbrellas to a host of specific sub-skills. Perception components include discrimination (judgments to define subtle differences), processing (ability to sequence meaningful language), memory (immediate recall), and/or comprehension (interpretation) (Gardner, 1985). Current literature is in agreement that a relationship exists among the variables of auditory and visual perception and reading success while the true hierarchical relationships remain ambiguous at this time (Badian, 2005).

Auditory perception is suggested to be one of the most highly individualized variables of phonological skills. As phonological skills are accepted to be a predictor of reading success, it follows that the skill of auditory perception holds equal importance in a child’s literacy readiness. Watson and Miller (1993) found that a deficit in auditory perception holds lifelong consequences for literacy success. An adult sample of 94 college undergraduates were assessed according to their auditory memory and phoneme segmentation as well as speech perception tasks of repetition and syllable sequence discrimination. Results indicated a difference in performance between the reading-disabled and nondisabled readers. While causality cannot be determined from this single study, further research is needed to investigate this emerging relationship. Watson and Miller posed many questions, still to be determined by research. It is possible that a causal relationship exists in which auditory perception affects reading proficiency (defined here as phonological skills). Or, it is possible that a causal relationship exists where reading proficiency affects auditory perception. It could be that differences are not due to a causal relationship, but rather that poor auditory perception found in those with reading disability is a variable indicative of reading disability, implying that the two co-exist but are not directly correlated with the condition. If this is the case, it is possible that a third variable may directly influence both auditory perception and reading, accounting for the presumed relationship. To date, this is the focus of research in this area.
Nittrouer (1999) claimed no relationship between auditory temporal order judgment (judging the order of two rapidly presented stimuli) and literacy skills. However, several studies contradict this finding (Bretherton & Holmes, 2003; Cestnick, 2001; Cestnick & Jerger, 2000; Waber et al., 2001). Hood and Conlon (2004) studied 125 children with a mean age of 5.36 years to assess their ability of temporal processing. Results indicated that visual and auditory temporal order judgment measured at the preschool age significantly predicted reading ability in the first grade. While the hypothesis predicted the correlation with visual temporal order judgment, the authors were surprised to find that auditory temporal order judgment accounted for a significant correlation with reading success. The study concluded that auditory and visual processing at the preschool age made significant contributions to the later success of reading ability at the first grade level.

Feldman (1970) suggested that the memory of structural elements in decoding visual forms is the most important influence on reading success. Reading is a process by which symbols are decoded. In order to decode symbols one must be able to preserve the memory of each symbol (Hayes & Pereira, 1972). As children prepare to read, the knowledge of a symbol’s shape and sound must be stored in a fashion that allows immediate recall of the meaning. Similarly, the same process must be repeated several times in order to read even the simplest words. One hypothesis proposes the memory of one letter’s shape and sound uses a different part of intellect than is used in remembering whole words (Hayes & Pereira).

Visual memory is integral to the reading process (Samuels & Anderson, 1973). The study investigated sixty-four children in the second grade and hypothesized that the poor readers would perform significantly inferior to their typically developing matched peers in visual memory tasks. Samuels and Anderson provided each subject with three experimental tasks, compromising internal validity. However, results proved significant. When the various tasks increased demand on visual memory, children with poor reading skills saw a drastic decrease in performance. Samuels and Anderson concluded that the correlation between reading success and visual memory suggested the implementation of strategies for visual memory skills as a remediation task in delayed readers.

The need for further research is the common thread in all research investigating literacy learning. Hayes and Pereira (1972) stress the need to establish the relationship between visual and auditory memory and reading, arguing that it is vital to the development of effective
intervention techniques. If such critical skills are evaluated and discovered to be delayed, these skills must then be remediated in early years (Feldman, 1970). Farmer and Klein (1995) as well as Ramus (2004) both state the need for further research regarding longitudinal studies to follow the effect of linguistic variables on reading achievement throughout the lifespan. Specifically, the researchers determined the relationship between temporal processing and reading ability in the early literacy years to be of prime importance in future research endeavors.

Conclusion

The current study seeks to investigate the relation between auditory and visual perception as associated with literacy readiness in kindergarteners. Knowledge in this area may increase the effectiveness of identification and intervention of children with delayed literacy skills.
Chapter II
Literature Review

Auditory perception and visual perception serve as umbrellas to a host of specific sub-skills. These components include discrimination (judgments to define subtle differences), processing (ability to sequence meaningful language), memory (immediate recall), and/or comprehension (interpretation) (Gardner, 1985). Relationships between the variables of auditory and visual perception with reading success have been established, while the true hierarchical relationships remain ambiguous at this time (Badian, 2005).

**Literacy Readiness**

The process of reading is dynamic, simultaneously integrating several skills, subsequently providing numerous potentials for breakdown (Maria, 1990). An inherent problem in the school system is the identification of children with language learning problems, specifically with a delay in the development of literacy skills. Often children with a literacy delay are not identified until first or second grade. Speech-language pathologists and school professionals have struggled to identify children, at risk for such delay, as early as possible in order to remediate these skills. Success in all areas of formal education is essentially dependent on a child’s ability to read and learn and consequently impacts the child’s feeling of self-worth (Bond & Tinker, 1957; Gates, 1947). According to Justice (2007), a first-grader with poor reading skills maintains an 88% chance of remaining a poor reader through the fourth grade.

The establishment of relationships between literacy constructs, and the resulting success or failure of reading skill in young children, is imperative research. Linguistic foundations that underlie language impairment in children must emerge similarly with impaired linguistic constructs in the early development of literacy (Boudreau & Hedberg, 1999). While research seeks to develop knowledge in the area of emergent literacy skills, a frequent limitation of existing research is the focus on a single skill at a time. Barnhart (1991) confirms that early literacy skills are a unitary construct, a variety of skills entwined into a single unit. With the understanding that language impairments most likely affect a variety of modalities, it can be expected that each modality is affected simultaneously. A multifaceted impairment of this sort results in research that is ineffective in application as it can be an impossible task to separate the linguistic components associated with literacy skills. Researchers are in agreement however, that skills including print conventions, phonological awareness, and narrative abilities are
significantly associated with future reading achievement (Badian, 1988; Barnhart, 1991; Maclean, Bryant, & Bradley, 1987; Roth, Speece, & Cooper, 1997; Snow, Tabors, Nicholson, & Kurland, 1995; Stuart, 1995; Wells, 1986).

Boudreau and Hedberg (1999) investigated the differences between preschool children with specific language impairment (SLI) and a group of typically developing (TD) peers. Measures associated with phonological awareness, such as rhyme, segmentation, and blending, demonstrated a significant difference between the groups where the typically developing children maintained superior scores. In contrast, tests of narrative measures, such as comprehension and vocabulary, demonstrated no significant relationship between the two groups. Decoding skills, specifically the skill that is used to detect, analyze, and match print to previously stored representations either phonetic or visual, were discovered to be significantly poorer in children with SLI than those of typically developing children. Results of this study concurred with existing literature that confirmed skills associated with phonological awareness are indicative of later reading achievement (Bishop & Edmudson, 1987; Catts, 1991; Gillam & Johnston, 1985; Magnusson & Naucler, 1990a, 1990b; Paul, 1996, Paul & Smith, 1993; Warrick & Rubin, 1992).

Catts, Fey, Zhang, and Tomblin (2001) identified kindergarten predictors of second grade reading success. Subjects included 604 children, randomly selected from part of a larger epidemiologic study of language impairments in children. A battery of language, early literacy, and nonverbal cognitive assessments were administered: Test of Language Development-2: Primary (TOLD: P2) (Newcomer & Hammill, 1988), a narrative story task, phonological awareness deletion task, rapid automatized naming of animals task, the Woodcock Reading Mastery Tests-Revised (WRMT-R) (Woodcock, 1987), and the Wechsler Preschool and Primary Scale of Intelligence-Revised (WPSI-R) (Wechsler, 1989). Results were compared with performance on the WRMT-R, the Gray Oral Reading Test-3 (GORT-3) (Wiederholt & Bryant, 1992), and the Diagnostic Achievement Battery-2 (Newcomer, 1990) completed in the second grade. Participants were divided into children with and without reading difficulties and compared with their kindergarten performance using logistic regression analysis. Findings revealed that five variables, present in kindergarten, were predictive of reading success in the second grade. These variables included letter identification, sentence imitation, phonological awareness, rapid naming, and mother’s education. Authors noted that due to the population
chosen, as a part of a larger study on language impairment, subjects displayed more reading difficulties, and were not representative of the general population.

Bishop (2003) identified measures indicative of reading achievement in a study of kindergarten performance. Subjects included 103 kindergarteners over a 2 year span. In the kindergarten year, measures of letter identification, phonological awareness, phonological memory, and rapid automatized naming were administered. In the first grade, measures of passage comprehension, fluency, sight-word recognition, and phonemic decoding were administered. Results indicated that the assessment battery of letter identification, phonological awareness, and rapid automatized naming were the best indicators of literacy readiness and future reading success.

Research has identified phonological awareness as an indicator of literacy readiness. Despite each study’s investigation of an assortment of hypothesized literacy skills, phonological awareness continues to surface as a widespread indicator of literacy readiness. Phonological awareness, however, is a multifaceted skill, and its relationship to literacy readiness is the focus of deeper investigation in recent research.

**Literacy and Phonological Awareness**

According to Justice (2007), phonological awareness was defined as awareness to sound segments in spoken communication. Justice suggested phonological awareness is a two-fold skill. First, a shallow awareness was demonstrated by the recognition of larger sound segments such as phrases and/or sentences broken into words or multisyllabic words broken into syllables (Justice & Schuele, 2004). Second, a deep awareness, called phonemic awareness, was demonstrated by the identification of a difference between onset and rime of a word as well as the identification of phonemes as initial and final sounds. The deep awareness was linked specifically with the ability to decode words, a necessary component in literacy readiness (Anthony & Lonigan, 2004; Ball & Blachman, 1991; Torgesen, Morgan, & Davis, 1992; Wagner & Torgesen, 1987; Wagner, Torgesen, Laughon, Simmons, & Rashotte, 1993). Blachman (1997) found insufficient phonological awareness in kindergarten children was significantly correlated with inadequate reading achievement. This was specifically linked with word identification and word decoding difficulties that linger into the fourth grade and beyond.

Adams (1990) operationally defined phonological awareness as consisting of five different tasks, including knowledge of rhymes, sound categorization, blending, segmentation,
Rhyming tasks demand the child recognize or create rhyming words. Sound categorization tasks involve the ability to decide which words start or end with the same or different sounds. Blending tasks involve combining a string of sounds into recognizable words. Segmenting tasks require breaking apart words into sounds. Manipulation tasks ask the child to delete or substitute one sound with another.

Phonological awareness is recognized as a collection of skills most closely associated with a child’s literacy abilities (Stackhouse, Wells, Pascoe, & Rees, 2002). Specifically, phonological awareness is known as an ability to identify and manipulate the sound structure of a speech signal as separate from its meaning. Children rely on this skill when learning the arbitrary symbol system of the alphabet in order to develop reading and writing skills. In typically developing children, phonological awareness is utilized when a child can associate spoken sounds and/or words with its written representation in the form of letters and vice versa. To do this, children learn to identify segments of consonants and vowels. The process continues to be used when spelling a new word in which case, typically developing children divide the verbal component into segments and then attach the appropriate letters representative of each sound. Conversely, when reading an unfamiliar word, typically developing children must decode the printed letters into familiar segments and blend them together to form the new word. It follows that an ability to manipulate the components of phonological awareness is directly correlated with a child’s ability to read and write. Literacy success is thus dependent on the skills of phonological awareness. (Schatschneider, Francis, Foorman, Fletcher, & Mehta, 1999).

Hogan, Catts, and Little (2005) provided a longitudinal study to validate the hypothesis that phonological awareness tasks in the kindergarten year are indicative of reading performance in the second grade, and if second grade phonetic decoding could predict reading success in the fourth grade. The sample included 570 children, recruited as a subsample of an epidemiologic study investigating language impairments in which children were taken from a stratified cluster (by residential setting) of more than 7,000, and cluster sampled by school building. In each grade, children were assessed using the Catts Deletion Task (Catts et al., 2001) to assess phonological awareness. In kindergarten, children also completed the Letter Identification Task from the WRMT–R. Second and fourth grade assessments included phonetic decoding and word reading, using the Word Attack subtest of the WRMT–R and the Word Identification subtest of the WRMT–R, respectively. Results confirmed hypotheses that phonological awareness in
kindergarten was significantly more strongly correlated to second grade word reading than that of kindergarten letter identification skills. The opposite was found in second grade, where phonological awareness was not significantly correlated with word reading skills in the fourth grade. Results were comparable with Ehri et al.’s (2001) meta-analysis findings which suggested that phonological awareness in kindergarten is more crucial information in the prediction of word reading than that of other literacy predictors such as letter identification. Ehri et al.’s results indicated that tasks of phonological awareness should be included in assessment batteries to predict reading success and/or risk for reading delays and disorders.

Runge and Watkins (2006) investigated the relationship between phonological awareness and its predictive nature by analyzing 23 preliteracy assessments on a sample of 161 kindergarten children across nine schools in a rural school district in Pennsylvania at the end of the kindergarten year. All children were native English speakers but there was no control for the participation of children receiving special services. Assessments were chosen for the test battery on the basis of Adam’s (1990) categorization of five phonological awareness tasks including rhyme, sound categorization, blending, segmenting, and manipulation. For validity purposes, at least three measures of each task were conducted (Kline, 1994). Task type, response method, sound representation, linguistic unit, phoneme position, and phonological properties were all controlled in the study. Following exploratory factor analysis, the study concluded that phonological awareness was a two-dimensional paradigm in kindergarten children. The first dimension consisted of tasks that involved the identification and manipulation of phonemes such as sound categorization, blending, segmenting, and manipulation tasks. The second dimension involved the ability to recognize and create rhyming words such as with rhyming tasks. Letter knowledge and rapid serial naming were determined to be less associated with phonological awareness at this age. The authors confirmed that two tasks related to each construct was sufficient to determine ability. Based on these findings, the authors specifically stated that the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) (Good & Kaminski, 2002) sufficiently assessed the phonological skills construct.

Schatschneider, Fletcher, Francis, Carlson, and Foorman (2004) compared the results of kindergarten assessments of 540 children in kindergarten with their achievement scores in first and second grade. Children were assessed using a battery of subtests taken from the Comprehensive Tests of Phonological Processes (CTOPP) (Wagner, Torgesen, & Rashotte,
1999) including blending onset and rime, blending phonemes into words, blending phonemes into nonwords, first sound comparison, phoneme elision, phoneme segmentation, sound categorization, alphabetic knowledge, rapid automatized naming, vocabulary, visual-motor integration, recognition-discrimination, expressive syntax, and syntactic comprehension. Results identified the measures of phonological awareness, letter sound knowledge, and naming speech as significant indicators of later reading success in the second grade. Measures of perceptual skills, oral language, and vocabulary were not significantly correlated with second grade reading performance.

The time at which phonological skills are assessed in order to determine literacy readiness impacts the skill’s effectiveness as an indicator. Scarborough (1998) investigated kindergarten predictors of later reading achievement according to a variety of hypothesized skill measures. Results suggested that kindergarten measures of print-specific knowledge, letter identification, concepts of print, picture naming, sentence recall, phonological awareness skill, and rapid automatized naming, intelligence, receptive language, expressive language, and verbal memory tasks were all positively correlated with later reading skills. Skill assessment of perceptual skills, motor ability, and speech perception demonstrated less association with later reading achievement. Scarborough discovered that the skills with strongest association were those that did not involve knowledge of print or phonological awareness but rather measures that involved the concept of letter to sound. Scarborough found that this skill was weak when assessed at the onset of kindergarten which coincided with the onset of formal schooling.

Stahl and Murray (1994) investigated the relationship between phonological awareness tasks as it relates to early reading success with the intention of separating task difficulty from linguistic complexity. Authors compared a sample of 113 kindergarten and first grade children on phonological awareness tasks, memory, and written language. Results suggested that measures when controlled from linguistic complexity, task differences were most associated with alphabet knowledge. Once alphabet knowledge was obtained, the ability of a child to separate the onset and rime in a word demonstrated the greatest indicator of early reading success.

Smith, Scott, Roberts, and Locke (2008) produced a retrospective study to determine the relationship between pre literacy skills and later reading performance. Forty-four children were divided into two groups: one with reading-disability and the other with typically developing peers. The WRMT-R (Woodcock, 1987) and GORT-3 (Wiederholt & Bryant, 1992) were
administered at the beginning of kindergarten and immediately prior to first grade. Results indicated that alphabetic knowledge, phonological awareness, and rapid naming skills were the most significant indicators of success at the early kindergarten time of assessment. When assessed again at the end of the year, these abilities were not longer associated with reading performance in the first grade with the exception of phonological awareness skills. Research validates the use of phonological awareness skills as an indicator of literacy readiness. Other variables, specifically auditory and visual perception, are suggested to exhibit a similar relationship in the present study.

Literacy and Auditory Perception

Literacy and Auditory Discrimination. Tallal (1980) provided the seminal work in research on auditory discrimination and reading. In this study, children labeled as reading-impaired were compared with control children on a nonverbal auditory perception assessment battery which explored discrimination and temporal order perception. Tallal discovered no significant differences between groups on tests in which stimuli were presented at slow rates. However, when the same stimuli was presented more rapidly, the reading delayed group made significantly more errors than the control group. The author attributed the ability to process varying auditory information at a rapid pace, as playing a crucial role in efficiently analyzing the phonetic code in normal speech perception. Following this discovery, the reading delayed children’s abilities to use phonics skills were also investigated and found to maintain a high correlation between the number of errors made on the previous auditory discrimination tasks. Tallal concluded that reading impairment was significantly correlated with inferior functioning of auditory perception that affects the ability to learn to use phonics skills. Her work did not include specific measures of auditory discrimination.

Elliott, Hammer, and Scholl (1989) investigated the difference between auditory discrimination in 294 children aged 6 years to 11 years with language-learning problems as compared with a control group. To investigate auditory discrimination, temporal dimension and then place of articulation was used in order to determine the smallest acoustic differences among syllables that the children were capable of discriminating. In order to demonstrate the association between language-learning and auditory discrimination, the results were used to predict the child’s classroom placement (normally progressing classroom or language-learning difficulties classroom). Results indicated correct classification of classroom placements for approximately
80% of the 6- and 7-year olds and 65% of the 8- to 11- year olds. The ability to correctly predict classrooms increased to 87% and 75% respectively when measures of receptive vocabulary were included in the auditory discriminant functions.

Marston and Larkin (1979) found that the relationship between auditory discrimination and literacy success was significant. In this case, 12 children experiencing reading problems in the third and fourth grades were compared with 12 children considered typical readers in the same age group. Each child was given a battery of auditory discrimination tasks, both verbal and nonverbal. Tests of both verbal and nonverbal auditory discrimination tasks demonstrated a significant gap (p = 0.001) of achievement, capable of differentiating the two groups of poor versus successful readers.

The relationship between auditory discrimination and literacy success are not entirely accepted. McAnally, Castles, and Bannister (2004) claimed that reading ability was not related to the ability to discriminate auditory stimuli. The study compared 10 children with reading delays and 10 children with no history of reading difficulties across a battery of auditory discrimination tasks. Authors determined that both groups of children were equally capable of discrimination tasks. Results further indicated that children’s performance was not significantly correlated with an ability to discriminate words for reading. Investigation of auditory perceptual skills is not limited to auditory discrimination. Auditory memory was not explored in MaAnally et al.’s research as a possible significant variable in the relationship between auditory perceptual skills and literacy readiness.

**Literacy and Auditory Memory.** Tobey, Fleischer-Gallagher, and Cullen (1982) examined the auditory memory of first and third-grade children who failed the language screen of consonant-vowel (CV) memory. CV memory was suggested to be a necessary linguistic component of speech and language evaluations in school-age children (Rampp, 1972; Witkin, Bulter, & Whalen, 1977). Insufficient auditory memory was proposed to negatively influence other linguistic skills of coding, storing, and processing stimuli that are necessary for the efficiency of higher language processing such as learning to read. Results of Tobey, Fleischer-Gallagher, and Cullen’s study indicated that children who failed the language-memory screen were significantly weaker readers than that of their peers who passed the screen. Results also identified children failing language-memory tasks as performing at the same proficiency as typically developing children of a younger age.
Kurdek and Sinclair (2001) investigated age and gender differences in verbal and visuomotor skills based on reading and mathematics performance at the level of kindergarten and fourth grade. The retrospective study included 281 children. Data was examined regarding entry level assessments for kindergarten, the Kindergarten Diagnostic Instrument (Robinson & Miller, 1986) in comparison with achievement scores on the fourth grade using the Ohio proficiency-based tests of reading and mathematics. Results indicated that verbal skills were indicative of later reading success alone. Specifically, auditory memory was identified as the sole subtest significantly correlated with later reading performance.

Kurdek and Sinclair (2001) confirmed the work of Badian (1977) who examined the relationship between auditory memory and reading success across 60 children divided into two groups: one group of delayed readers and the other of typically-developing peers. The children were all assessed by the GORT, the Stanford Diagnostic Reading Test (Karlsen, Madden, & Gardner, 1984), and the Reading Comprehension subtest in order to establish the auditory-visual integration abilities of each group. Badian hypothesized that children with delayed reading performance may have an underlying auditory memory deficit that inhibits the ability to remember stimuli in order to create meaningful reading experiences. Results indicated that all tasks demanding short-term auditory memory were significantly inferior when compared with the performance of typically developing peers. Inferior performance was evidenced in a notably lengthy lag time between presentation of stimuli and delivery of response. When the demand on memory was minimized in specific tasks across the subtests, the children’s reading performance demonstrated improvement.

Similarly, Penney, Hann, and Power (1999) assessed 36 kindergarten children using the PPVT-R, the Rosner Auditory Analysis Test (Rosner & Simon, 1971), a timed test of naming letters and digits, the auditory word-retrieval test, the semantic word-retrieval test, and a test of their ability to read 30 words in order to compare results of word-identification tasks and retrieval of words in response to semantic and auditory cues. Children were assessed prior to reading instruction. Results demonstrated that poor readers produced fewer words on all word-retrieval tasks than did children identified as good readers. Also, the ability to produce words containing a particular sound was significantly correlated to the child’s ability to read words. Performance on the auditory word-retrieval tasks were significantly correlated with reading ability and word identification. Causal relationship between auditory memory and literacy
readiness was confirmed in research. However, studies confirmed this relationship without control for a final variable of auditory comprehension, within the auditory perception umbrella. 

**Literacy and Auditory Comprehension.** The literature provides a great deal of conflicting research regarding auditory processing as it relates to reading deficit. Nittrouer (1999) claimed no relationship between auditory temporal order judgment (judging the order of two rapidly presented stimuli) and literacy skills. However, several studies contradict this finding (Bretherton & Holmes, 2003; Cestnick, 2001; Cestnick & Jerger, 2000; Waber et al., 2001).

Burrows and Neyland (1978) investigated the relationship between performance of kindergarten children on a test of reading readiness skills and on tests of auditory comprehension of language. Authors recognized that many reading subtests are similar to examination items of instruments employed by speech-language pathologists for the evaluation of children with language disorders, suggesting that auditory comprehension may also predict later academic achievement. Results indicated that the tests of auditory processing of receptive language examined in this study were useful assessments for predicting scores of kindergarten children on reading readiness skills and achievement. The internal reliability concluded that these tests were assessing identical components reflective of linguistic competence, indicating the association between literacy readiness and auditory processing skills.

Hood and Conlon (2004) evaluated 125 children with a mean age of 5.36 years according to the ability of temporal processing. Results indicated that auditory temporal order judgment measured at the preschool age, significantly predicted reading ability in the first grade. While the hypothesis predicted the correlation with visual temporal order judgment, the authors were surprised to find that auditory temporal order judgment accounted for a significant correlation with reading success.

Corriveau, Pasquini, and Goswami (2007) explored the differences between children with specific language impairment and typically developing children on the basis of auditory processing skills in a different manner. Following a battery of psychometric, phonological tasks, and psychoacoustic tasks, it was determined that children with specific language impairment presented with scores below the fifth percentile of the performance achieved by the control group in the areas of amplitude detection and tone duration.
Literacy and Visual Perception

Literacy and Visual Discrimination. According to Whisler (1974), visual discrimination is an essential skill for reading readiness. For this reason, assessments of reading readiness often employ visual discrimination as a component. In order to read successfully, students must maintain the task of word recognition, the precursor of which is the ability to discriminate similarities and differences among letter and word forms, or visual discrimination.

King, Wood, and Faulkner (2007) investigated the visual and auditory processing of 82 children between the ages of 4 years and 6 years, grouped according to pre-alphabetic children (demonstrating no knowledge of the alphabetic principle) and an alphabetic group (demonstrating knowledge of the alphabetic principle). Each group was assessed using The British Ability Scales II (BAS II) (Elliott, 1996) word reading test, the Phonological Assessment Battery (PhAB) (Frederickson, Frith, & Reason, 1997), and four measures of perceptual skills including auditory onset detection, auditory offset detection, visual onset detection, and visual offset detection. The alphabetic group demonstrated higher scores in reading and spelling as well as offset detection of visual stimuli when in comparison to the pre-alphabetic group when controlled for age. Authors concluded that the discrimination of visual stimuli is developing concurrently with the development of the alphabetic principle.

Gupta, Ceci, and Slater (1978) investigated the performance of elementary school children on match-to-sample tasks measuring visual discrimination skills. Twenty-four children were included and assessed using the Visual Discrimination and Orientation Test (VDOT) (Daniels & Diack, 1976), and the Bender Visual-Motor Gestalt Test (Bender, 1938). Results indicated that poor readers made more errors when the stimuli closely approximated English. When the stimuli was nonsense shapes which did not have verbal labels, good readers did not make fewer errors than poor readers. Authors concluded that visual discrimination abilities are not a factor associated with reading achievement. Authors propose that differences in reading abilities are the caused by cognitive and/or linguistic strategies instead.

Pammer and Kevan (2007) proposed an experiment to dispel the conclusions of Gupta, Ceci, and Slater (1978). Pammer and Keven evaluated 44 children in a battery of tasks including rhyme discrimination, phoneme deletion, non-word and irregular word reading, an IQ measure, and reading achievement assessment in order to prove the existence of a visual discrimination deficit. Visual discrimination skills were assessed using a visual field instrument. Results
indicated that when controlling for IQ, visual discrimination accounted for the 6% variance reported in reading ability of the participants. Visual discrimination was most closely associated with irregular word reading, verifying its relationship to reading achievement.

Cornelissen, Hansen, Hutton, Evangelinou, and Stein (1998) as well as Olson and Datta (2002) both sought to evaluate the visual processing tasks in relation to reading success. Both studies involved the assessment of visual processing tasks according to motion threshold and contrast sensitivity. Results indicated that visual processing was significantly related to reading as a component that signifies ability and success.

The research of Cornelissen, Hansen, Hutton, Evangelinou, and Stein (1998) and Olson and Datta (2002) successfully established the relationship between the visual perceptual task of visual discrimination and literacy readiness. The work of these researchers however, did not indicate evidence of other visual perceptual tasks functioning simultaneously such as visual memory or visual comprehension.

**Literacy and Visual Memory.** Visual memory was integral to the reading process as established by Samuels and Anderson (1973). The study investigated 64 children in the second grade and hypothesized that the poor readers would perform significantly inferior to their typically developing matched peers in visual memory tasks. The authors provided each subject with three experimental tasks, compromising internal validity. Results proved significant. When the various tasks increased demand on visual memory, children with poor reading skills gave a drastic decrease in performance.

At the same time, Noelker and Schumsky (1973) evaluated 48 children with reading deficits and matched typically developing peers on three memory tasks. Noelker and Schumsky hypothesized a difference between the two groups in visual memory. Tasks of sequencing, memory for form, and memory for position were individually administered. Results demonstrated a significant difference between groups on all memory tasks, specifically for the task of position memory.

Fazio (1998) investigated the visual memory of preschool children with and without specific language impairment. It was suggested that poor visual storage and retrieval of visual memory may be responsible for comprehension problems in poor readers (Stanovich, 1986). Thirty children were assessed using a variety of visual tasks which asked the children to identify patterns with varying presentation durations. Visual tasks included images of common objects
and iconic images. Results suggested that under long presentation duration, children with specific language impairment did not differ in performance from their typically developing peers. When asked to complete the task under short presentation duration, the children with specific language impairment differed significantly in inferior ability. Effective visual memory, proven in study, does not account for visual comprehension skills. Establishment of the causal relationship between visual memory and literacy readiness was confirmed in research. However, studies confirmed this relationship without control for a final variable of visual comprehension or processing (reference), within the visual perception umbrella.

**Literacy and Visual Comprehension.** Visual processing deficits have been identified as being associated with the performance of poor readers. While the most commonly associated area of deficit is in phonological processing, recent research suggested that a number of factors such as visual processing could limit the functioning of literacy skills (Lovegrove et al., 1986; Lovegrove, 1991; Lovegrove & Williams, 1993; Hogben, 1997; Stein & Walsh, 1997; Skottun, 2000). Recent research supported the relationship between reading readiness and visual interpretation skills (Farmer & Klein, 1995; Studdert-Kennedy & Mody, 1995). According to these studies, poor readers were less capable of discrimination tasks between basic auditory and visual stimuli than their age-matched, typically developing peers. Regarding visual deficits, research has demonstrated that poor readers are less sensitive to stimuli in motion (Cornelissen et al., 1995; Witton et al., 1998; Everatt et al., 1999; Slaghuis & Ryan, 1999; Hansen et al., 2001) which serves as an extension of orthographic information read in text, (Cornelissen et al., 1998; Talcott et al., 2000; Cestnick & Coltheart, 1999). Talcott et. al (2002) hypothesized the relationship between reading success and visual and auditory processing, replicating a previous study of a smaller single classroom population by Talcott et al. (2000). The subject population included 350 children between the ages of 7 and 12 within general education classrooms. Children were administered a battery of standardized measure of cognitive and literacy skill, measures of component literacy skills, a phonological assessment, word-pseudohomophone discrimination, auditory frequency discrimination, and visual coherent motion. Regression analysis was performed on all assessment data. Results identified visual motion sensitivity to be significantly predictive of literacy skills as well as orthographic and phonological skills.

These results were found to be in direct agreement with the results of Olson and Datta (2002) which also assessed the performance of two groups of children with good and poor
reading abilities according to measures of visual contrast sensitivity. Identical relationships were found indicating a linear relationship between visual processing and reading ability.

Assessment of Literacy

The current study proposes existence of a significant relationship between auditory and visual perception and literacy readiness which requires the use of effective assessment protocol. Research is needed to verify the efficacy of assessments in the area of auditory processing, visual processing, and literacy readiness.

Dynamic Indicators of Basic Early Literacy Skills (DIBELS). Bishop and League (2006) evaluated the predictive validity of reading measures in its effectiveness to predict long-term reading performance. A total of 79 kindergartners were screened in the fall and winter of the kindergarten year on skills of letter identification, phonological awareness, phonological memory, and rapid automatized naming. Authors collected reading achievement scores in four consecutive school years, consisting of passage comprehension, oral reading fluency, sight-word recognition, and phonemic decoding. Regression analysis determined that letter identification, phonological awareness, and rapid automatized naming were the most predictive measures associated with later reading success. Results of the predictive measures were most highly correlated with measures of the oral reading fluency subtest of the DIBELS.

Manzo (2005) confirmed that schools in more than 40 states now use the DIBELS to screen children between kindergarten and third grade for potential reading problems and to monitor progress of reading skills. Coyne and Harn (2006) identified the DIBELS to be a comprehensive assessment capable of evaluating these early literacy skills in young children including subtests of phonemic awareness, alphabetic understanding, accuracy and fluency with connected text, vocabulary development, and reading comprehension.

Hintze, Ryan, and Stoner (2003) investigated the concurrent validity of the DIBELS with the CTOPP. Eighty-six kindergarten children were individually assessed using the two evaluation tools. Results indicated significantly strong correlations between the two resulting reports. Authors concluded the DIBELS was of similar construct to the Comprehensive Tests of Phonological Processes (CTOPP) in the evaluation of phonological awareness skills, most highly associated with literacy readiness, and determined its established accuracy was an effective tool for screening and diagnostic procedures.
The Test of Auditory Perceptual Skills - TAPS. The TAPS was developed by Morrison Gardner to assess the auditory perceptual skills according to tasks of auditory discrimination, auditory memory, and auditory processing. Gardner (1985) suggested that poor performance on any one or combination of the subtests can interfere with the process of learning to read. The TAPS was normed on 808 children between the ages of 4 and 12 years in the San Francisco area in 1985. The normative data including standard scores, percentile rank, and language ages, was made available for each subtest as well as the assessment of auditory-perceptual skills as a whole entity. Tests of reliability include content validity, item validity, and criterion-related validity. In order to establish criterion-related validity, the TAPS was administered concurrently with a variety of other auditory-perceptual skills including the WPPSI, WISC-R, and the Expressive One-Word Picture Vocabulary Test (EOWPTV) (Gardner, 1979). Correlations across subtests ranged from .42 to .80, with an average of .60, providing sufficient validity to use the TAPS in the clinic setting for the evaluation of auditory perceptual skills.

The TAPS was used by the research of Ross-Swain (2007) who sought to determine the efficacy of an auditory stimulation intervention procedure known as the Tomatis Meth. Forty-one subjects were given a battery of standardized assessments including the TAPS, Wide Range Achievement Test (WRAT), Lindamood Auditory Conceptualization Test (LACT) (Lindamood & Lindamood, 1971), Phonemic Awareness Test, and Token Test for Children as both pre- and post-treatment measures. A statistically significant difference was found between the pre- and post-treatment measures and established efficacy for the intervention procedure. Evaluation of auditory-perceptual skills is usually established using a battery of assessments. Walker, Givens, Cranford, Holbert, (year?)and Walker (2006) sought to identify auditory pattern recognition skills in children with reading disorders using perceptual tests to identify discrimination of frequency and duration tonal patterns. The 18 children were assessed using the Woodcock Reading Mastery Test—Revised, WRMT-R (Woodcock, 1987), Peabody Picture Vocabulary Test III (PPVT-III) (Dunn & Dunn, 1997), Weschler Intelligence Scales for Children—Weschler Intelligence Test for Children, third edition WISC-III, (Weschler, 1991), and the Test of Nonverbal Intelligence—TONI-3 (Brown, Sherbenou, & Johnson, 1997). Specific auditory measures included the Frequency Pattern test, administered according to the protocol of Musiek and Pinheiro (1987) and the Duration Pattern test according to the procedure of Museik, Baran,
and Pinheiro (1990). Results confirmed that children with reading impairment demonstrated significantly higher error rates in auditory discrimination than their typically developing peers.

*Motor-Free Visual Perception Test- Third Edition (MVPT-3).* The MVPT was used to compare the visual encoding processes of perceptually impaired and normal children as well as to establish if the correctness of the subject’s responses on the MFVP as indicative of a sufficiently accurate measure of differences in perceptual abilities (Locher & Worms, 1981). According to Locher and Worms, the MVPT has been frequently chosen for such research because of its lack of motoric involvement, allowing effective evaluation of children with motoric deficits that would otherwise exclude them from participation in research. Ten perceptually impaired children and 10 children typically developing children between fourth and sixth grade were used in this study. Only ten cards from the MVPT were used, inclusive of five types of perceptual skills measured by the MVPT (spatial relationships, closure, closure and spatial relationships, figure ground, and discrimination of figure differences). In the case of the perceptually impaired students, instructions were change to include verbal responses rather than the selection of answer via pointing. Results of the study found that visual information processing at the level of encoding and visual memory are significantly different in typically developing children and children with perceptual deficits. The typically developing children required significantly less scanning time and fixations during assessment than that of the experimental group.

The MVPT has been validated as a sufficient tool to assess visual processing by Harber (1979) in an investigation of assessments of perceptual skills to identify those which are reliable in the identification of children with learning disabilities. Subjects included 55 children labeled as learning disabled and 54 children labeled as typically developing. Harber assessed each student individually using The MVPT-3, Developmental Test of Visual-Motor Integration (VMI) (Beery & Buktenica, 1967), Sound Blending and Visual Closure subtests of the Illinois Test of Psycholinguistic Abilities (ITPA) (Kirk, McCarthy, & Kirk, 1968), to be compared with results of the Reading Recognition and Reading Comprehension subtests of the Peabody Individual Achievement Test (PIAT) (Dunn & Markwardt, 1970). An ANOVA analysis was completed on the data and revealed that children identified as learning disabled performed significantly lower than typically developing peers on all assessments except the Visual Closure subtest of the ITPA.
Results found that while perceptual skills were significantly different between the two groups, the reading achievement gap was much larger.

**Research Questions**

A variety of linguistic variables are components of the literacy construct in kindergartners. The establishment of the relationships between visual and auditory perception and literacy readiness may provide additional information to assist in the identification of linguistic deficits at the kindergarten level. Identifying deficits at this age may advance the effectiveness of intervention. With the advancement of intervention, it is possible that literacy delays may be identified and remediated before children reach an age in which the delay becomes stigmatizing and debilitating to future scholastic success.

The purpose of the study seeks to identify the correlation between the previously described linguistic variables and literacy readiness at the kindergarten level. An understanding of the following questions may enhance the effectiveness of assessment and treatment of children with delayed literacy skills. The research questions under investigation are as follows:

1. Is auditory perception positively correlated with literacy readiness (as determined by DIBELS assessment) in kindergartners?
2. Is there a significant difference between the components of auditory perception (discrimination, comprehension, and memory) and literacy readiness (as determined by DIBELS assessment) in kindergartners across subgroup means?
3. Is visual perception positively correlated with literacy readiness (as determined by DIBELS assessment) in kindergartners?
4. Is there a significant difference between visual perception performance and auditory perception performance across subgroups?
Chapter III

Methods

Participants

Thirty kindergarten children (ages 5.0 years-6.0 years) were randomly selected from the a.m. and p.m. sessions of 740 children at the Fairfield Kindergarten Center in Fairfield, Ohio. Children were divided into three distinct subgroups based on the DIBELS assessment of emergent literacy skills. Ten children were randomly selected within the following three subgroups (a) children at benchmark (low risk for literacy delay), (b) children needing intervention (some risk for literacy delay), and (c) children needing substantial intervention (at risk for literacy delay).

Inclusion criteria consisted of a signed parental consent form and a first attempt at completion of the kindergarten year. Exclusion criteria consisted of children making a second attempt at the kindergarten year, refusal to participate by the child or child’s parents, and/or incomplete DIBELS assessment. Children in which English was not the primary language or who were considered English Language Learners were excluded. All children with or without Individualized Education Plans (IEPs) who were incapable of responding to formal testing were excluded. Examples of this population included the legally blind, children with decreased motor control, and/or moderate to severe deafness with hearing aid.

Setting

All participants were tested at the Fairfield Kindergarten Center in Fairfield, Ohio. Fairfield Kindergarten Center exclusively houses all kindergarten students in the school district with approximately 16 students in each class. The school district is located in suburban southwestern Ohio.

Materials

DIBELS. The administration of the DIBELS (Good & Kaminski, 2002) marked the onset of the study. Testing dates occurred between October 6-10, 2008. At this time, the student completed only two subtests: Initial Sounds Fluency (ISF) and Letter Naming Fluency (LNF). The ISF subtest measures the ability to recognize and produce the initial sound in an orally presented word. The LNF subtest was administered next to assess the child’s ability to name letters of the alphabet. The total time for administration did not exceed five minutes and the test was administered by professionals trained in the administration of the assessment, including the
The assessments were scored according to the administration guidelines and submitted to a statistician for school-wide data reports during the second week of November 2008.

**TAPS.** The TAPS (Gardner, 1985) was administered to each subject between December 2008 and February 2009. Instructions were given from the text provided by the instruction manual. Each subtest was completed in the same order and sequence for all students according to the instruction manual. Table 1 identifies each subset in the order it was administered, describes what each task measures, and describes what the measurement indicates regarding the child’s auditory abilities.

### Table 1: Description of TAPS Subtests

<table>
<thead>
<tr>
<th>TAPS Subtest</th>
<th>Measures</th>
<th>Indicates</th>
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<tbody>
<tr>
<td>Auditory Number Memory-Forward Subtest</td>
<td>Ability to use rote memory for nonsense stimuli including the ability to hear the sound and maintain the digits as given</td>
<td>Retention of comprehended auditory stimuli</td>
</tr>
<tr>
<td>Auditory Number Memory-Reversed Subtest</td>
<td>Ability to reorganize and manipulate the structure of auditory stimuli to reverse the digit sequence</td>
<td>Concentration on auditory stimuli</td>
</tr>
<tr>
<td>Auditory Sentence Memory Subtest</td>
<td>Ability to recall information immediately while also providing the correct sequence</td>
<td>Recall of all parts of auditory stimulus without omitting or distorting the message</td>
</tr>
<tr>
<td>Auditory Word Memory Subtest</td>
<td>Level of complexity for which a child can immediately recall the sequence of words at a one-syllable, two-syllable, and compound word level</td>
<td>Not indicative of the child’s sequencing but the greatest amount of auditory stimulus that a child is able to recall from a single presentation</td>
</tr>
<tr>
<td>Auditory Interpretation of Directions Subtest</td>
<td>Ability of the child to interpret a complex auditory presentation (directions of increasing step complexity)</td>
<td>Comprehension of various levels of instructions</td>
</tr>
<tr>
<td>Auditory Discrimination Subtest</td>
<td>Ability to discriminate paired one- and two-syllable words with similar consonants or vowels</td>
<td>Identification of minor differences in the auditory signal</td>
</tr>
<tr>
<td>Auditory Processing Subtest</td>
<td>Ability to use formulate solutions to solve common problems</td>
<td>Understanding of the type of question being asked and providing a reasonable response</td>
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</table>

**MVPT-3.** The MVPT-3 (Colarusso & Hammill, 2003) was administered after the completion of the TAPS. Instructions were read from the text provided by the instruction
manual verbatim. The purpose of this assessment was to assess overall visual perceptual ability including the skills of visual discrimination, figure-ground, visual closure, and visual memory.

*Procedures*

A letter requesting written approval was sent to the principal of the Fairfield Kindergarten Center (see Appendix A). Once written approval was obtained, teachers were also given a letter requesting verbal consent to remove children from the classroom throughout the school day (see Appendix B). Once obtained, children selected for the study were sent a letter requesting written parental consent for the administration of the assessment as well as audio recording of the session (see Appendix C). Teachers sent letters home in the child’s school bag and those returning with signed permission forms were placed in the faculty workroom mailbox. Once approval was obtained, the student’s name was given a coded number and the permission form filed safely into a locked cabinet. The principal researcher also signed a Student Confidentiality Agreement (see Appendix D).

The Fairfield Kindergarten Center was mandated by the district of Fairfield City Schools to administer the DIBELS testing during the kindergarten year. DIBELS testing was administered by professionals trained in the administration of the assessment, including the principal researcher. The administration of the DIBELS did not exceed three minutes for each child.

All children were called from the classroom and taken to a work station. Work stations were located in cubicles within the hallway. A table with student-sized chairs was located in the cubicle. The principal researcher and the student sat side by side throughout the assessment. First, the child was read the Child Permission Text (see Appendix E) and allowed to look through the stickers that would be received for completion of the assessments. All subjects began the assessment session with the TAPS. The administration of the TAPS was approximately 15-18 minutes in length. Following the administration of the TAPS, children were given a short break (see Appendix F).

The MVPT-3 was administered next following the TAPS. The administration of the MVPT-3 was approximately 7-10 minutes in length. The children were then allowed to choose a sticker for reward, and walked back to their classroom independently. The entire assessment session did not exceed 25 minutes and all sessions were audio recorded with permission from the parent.
Data Collection

Assessments were scored according to the specific guidelines outlined in each assessment manual. The DIBELS used raw scores to determine percentile rank, level of risk associated with score (low risk, some risk, at risk) and recommended levels of intervention (benchmark, intervention, substantial intervention). The TAPS raw scores were converted to language ages, scaled scores, percentile ranks, and stanines. An overall auditory quotient, language age, and percentile rank was obtained. The MVPT-3 converted raw scores into standard scores, percentile rank, and age equivalence.

Data Analysis

Descriptive and quantitative analysis was completed. The data was described using central tendency (means) and dispersion (standard deviation) for continuous/ordinal scaled variables. Pearson’s r correlation test was used to determine the relationship between the independent variable (DIBELS) and the dependent variables (MVPT and TAPS). A one-way ANOVA test and ANOVA-F test was completed to determine significant difference between the performance of the MVPT and TAPS for the three treatment groups (baseline, intervention, and substantial intervention).
Chapter IV
Results

Chapter four provides a summary of the results of the present study. First, the descriptive data relative to the research questions regarding auditory and visual perception (as determined by the TAPS and the MVPT-3) performance across subgroups are presented. Correlation data and statistical results relative to the research questions regarding the relationship between literacy readiness (as determined by the DIBELS) and auditory and visual perception follow. Finally, a comparison of the means between the two perceptual assessments is discussed.

Research Question 1. Is auditory perception positively correlated with literacy readiness as determined by the DIBEL assessment in kindergartners?

Overall Performance. The performance of all kindergarten participants on the TAPS was determined by the Auditory Quotient Score. The overall Auditory Quotient for all 30 participants was determined to have a mean of 92.66 with a standard deviation of 14.89. The mean for Baseline subjects was 101.80 (15.84), the mean for Intervention subjects was 94.40 (12.41), and the mean for Substantial Intervention subjects was 81.10 (9.09). Table 2 depicts the descriptive statistics of the Auditory Quotient scores on the TAPS. Figure 1 shows the performance of each subject according to the Auditory Quotient on the TAPS. Higher Auditory Quotient scores indicate more proficient auditory perceptual skills.

A significant statistical difference was found between the DIBELS’ LNF score and the TAPS Auditory Quotient. The two-tailed test of correlation determined a significant association (p = 0.001).

A significant statistical difference was also found between the DIBELS’ ISF score and the TAPS Auditory Quotient. Using a two-tailed test where correlation was determined to be significant at the 0.01 level, correlation between the two scores was found to be p = .005

Pearson’s r correlations were used to measure the degree to which DIBELS measure were related to student performance on the TAPS as determined by the Auditory Quotient for all 30 students. Overall, a significant correlation was found to exist between this measure and the DIBELS measures. Specifically, the correlation between the Auditory Quotient and DIBELS’ LNF score (r =.591) was found to be a strong, positive correlation (p = 0.001). The correlation between the Auditory Quotient and DIBELS’ ISF score (r =.604) was reported to be a strong, positive correlation (p = 0.005). In conclusion, auditory perception is positively, significantly
correlated with literacy readiness. Table 3 depicts the quantitative analysis of the TAPS Auditory Quotient and the DIBELS scores.

Table 2: Descriptive Statistics of TAPS Auditory Quotient

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<th>N</th>
<th>Mean</th>
<th>SD</th>
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<tr>
<td>Baseline</td>
<td>10</td>
<td>101.80</td>
<td>15.84</td>
</tr>
<tr>
<td>Intervention</td>
<td>10</td>
<td>94.40</td>
<td>12.41</td>
</tr>
<tr>
<td>Substantial Intervention</td>
<td>10</td>
<td>81.10</td>
<td>9.09</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>92.66</td>
<td>14.89</td>
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Table 3: Quantitative Analysis of TAPS Auditory Quotient and DIBELS Scores

<table>
<thead>
<tr>
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<th>TAPS Auditory Quotient</th>
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<tr>
<td>DIBELS LNF Score</td>
<td>p = 0.001</td>
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<tr>
<td></td>
<td>r = 0.591</td>
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<tr>
<td>DIBELS ISF Score</td>
<td>p = 0.005</td>
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<td></td>
<td>r = 0.604</td>
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</table>

Research Question 2. Is there a significant difference between the components of auditory perception (discrimination, comprehension, and memory) and literacy readiness (as determined by DIBEL assessment) in kindergarteners across subgroup means?

There is a significant difference between the means of auditory perceptual skill of auditory memory and literacy readiness across the three subgroups. The auditory perceptual skills of auditory discrimination and auditory processing do not demonstrate a significant difference between the means in the present study. Table 4 depicts the means and standard deviations of each subtest’s scaled scores and significance according to the between-group ANOVA test. Higher scaled scores on each subtest indicate more proficient auditory perceptual skills.

Auditory Discrimination. The performance of all kindergarten participants on auditory discrimination was determined by the task of the Auditory Discrimination Subtest of the TAPS. The Auditory Discrimination scaled score mean for the Baseline group was 11.20 (3.33), the mean for the Intervention group was 10.30 (3.68), and the mean for the Substantial Intervention group was 7.00 (3.83).

Auditory Memory. The performance of all kindergarten participants on auditory memory was determined by the tasks of the Auditory Number Memory-Forward subtest, Auditory
Number Memory-Reversal subtest, Auditory Word Memory, and Auditory Sentence Memory subtest of the TAPS. The Auditory Number Memory-Forward subtest scaled score mean for the Baseline group was 12.30 (3.65), the mean for the Intervention group was 9.60 (2.91), and the mean for the Substantial Intervention group was 8.40 (3.37).

The Auditory Number Memory-Reversal subtest scaled score mean for the Baseline group was 8.00 (2.21), the mean for the Intervention group was 8.30 (2.36), and the mean for the Substantial Intervention group was 5.30 (0.95). Figure 2 shows the performance of each subject according to Scaled Scores on the Auditory Number Memory-Reversal Subtest of the TAPS.

The Auditory Word Memory subtest scaled score mean for the Baseline group was 10.60 (2.99), the mean for the Intervention group was 10.50 (3.60), and the mean for the Substantial Intervention group was 9.80 (3.68).

The Auditory Sentence Memory subtest scaled score mean for the Baseline group was 8.70 (2.95), the mean for the Intervention group was 9.00 (2.71), and the mean for the Substantial Intervention group was 7.50 (2.59).

Auditory Comprehension. The performance of all kindergarten participants on auditory comprehension was determined by the tasks of the Auditory Interpretation of Directions subtest and the Auditory Processing subtest. The Auditory Interpretation of Directions subtest scaled score mean for the Baseline group was 10.00 (3.09), the mean for the Intervention group was 8.80 (2.30), and the mean for the Substantial Intervention group was 7.50 (1.72).

The Auditory Processing subtest scaled score mean for the Baseline group was 10.80 (4.92), the mean for the Intervention group was 8.20 (2.39), and the mean for the Substantial Intervention group was 7.10 (2.33).

A between-group ANOVA test revealed that the only subtest with a significantly statistical difference between the three group means was the Auditory Number Memory-Reversed .015. Analysis of the subtests of the TAPS indicated that there was no significant statistical difference between the means of the remaining TAPS subtests. Significance of the Auditory Word Discrimination subtest was .064, the Auditory Number Memory-Forward subtest was .101, the Auditory Word Memory subtest was .059, the Auditory Sentence Memory subtest was .387, the Auditory Interpretation of Directions subtest was .080, and the Auditory Processing subtest was .100.
Figure 4: Descriptive Statistics and Between-group ANOVA Test on TAPS Subtests

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<th>N</th>
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<th>SD</th>
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<td>Auditory Word Discrimination</td>
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<td>Intervention</td>
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<td>10.30</td>
<td>3.68</td>
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<tr>
<td>Substantial Intervention</td>
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<td>Auditory Number Memory- Forward</td>
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<td>10.60</td>
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<tr>
<td>Intervention</td>
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<td>10.50</td>
<td>3.60</td>
<td>0.059</td>
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<tr>
<td>Substantial Intervention</td>
<td>10</td>
<td>9.80</td>
<td>3.68</td>
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</tr>
<tr>
<td>Auditory Sentence Memory</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
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<td>8.70</td>
<td>2.95</td>
<td></td>
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<tr>
<td>Intervention</td>
<td>10</td>
<td>9.00</td>
<td>2.71</td>
<td>0.387</td>
</tr>
<tr>
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<td>7.50</td>
<td>2.59</td>
<td></td>
</tr>
<tr>
<td>Auditory Interpretation of Directions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
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<td>10.00</td>
<td>3.09</td>
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<tr>
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<td>8.80</td>
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<td>1.72</td>
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<td>Auditory Processing</td>
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<td>Baseline</td>
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<td>10.80</td>
<td>4.92</td>
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<tr>
<td>Intervention</td>
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<td>8.20</td>
<td>2.39</td>
<td>0.100</td>
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<tr>
<td>Substantial Intervention</td>
<td>10</td>
<td>7.10</td>
<td>2.33</td>
<td></td>
</tr>
</tbody>
</table>

*Research Question 3. Is visual perception positively correlated with literacy readiness (as determined by DIBEL assessment) in kindergarteners?*

Visual perception is not positively, significantly correlated with literacy readiness. The performance of all kindergarten participants on the MVPT-3 was determined by the overall standard score. The overall standard score for all 30 participants was determined to have a mean of 75.26 with a standard deviation of 17.46. The mean for Baseline subjects was 82.20, the mean
for Intervention subjects was 76.10 and the mean for Substantial Intervention subjects was 67.50. Table 5 depicts the descriptive statistics of the standard scores on the MVPT-3 assessment. Figure 3 shows the performance of each subject according to standard scores on the MVPT-3 assessment.

A significant statistical difference was not found between the DIBELS’ LNF score and the MVPT-3 standard score. Using a two-tailed test where correlation was determined to be significant at the 0.01 level, correlation between the two scores was found to be $p = 0.069$, just slight of significance.

A significant statistical difference was not found between the DIBELS’ ISF score and the MVPT-3 standard score. Using a two-tailed test where correlation was determined to be significant at the 0.01 level, correlation between the two scores was found to be $p = 0.224$.

Pearson’s r correlations were used to determine the degree to which DIBELS measure were related to student performance on the MVPT-3 for all 30 students. Overall, no significant correlation was found to exist between this measure and the DIBELS measures. Specifically, the correlation between the MVPT-3 standard scores and DIBELS’ ISF score ($r = 0.229$) was found to be a weak, positive correlation. The correlation between the MVPT-3 standard scores and DIBELS’ LNF score ($r = 0.337$) was reported to be a weak, positive correlation. Table 6 depicts the quantitative analysis of the MVPT-3 overall scaled score and the DIBELS scores.

### Table 5: Descriptive Statistics of MVPT-3 Standard Scores

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
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<tr>
<td>Baseline</td>
<td>10</td>
<td>82.20</td>
<td>14.34</td>
</tr>
<tr>
<td>Intervention</td>
<td>10</td>
<td>76.10</td>
<td>17.23</td>
</tr>
<tr>
<td>Substantial Intervention</td>
<td>10</td>
<td>67.50</td>
<td>18.95</td>
</tr>
<tr>
<td>Overall</td>
<td>30</td>
<td>75.26</td>
<td>17.46</td>
</tr>
</tbody>
</table>

### Table 6: Quantitative Analysis of the MVPT-3 Overall Scaled Score and DIBELS Scores

<table>
<thead>
<tr>
<th></th>
<th>MVPT-3 Standard Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIBELS LNF Score</td>
<td>$p = 0.069$</td>
</tr>
<tr>
<td></td>
<td>$r = 0.337$</td>
</tr>
<tr>
<td>DIBELS ISF Score</td>
<td>$p = 0.224$</td>
</tr>
<tr>
<td></td>
<td>$r = 0.229$</td>
</tr>
</tbody>
</table>
Research Question 4. Is there a significant difference between visual perception performance and auditory perception performance across subgroups?

There is no significant difference between visual perception performance and auditory perception performance across subgroups. The difference between standardized scores on the two tests is compared between the three groups using a one-way analysis of variance (ANOVA). The one-way ANOVA tests to see if the difference in mean standardized scores on MVPT-3 and TAPS differs significantly between the three treatment groups. The mean difference scores (MVPT-3 – TAPS) were –2.90 for the Baseline subgroup (SE = 6.17), 0.04 for the Intervention subgroup (SE = 6.17), and 2.86 for the Substantial Intervention subgroup (SE = 6.17).

The ANOVA F-test was not significant ($F_{2,27} = 0.22, p = 0.803, R^2 = 0.016$), indicating that there is insufficient evidence to determine a difference. There is also no significant evidence that standardized MVPT-3 scores differed from standardized TAPS scores within any of the three treatment groups under study (baseline $p$-value = 0.64, intervention $p$-value = 0.99, substantial intervention $p$-value = 0.6445). Table 7 depicts these results.

Table 7: ANOVA F-test Between MVPT-3 and TAPS Performance

<table>
<thead>
<tr>
<th></th>
<th>Mean (MVPT-3- TAPS)</th>
<th>Std. Error</th>
<th>Pr &gt;</th>
<th>t</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>-2.91</td>
<td>6.14</td>
<td>0.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intervention</td>
<td>0.04</td>
<td>6.14</td>
<td>0.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Substantial Intervention</td>
<td>2.86</td>
<td>6.14</td>
<td>0.64</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Conclusion

When comparing the overall performance of participants on both tasks, the only statistically significant correlation was that of auditory perceptual tasks demonstrated by performance on the TAPS across subgroups when compared with literacy readiness tasks demonstrated by performance on the DIBELS. Visual perceptual tasks as demonstrated by performance on the MVPT-3 did not predict literacy readiness as demonstrated by the participants’ performance on the DIBELS tasks to any level of significance. A comparison of student performance based the means of overall performance of the auditory and visual perceptual assessments for all children is depicted in figure 10. The figure illustrates the overall trend of performance across
group means where the baseline subgroup presented with a superior performance on both assessments when compared with the intervention subgroup and the substantial intervention subgroup. Likewise, the intervention group presented with a superior performance when compared to the substantial intervention group while this was still an inferior performance when compared with the baseline subgroup.
Chapter V
Discussion

The present study was designed to investigate the correlation between literacy readiness as determined by the DIBELS assessment and auditory and visual perception in kindergarten children. In addition, an attempt was made to determine if either auditory perceptual skills or visual perceptual skills played a significant role in predicting beginning reading performance.

Gardner (1985) and Badian (2005) both found a relationship between auditory and visual perception and literacy readiness skills does exist. Seminal research conducted by Paula Tallal (1980) further suggested that basic perceptual mechanisms may underlie some difficulties in analyzing the phonetic code efficiently and ultimately in learning to read.

*Literacy Readiness and Auditory Perception*

The finding from research question 1 revealed that auditory perception is positively, significantly correlated with literacy readiness. Children in the baseline subgroup as a result of DIBELS testing performed significantly better than children in the intervention and substantial intervention subgroups on the TAPS. Likewise, children in the intervention subgroup as a result of DIBELS testing performed significantly better than children in the substantial intervention subgroup on the TAPS. This finding was consistent with research that has found a reciprocal relationship between auditory perceptual skills and literacy readiness (Bretherton & Holmes, 2003; Cestnick, 2001; Cestnick & Jerger, 2000; Waber et al., 2001). In addition, the results for the current study indicated that auditory perceptual skills can predict reading readiness skills of kindergartners.

The findings of the present study were consistent with the correlational studies conducted by Burrows and Neyland (1978) who studied the association of auditory receptive language and reading readiness. Burrows and Neyland were also able to conclude that auditory perception in kindergarten is indicative of reading success in later grades. Marston and Larkin (1979) found auditory discrimination tasks to affirm the relationship with literacy success as well, concluding the difference in auditory discrimination task ability could distinguish poor readers from typically developing peers. Correlational studies in agreement with the relationship between auditory perceptual skills and literacy readiness skills include Marston and Larkin (1979), Elliott, Hammer, and Scholl (1989), and Corriveau, Pasquini, and Goswami (2007).
The current study found only one predominant pattern regarding specific auditory perceptual skills and literacy readiness. The present study discovered that auditory memory, assessed by the TAPS Auditory Number Memory- Reversed, demonstrated a significant difference between means across the subgroups, consistent with the findings of Kurdek and Sinclair (2001). Kurdek and Sinclair confirmed, following a longitudinal study with assessment of auditory perceptual skills in the kindergarten year, the sole indicator of fourth grade reading success was the child’s auditory memory performance. Specifically, the Kindergarten Diagnostic Instrument’s auditory memory subtest was most strongly correlated with the verbal scores on the Ohio proficiency test in the fourth grade. This longitudinal study increased the strength of the association between literacy and auditory memory, suggesting auditory memory plays a role in literacy through fourth grade.

The difference of auditory memory performance across the reading subgroups in the current study was a finding consistent with the study conducted by Badin (1977) as well. Badin identified auditory memory to be of exclusive importance in literacy readiness. He suggested that in some cases, a poor reader may be the result of an inability to recall the auditory equivalent of the printed word due to an impaired auditory memory despite the child’s ability to discriminate the words visually. A deficit in auditory memory would inhibit a child’s ability to remember auditory stimuli in order to develop meaningful experiences.

Auditory memory as a vital component of literacy readiness as well as future reading success was a conclusion consistent with other studies (Penney, Hann, and Power, 1999; Tobey, Fleischer-Gallagher, & Cullen). Authors concluded that poor readers have an underdeveloped, disorganized long term memory that may be associated with failure to understand and develop relationships between orthography and phonology during pre-literacy stages. Further, children incapable of immediate auditory recall suffer great interference in the performance of later occurring stimuli, impacting the overall ability to recall from memory. Authors concluded that whether this finding indicates dysfunction and disorder or just immature functioning is still ambiguous.

Literacy Readiness and Visual Perception

The current study discovered that no statistically significant differences between the literacy readiness measure of the DIBELS and the visual perception measure of the MVPT-3. No statistically significant differences were noted. Comparisons indicated that subject
performance on visual perceptual tasks were significantly different when comparing the MVPT-
3 data across DIBELS’ subgroups. Fazio (1998) also found no relationship between visual
perception and literacy readiness. Fazio suggested that under minimal time constraints, all
children are capable of successfully completing visual retrieval tasks indicating no significant
difference among literacy abilities. Similarly to Fazio’s conclusion, the present study imposed
no time constraint on participants during administration of the MVPT-3 to assess visual
perception skills. Fazio explains that only under time constraints do the children present with a
statistically different performance across literacy groups.

The present study concludes that there is no relationship between visual perception and
literacy readiness skills, in contrast to an assortment of previously conducted correlational
studies. A lack of relationship between visual perception and literacy readiness skills is in direct
contrast with the work of Noelker and Schumsky (1973). Noelker and Schumsky demonstrated a
significant difference between children with reading deficits and typically developing peers
when comparing results of visual memory tasks. Results of the current study do support the
findings of Pammer and Kevan (2007) who indicated a lack of relationship between normal and
delayed readers according to visual discrimination task performance.

Clinical Implications

The conclusions of the present study imply a host of clinical implications. As Maria
(1990) suggested, the understanding that several skills are integrated into the reading process
provides a number of opportunities for the kindergarten child to breakdown. The present study
was capable of identifying one of these integrated skills as auditory perceptual skills, also
indicative of literacy readiness.

The early identification of children with delayed literacy skills specifically that of
auditory memory may have the opportunity to be developed and provided earlier intervention.
This movement could have a huge impact on children with delayed literacy skills, preventing
them from moving into the first grade with poor reading skills. As Justice (2007) indicates, a
first grade child with poor reading skills maintains an 88% chance of remaining a poor reader
through the fourth grade. As Hayes & Pereira (1972) affirm, when this literacy delayed child
becomes aware of his or her need for additional aid and academic support, the child realizes the
inadequacy of his or her skills. This results in an emotional lag and the problem is exacerbated.
The present study confirmed that auditory perceptual skills are highly correlated with reading readiness. As Boudreau & Hedberg (1999) suggest, linguistic foundations that underlie language impairment in children emerge with impaired linguistic constructs as well. It can be concluded that while the kindergarten child is presenting with impaired literacy skills, he or she is likely to demonstrate this delay in regards to auditory perceptual skills. The establishment of this relationship suggests that this skill could be an essential addition to screening tools and assessment batteries. The assessment of auditory perceptual skills at the first sign of literacy delay may advance the effectiveness of intervention and help to provide early intervention. With the advancement and early onset of intervention, it is possible that literacy delays may be remediated before children reach an age in which the delay becomes stigmatizing and debilitating to future academic success.

The conclusions of the present study further validate the efficacy of the DIBELS use at the kindergarten level. The DIBELS is regarded as a comprehensive assessment capable of evaluating these early literacy skills in young children and maintains effectiveness in predicting later reading performance (Coyne & Harn, 2006; Bishop & League, 2006). For the students of the Fairfield Kindergarten Center, the DIBELS can be regarded as an accurate measure of students’ emerging literacy skills. While the current study cannot be generalized to the greater public, Manzo (2005) suggests that schools in more than 40 states rely on the DIBELS to screen children between kindergarten and third grade for potential reading problems as well as to monitor progress of reading skills. The evidence of a difference between the means across subgroups indicates that the DIBELS accurately segregates the students into tiered levels of literacy readiness. The current study supports research that suggests the DIBELS be regarded as an effective tool for screening and diagnostic procedures (Hintze, Ryan, & Stoner, 2003).

Limitations of the Study

The present study suggests and is in agreement with other correlational studies that argue the relationship between auditory perception skills and literacy readiness. Although these results cannot be generalized beyond this population, it is appropriate to determine that an important relationship exists between the skills of auditory perception and literacy readiness. For this reason, generalization of results beyond this population would not be recommended. It would be appropriate to perform this study on a much larger scale and more diverse population in order to
make generalizations regarding the relationship of auditory perception and literacy skills in kindergarten settings.

While the current study attempted to assess children in a controlled manner, there were several variables uncontrolled. For example, the effect of constant literacy instruction throughout the course of data collection could have impacted student performance. At the time of November during the kindergarten year, most students are deep into literacy instruction and participating in several activities daily to increase their literacy skills. Simultaneously, the impact of home environments related to literacy experiences, exposure to reading materials in and outside the classroom, parental involvement in the acquisition of literacy skills, instructional differences among teachers, and simply the maturity of the student in the school environment are all factors that were uncontrollable in the present study.

A third limitation of the study was the assumed mastery of some language concepts by the assessment battery. The TAPS’ Auditory Discrimination task instructed the participant to identify the two words as either “same” or “different.” The language concept of “same” vs. “different” is a concept that is introduced in the kindergarten year. In fact, this concept was being taught throughout the data collection of the present study. Therefore, some children had mastered this concept while others were still struggling to understand and correctly use the two concepts expressively. Therefore, their answers were inconsistent and not an accurate description of a child’s auditory discrimination.

Another limitation is the time frame in which data collection occurred in correlation with DIBELS scores. The DIBELS assessment is administered three times throughout the kindergarten year with different benchmarks associated with average performance of literacy readiness skills. The first administration of the DIBELS uses only the Letter Naming Fluency subtest and the Initial Sound Fluency subtest whereas the second and third administrations include the additional subtests of Phoneme Segmentation Fluency and Nonsense Word Fluency, which may be more highly correlated with an accurate prediction of literacy readiness skills (Scarborough, 1998).

Scarborough (1998) also suggested that the ongoing literacy instruction in formal schooling impacts DIBELS scoring. With increased literacy development, DIBELS administration later in the year may create a more realistic picture of a child’s literacy skills. An extension of this limitation suggests the impact of maturity in a formal school setting with
ongoing literacy instruction, also impacts the child’s performance on assessments. It could be argued that children assessed at the beginning of the current study were at a disadvantage to children assessed at the end of the study due to more literacy instruction. Similarly, children assessed at the beginning of the current study were most likely more strongly correlated with their initial DIBELS performance. Children assessed at the end of the study were preparing for the second administration of the DIBELS, and their literacy skill performance had most likely changed.

Finally, it is possible that the lack of association between the MVPT-3 and DIBELS scores could be due to subject fatigue. Each participant received the assessments in the same order and sequence. The TAPS was administered first and the MVPT-3, last. The entire administration period did not exceed twenty-five minutes. However, following the TAPS assessment, a battery of seven subtests, it is possible that subject fatigue did play a role in the child’s ability to perform on the second assessment, negatively impacting data associated with DIBELS scores.

**Implications for Further Study**

Data gathered from this thesis generated several directions for future research. First, a longitudinal study of this same population would be beneficial to measure a variety of uncontrolled variables at play during the present study. The confounded impact of reading level as a function of age, instruction, parental involvement, exposure to reading materials, and other similar factors in kindergarten students are ambiguous relationships. The need to understand literacy experiences associated with auditory perception that allow provide children with the ability to advance literacy skills is an obvious direction for future research. As Alexander & Entwisle (1988) and Foster & Miller (2007) suggest, such relationships present at the kindergarten level are indicative of future success of children.

The limitation of three administrations of the DIBELS assessment as a combined effort to predict kindergarten literacy readiness serves another direction for future research. Future studies could examine a comparison of the DIBELS scores across all three administrations in the kindergarten through second grade years and then follow each child’s literacy success through the end of third grade. A longitudinal study could investigate which administration was the most predictive throughout the three years and thus, most indicative of future literacy abilities. For
that matter, there is a need to know a specific subtest within the DIBELS as most highly associated with predictive literacy skills.

As the current study suggests, the understanding that a relationship between auditory perception and literacy readiness skills exists, poses a potential instructional resource. Future research could focus a longitudinal treatment study for children on the basis of DIBELS scores. For children falling below benchmark on the DIBELS assessment, indicating that the child is not demonstrating sufficient literacy readiness, an auditory perceptual training program could be implemented. This auditory perceptual training could include activities targeting auditory discrimination, memory, and/or comprehension. Following this training, the remaining two DIBELS administrations could challenge the effectiveness of the treatment, investigating if literacy readiness scores increased to benchmark.

Conclusions

Several important conclusions were generated as a result of this research study. First, literacy readiness is significantly associated with auditory perception, specifically the skills of auditory memory. However, literacy readiness is not significantly associated with visual perception. Furthermore, the relationship of performance on visual perception assessments and auditory perception assessments are not significantly correlated.

Therefore, this research, along with the research previously cited suggests that a correlation exists between auditory perception and literacy readiness skills. With this proven relationship, kindergarten instructors can plan auditory perceptual activities in order to maximize literacy potential for all students preparing to read as well as for those developing their literacy skills.
References


Stein, J. and Walsh, V. (1997) To see but not to read; the magnocellular theory of dyslexia. 
*Trends in Neurosciences,* 20, 147–152.


Figures

Figure 1: TAPS Auditory Quotient Score

![TAPS Auditory Quotient Score](image1)

Figure 2: Auditory Number Memory Reversed Subtest

![Auditory Number Memory-Reversed Subtest](image2)
Figure 3: MVPT-3 Scores Across Subgroups

![MVPT-3 Scores Across Subgroups](image)

Figure 4: Comparison of Mean Scores of TAPS & MVPT-3 Across Subgroups

![Comparison of Mean Scores of TAPS & MVPT-3 Across Subgroups](image)
APPENDIX A

Letter to the Principal

Dear (Principal)

Hello, my name is Kate Schnobrich. I am a graduate student at Miami University studying Speech-Language Pathology. I am conducting a research study on skills that kindergartners need in order to read successfully. This includes visual skills such as memory and identification of letters and sounds and auditory skills such as the ability to identify the difference between sounds and remember sounds in order to hear and understand words. The title of the study is “The Relationship between Literacy Readiness and Auditory and Visual Perception in Kindergartners.”

I would like to have your written permission to allow the students in your kindergarten classes to take part in the study. In order to complete the study I will need access to school records such as the students’ IEPs and the school districts’ Dynamic Indicators of Basic Early Literacy Skills (DIBELS) testing results I will administer two assessments (similar in format to the DIBELS, the assessment that each child completes at the beginning of their kindergartner year). Both the Test of Auditory Perceptual Skills and the Motor-Free Visual Perception Test, Third Edition will be used to look at the skills each child needs to begin reading successfully. I would like to conduct these assessments at a time that you deem convenient, interfering as little as possible with your direct instruction and class time. I will be completing the study under the supervision of Lisa Williamson, Student Teacher Coordinator, and my research advisor, Dr. Joan Nolan. I will contact you personally regarding what you feel is most appropriate for your students and schedule.

All information is strictly confidential. No child's name will not be associated with their responses in any way. There will be two sessions in which each child will participate, approximately 20 minutes each. Participation in this study is voluntary. If at any time the child would like to stop and withdraw from the session, or does not want to answer any of the questions, they may do so. Parents may also withdraw their child at any time and will have the option to receive their child’s assessment results.
There are no risks associated with this study. The general results of the study will be shared with you and parents if they request. The benefit of the study is to help Speech-Language Pathologist and Classroom Teachers identify their students' skills needed for reading. This will help with the early identification of children who need additional help with these skills and provide appropriate intervention to avoid future reading problems.

If you have any further questions about the study, please contact Kate Schnobrich at 513-529-2500, schnobkm@muohio.edu or Dr. Joan Nolan at 513-529-2549, nolanjt@muohio.edu. If you have any questions about the rights of any research participant in this study, please call the Office of Advancement of Research and Scholarship at 513-529-3600, humansubjects@muohio.edu.

I am very grateful for your help and hope that this will be a great learning experience. I will await your written permission to conduct the study.

Thank you for your attention in this matter.

Sincerely,

Kate Schnobrich, B.S.
Graduate Student Clinician
Miami University
Dear Teachers

Hello, my name is Kate Schnobrich. I am a graduate student at Miami University studying Speech-Language Pathology. I am conducting a research study on skills that kindergartners need in order to read successfully. This includes visual skills such as memory and identification of letters and sounds and auditory skills such as the ability to identify the difference between sounds and remember sounds in order to hear and understand words. The title of the study is “The Relationship between Literacy Readiness and Auditory and Visual Perception in Kindergartners.”

I have been given permission from your principal to conduct this study in the Fairfield School District. However, I would like to have your assistance in recruiting students in your kindergarten classes to take part in the study. I will categorize all kindergarten students into three categories (no risk, low risk, at risk) according to the results of the school districts DIBELS testing. Ten children who meet the inclusion criteria will be randomly selected from each category. Exclusion criteria will include children making a second attempt at the kindergarten year, refusal to participate by the child or child’s parents, and/or incomplete DIBELS assessment. Children in which English is not the primary language or who are bilingual will also be excluded. Finally, all children with or without Individualized Education Plans (IEPs) who are incapable of responding to formal testing will be excluded. Examples of this population include the legally blind, children with decreased motor control, and/or moderate to severe deafness with hearing aid.

Parental Consent forms will be sent home in the children’s book bags. After parental consent is obtained (See attachment), I will administer the Test of Auditory Perceptual Skills and the Motor-Free Visual Perception Test, Third Edition. I would like to conduct these assessments at a time that you deem convenient, interfering as little as possible with your direct instruction and class time. I will be completing the study under the supervision of Lisa Williamson, Student Teacher Coordinator, and my research advisor, Dr. Joan Nolan. I will contact you personally regarding what you feel is most appropriate for your students and schedule.
All information is strictly confidential. No child's name will not be associated with their responses in any way. There will be two sessions in which each child will participate, approximately 20 minutes each. Participation in this study is voluntary. If at any time the child would like to stop and withdraw from the session, or does not want to answer any of the questions, they may do so. Parents may also withdraw their child at any time and will have the option to receive their child’s assessment results.

There are no risks associated with this study. The general results of the study will be shared with you and parents if they request. The benefit of the study is to help Speech-Language Pathologist and Classroom Teachers identify their students' skills needed for reading. This will help with the early identification of children who need additional help with these skills and provide appropriate intervention to avoid future reading problems.

If you have any further questions about the study, please contact Kate Schnobrich at 513-529-2500, schnobkm@muohio.edu or Dr. Joan Nolan at 513-529-2549, nolanjt@muohio.edu. If you have any questions about the rights of any research participant in this study, please call the Office of Advancement of Research and Scholarship at 513-529-3600, humansubjects@muohio.edu.

I am very grateful for your help and hope that this will be a great learning experience for both you and your students.

Thank you for your attention in this matter.

Sincerely,

Kate Schnobrich, B.S.
Graduate Student Clinician
Miami University
Dear Parents or Guardians:

Hello, my name is Kate Schnobrich. I am a graduate student at Miami University, and am studying Speech-Language Pathology. I am conducting a research study on skills that kindergartners need in order to read successfully. This includes visual skills such as memory and identification of letters and sounds. Similarly, auditory skills are important for reading such as the ability to identify the difference between sounds and remember sounds in order to hear and understand words.

I would like to have your permission to allow your child to take part in the study. I will administer the following two assessments: (1) The Test of Auditory Perceptual Skills and (2) The Motor-Free Visual Perception Test, Third Edition. These tests will be used to look at the skills your child needs to begin reading successfully. These are paper and pencil tests. The children are shown different pictures then have to answer different questions about the pictures either by pointing or saying the answer. The Test of Auditory Perceptual Skills (TAPS) tests your child’s ability to remember words, sentences, and numbers that they hear. The Motor-Free Visual Perception Test, Third Edition (MVPT-3) tests your child’s ability to visually remember/match words, identify different written letters and words, and find hidden pictures.

There will be two sessions in which your child will participate, approximately 20 minutes each. Participation in this study is voluntary. All information is strictly confidential. Your child's name will not be associated with their responses in any way. If at any time your child would like to stop and withdraw from the session, or does not want to answer any of the questions, they may do so. In addition, you may withdraw your child at any time.

There are no risks associated with this study. The general results of the study will be shared with the classroom teacher and principal, but will not be associated with your child’s name. The benefit of the study is to help Speech-Language Pathologist and Classroom Teachers identify their students' skills needed for reading. This will help with the early identification of children who need additional help with these skills and provide appropriate intervention to avoid future
reading problems. If you would like to receive the results of your child’s assessment, please select the appropriate box when completing the Parental Consent Form on the following page.

If you have any further questions about the study, please contact Kate Schnobrich at 513-529-2500, schnobkm@muohio.edu or Dr. Joan Nolan at 513-529-2549, nolanjt@muohio.edu. If you have questions about your child's rights as a research participant, please call the Office of Advancement of Research and Scholarship at 513-529-3600, humansubjects@muohio.edu.

Thank you for allowing your child to participate. I am very grateful for your help and hope that this will be a great learning experience for both you and your child. You may keep this page.

Sincerely,

Kate Schnobrich
Graduate Student Clinician
Please keep the first page and return this page to your child's classroom teacher.

I agree to allow my child to participate in the research study of kindergarten reading skills.

I understand my child's participation is voluntary and that their name will not be associated with their responses. I understand that my child’s school record will be accessed and used to draw the general results of the study. I understand that the general results will be shared with the classroom teacher and principal, but will never be associated with my child’s name.

I understand that my child will be removed from the general classroom for approximately 20 minutes to complete two assessments.

(Please circle the option in each statement that you prefer regarding assessment procedures.)

I ( do / do not ) want to receive the results of my child’s assessment.

I ( give / do not give ) permission for the researcher to audiotape the assessment session.

Parent or Guardian's Signature ____________________________________________

Child's Name ____________________________________________________________

Date_________________________
PATIENT CONFIDENTIALITY AGREEMENT

As a representative of Miami University Speech-Language-Hearing Clinic, I understand that I must abide by the following policies which assist in maintaining the patient’s right to privacy and confidentiality in matters related to his/her personal life, medical care and patient care services.

I will not:

- obtain information which I do not need in order to render care to that patient or otherwise meet the requirements of my specific educational program.

- communicate information to any person who does not require it for the same purpose (see preceding statement).

- assist others in obtaining confidential information.

- discuss the patient’s affairs in public areas such as the hallways, elevators, dining room, or off the clinic or externship site premises

I understand that:

- these policies which include, but are not limited to the specific examples, apply to all patients, all students and all instructors; that any action which violates the spirit of the patient confidentiality policy will be dealt with in the same manner.

- breaches of confidentiality are matters of serious consequence that may harm patient care, slander patient or his family, or lead patients, physicians, or others not to choose Miami University for services they need.

- that violation of any of these policies may result in dismissal from the Miami University Speech-Language-Hearing Program.

I hereby acknowledge that I have received a copy of the “NOTICE OF PRIVACY PRACTICES” and have read, understand, and agree to the terms and conditions in compliance with HIPAA regulations.

_________________________________  ____________________
Student Clinician                             Date

_________________________________  ____________________
Faculty                                      Date
APPENDIX E

Child Permission Text

During the next twenty minutes I am going to show you pictures, read sentences to you, and ask you to answer some questions. Please answer as best as you can. There is no such thing as a wrong answer. I want to learn about how you see and hear words and sounds. If at any time you want to stop and take a break or not finish the questions, you can do that. You will not be in trouble. Do you have any questions?
APPENDIX F

Break Period

I’m getting tired! Let’s take a break. Stand up. Reach up high and touch your toes. Again! And one more time! Ok, I feel much better. Let’s keep going! This next part is fun because we get to look at pictures.