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The Role of Phonemic Awareness in the Development of Emergent Literacy

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RUNNING HEAD: PHONEMIC AWARENESS

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CHAPTER 1

INTRODUCTION AND PURPOSE STATEMENT

As society in the United States is transformed from an economic structure based on industry to one based on information, reading becomes an increasingly critical skill for everyone. Unfortunately, illiteracy appears to be a growing problem in this country. According to Richek, Caldwell, Jennings, and Lerner (1996), approximately 35 million adults are classified as semiliterate, having literacy skills below the eighth-grade level. Another 23 million are classified as functionally illiterate, having skills below the fourth-grade level. Reading difficulties have been found to be associated with higher rates of unemployment, poverty, and school attrition (Richek et al., 1996). Richek et al. estimate that 60% of prison inmates, 75% of the unemployed, and 85% of juveniles who appear in court can be considered as either semiliterate or functionally illiterate. Clearly the costs of reading difficulties may be quite high for both individuals and society at large.

A variety of factors influence children's achievement in reading. Some of these factors, such as children's gender, socioeconomic status (SES), and parental educational level, cannot be controlled by schools. However, other

factors such as time spent reading, instructional practices, curricula, and learning materials are under the direct control of schools and can also affect children's reading abilities. These factors influence the particular reading skills which children develop. Phonemic awareness, the awareness that words are made up of sounds (Snider, 1995), is argued by many as one of the critical skills which children must develop in order to become proficient readers.

Significance of the Problem

Based on data collected in the 1994 National Assessment of Educational Progress (NAEP) Reading Assessment, more and more children are failing to achieve reading proficiency at grade level. The NAEP is a report published based on the results of academic information gathered nationwide. This particular report focused on reading achievement among randomly sampled students in grades 4, 8, and 12.

NAEP defined proficiency as having a "solid academic performance and demonstrated competence over challenging subject matter" (p. 2). Since the last assessment in 1992, reading proficiency for twelfth-grade students declined significantly, and this decline was accounted for by declines among those students who performed more poorly. Moreover, only 30% of fourth graders, 30% of eighth graders and 36% of twelfth graders were judged proficient in

reading. Thus, 63-70% of the students sampled were not considered to be proficient readers at their grade level.

Data were also analyzed by gender and ethnic group. For all grades, males had lower levels of reading proficiency than females. Fourth-grade Hispanic students' reading proficiency declined, as did White, Black and Hispanic adolescents' reading proficiency at grade twelve. Among the twelfth graders, proficiency declined for all parental education levels. Not surprisingly, for students in all three grades, proficiency was lower for children whose parents had less education. Children in public schools had lower reading scores than children in nonpublic schools.

The relationship between various factors associated with home and school environments and children's reading proficiency was also investigated. Children who had a variety of literacy materials at home were found to have higher levels of reading proficiency. Students who read for fun also had higher reading proficiency levels than students who did not. In addition, twelfth graders in the 1994 sample reported reading for fun less often than the twelfth graders in the 1992 sample. Students who reported watching less than four hours of television a day had higher reading proficiency levels than did students who watched more than four hours of television a day. Students who reported

discussing their studies at home and students who reported being asked by teachers to explain or support their reading at least once a week had higher reading proficiency than students who did not experience these home or school practices. Moreover, both of these activities were reported as occurring less often in 1994 than in 1992.

There are several possible explanations for these declines. Dual career families and single-parent families may not have as much time to discuss school activities with their children. Some children come home from school and are alone for several hours. This time may be spent watching more television and doing less reading. In addition, increased curriculum demands on teachers may lead to less discussion time in the classroom.

Based on the NAEP report and the findings of Richek et al., many children may be facing less promising futures because of their declines in reading proficiency. Not only are students becoming less proficient in reading, they are also engaging less in activities that promote reading proficiency.

Reading difficulties continue to pose problems for many students. Therefore, it would be beneficial to be able to identify students at risk for developing reading problems.

In order to make this prediction, prerequisites of reading ability must be identified.

Phonemic awareness has been found to be a good predictor of reading ability in children (Felton, 1992; Hurford, Schauf, Bunce, Blaich, & Moore, 1994). Through the use of programs which center around the development of phonemic awareness, it is possible to enhance reading proficiency for children who experience difficulty with reading. The purpose of this paper is to investigate the literature surrounding the relationship between phonemic awareness and emergent literacy.. Attention will be given to the subskills of phonemic awareness and ways of measuring these subskills. Attention will also be given to the effectiveness of training phonemic awareness skills to children at risk for developing reading problems. In addition, recommendations will be made for future research in the area of phonemic awareness and emergent literacy.

Defining Reading

For the purpose of this paper, reading is defined as a complex process utilizing a variety of skills and knowledge to make sense of printed material (Adams, 1990; Mitchell, 1982). Research regarding phonemic awareness has led to an understanding that phonemic awareness is a necessary but not sufficient prerequisite for reading. Phonemic awareness

research is heavily skills based, whereas other models of reading focus on more cognitive processes such as comprehension. Adams (1990) focused on the importance of developing word recognition skills in emergent readers. According to Adams, the ability to quickly and effortlessly recognize and identify words is a prerequisite to reading. Moreover, Adams stated that, "the knowledge and activities involved in visually recognizing individual printed words are useless in and of themselves. They are valuable and, in a strong sense, possible only as they are guided and received by complementary knowledge and activities of language comprehension. On the other hand, unless the processes involved in individual word recognition operate properly, nothing else in the system can either" (p.1).

It is also necessary to acknowledge that many reading experts hold a different definition of reading and make strong criticisms of skill based definitions. Goodman (1996) notes that the understanding that comes from written text does not come from the paper; instead it depends on the sense the reader brings to the text. Goodman (1996) proposes that reading is an active and constructive process in which the reader and the text transact. This transaction leads to an understanding of the meaning of the printed material.

One main criticism that Goodman (1996) posits against Adams' (1990) definition is that it is reductionistic. That is, for Adams, reading is reduced down to simply recognizing words on a page. Strong emphasis is given to bits and pieces of language and no focus is given to comprehension of real texts. In many of the studies of phonemic awareness children are asked to read a list of words in isolation. This leads to another criticism: simply recognizing words and letters in isolation is not the same thing as making sense of meaningful text. Goodman (1996) has found in his research that children can read words in stories that they cannot read on a list.

Definition of Terms

Throughout this paper several technical terms will be used repeatedly. The first group of terms is associated with specific aspects of phonemic awareness. Phonemic awareness is the conscious awareness that words are made up of sounds (Snider, 1995). Phonemes are the smallest units of sound in a language (Heilman, 1993). For example, the letter b is associated with the phoneme /b/, /d/ is the phoneme for the letter d, and /p/ is the phoneme for p (deVilliers & deVilliers, 1979).

Phonological coding in working memory refers to a child's ability to use verbal short-term memory (Felton &

Pepper, 1995). Working memory allows a child to be able to recall digits, word strings, and sentences. An example of phonological coding in working memory would be to repeat a sentence read out of a book. Phonological coding in lexical access is the ability to rapidly name letters and pictures, such as quickly repeating the alphabet, naming colors, and identifying pictures (Felton & Pepper, 1995).

The second group of terms refers to specific activities and abilities associated with reading. For the purpose of this paper the following definitions will be used. A task is an activity which a child is asked to participate in for the purposes of testing or educating. A task might be reciting the alphabet or completing a math worksheet. A skill is very similar to a task. A skill is the process used to perform a task. Reading is a process utilizing several skills. Thus, a task is what the child is asked to do, and his/her skill is what allows him/her to do the task. Ability is a child's level of proficiency in a skill.

The final group of terms is related to defining levels of reading ability which are often broken down into more specific categories. A normal reader is a child who can read successfully at his/her grade level (Hurford et al., 1994). A child who is labeled reading disabled is said to have at least average intelligence, but significantly lower

scores than expected in reading. In other words, there is a discrepancy between the child's intelligence test score and his/her reading test score. A "garden variety poor reader" is a child who reads below grade level and has lower than average intelligence as measured by a standardized intelligence test (Hurford et al., 1994, p. 371). In this case, most of the child's scores in academic areas are below grade level.

A child who is labeled at-risk is considered to have factors in his or her life that predispose him or her to certain problems (Garbarino, Dubrow, Kostelny, & Pardo, 1992). For example, children who come from poor families are considered at-risk for learning problems. Risk factors include parental marital status, socioeconomic status, parental educational level, and community violence. Garbarino et al. (1992) discuss the importance of the number of risk factors any particular child experiences. Exposure to one or two factors may have little influence on a child. However, exposure to three or more factors can greatly influence a child's ability to learn and be successful in school (Garbarino et al., 1992).

CHAPTER 2

PHONEMIC AWARENESS

Definitions and Components of Phonemic Awareness

Phonology is "the branch of linguistics dealing with the relations among speech sounds" (Trask, 1996, p. 275). Phonology also refers to "the system of sounds an oral language uses" (Goodman, 1993, p. 5). In other words, phonology refers to the speech sounds used in an oral language and the study of those speech sounds.

When studying phonology, the speech sounds can be broken down into smaller units of speech. Phonemes are the smallest fundamental units of sound in an oral language (Heilman, 1993; Trask, 1996). Phonemes have also been defined as "the significant [auditory] symbols perceived by speakers of a particular oral language" (Goodman, 1993, p. 6). For example, /b/ is the phoneme for the letter b, /p/ is the phoneme for the letter p, and /t/ is the phoneme for the letter t.

A morpheme is "the smallest meaningful unit of language" (Heilman, 1993, p. 3). Morphemes can either be free or bound. Free morphemes function independently (cat, man, house, want). Bound morphemes include prefixes, suffixes, and inflectional endings that combine with other morphemes (un, ed, es, 's) (Heilman, 1993).

Onsets and rimes are another way of breaking down words. Onsets are the opening unit of a word, and rimes are the end unit of a word (Goswami & Bryant, 1990). Onsets and rimes are smaller than syllables, but larger than phonemes. For example, cat is a syllable, the onset is /c/, and the rime is /at/, and the phonemes are /c/-/a/-/t/.

A grapheme is a "written or printed letter-symbol used to represent a speech sound or phoneme" (Heilman, 1993, p. 3). The grapheme for the phoneme /b/ would be b. Orthography is "the system of spellings and punctuation of written language" (Goodman, 1993, p. 8). Together these systems combine and form a complex relationship between written and spoken language.

Phonemic awareness has been operationally defined in a variety of ways, but is most frequently defined as "the conscious awareness that words are made up of phonemes or sounds" (Snider, 1995, p. 444) or "the ability to perceive spoken words as a sequence of sounds" (Spector, 1992, p. 353). Phonemic awareness is not the same thing as phonics (Griffith & Olson, 1992). Phonemic awareness is a conscious understanding of the structure of spoken language. Regardless of the definition used, there is no question that phonemic awareness has a strong relationship to reading as a predictor of possible reading failure (Felton, 1992;

Griffith, Klesius, & Kromrey, 1992; Hurford, et al., 1994; Lundberg, Olofsson, & Wall, 1980; Mann, 1991; & Stahl & Murray, 1994).

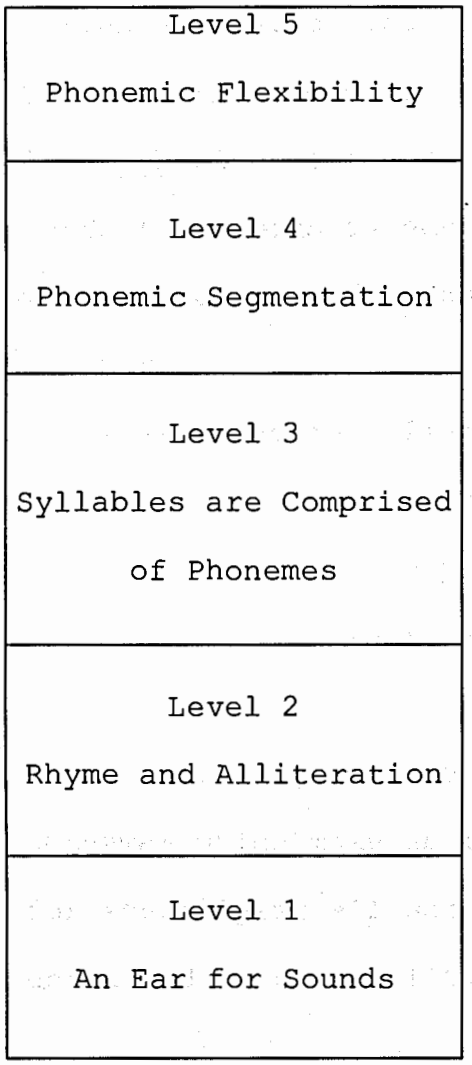
The importance of phonemic awareness skills arises from the fact that English is an alphabetic language as opposed to a logographic language such as Chinese (Snider, 1995; Spector, 1992; & Stahl & Murray, 1994). Chinese is logographic because it uses symbols to represent entire words. Chinese differs from alphabetic languages because alphabetic languages use sounds represented by letters (instead of symbols) to represent words. The alphabetic principle states that each letter or letter combination stands for a sound or sounds and when combined these sounds represent words.

Some children approach written English as a logographic language, memorizing words as visual patterns and never recognizing the combination of sounds involved in each word (Snider, 1995). Children with this approach to written English, similar to children who speak Chinese, may acquire a few thousand sight vocabulary words in the early years and then slowly learn fewer and fewer words as their memory "overloads" (Snider, 1995, p.445). On the other hand, children who can map sounds to letters will increase their reading vocabulary to the number of words they can use

orally (Snider, 1995). In other words they will be able to read words that they can speak. Although acquisition of the alphabetic principle is necessary for the development of reading in English, it alone is not sufficient to enable a child to become a skilled reader. The skills associated with phonemic awareness may also be necessary for the acquisition of reading.

Phonemic awareness can be broken down into three critical skills: phonological awareness, phonological coding in working memory, and phonological coding in lexical access (Felton & Pepper, 1995) (see Figure 1). Each of these skills are made up of separate tasks at different levels of complexity.

Figure 1. Levels of Phonological Awareness



Phonological Awareness

Phonological awareness is comprised of several different skills (Stahl & Murray, 1994). The ability to identify rhymes is one such skill. (Do cat and hat rhyme?) Another skill is the ability to match sounds to words. (Does dog start with a /d/?) Phonological awareness also

consists of isolating a single sound from a word. (What is the last sound in cat?) Blending, or the ability to form a word out of separate sounds is also important. (What does /c/-/a/-/t/ say?) Children also need to be able to delete sounds from words (Say fish without the /f/). Although the ability to delete sounds from words is not directly linked to reading, it allows children to understand and demonstrate how words are put together.

These skills can be arranged into five different levels of difficulty. Some researchers suggest that children start at the lowest, least difficult level and progress upward as they gain new skills. According to Adams (1990), the first and most primitive level is characterized as "having an ear for sounds in words" (p. 80). Children can partition words into the different phonemes which make up the word. This skill is necessary for identifying all words; however, this level can be best recognized by the ability to remember familiar rhymes.

The second level is the ability to distinguish patterns of rhyme and alliteration in words, where a sound is repeated throughout a sentence or phrase. This skill becomes evident in the oddity task, in which children are presented with three words and are asked to identify the word which does not have the same beginning, middle, or end

sound. For example, in a three word series, "dog, pie, day," a child is asked to identify the word which has a different beginning sound. In the example of "stay, play, flag," the child is asked to identify the word which has a different ending sound.

The third level consists of a familiarity with the concept that syllables are divided into phonemes. These skills can be identified through the blending task in which the child is asked to blend several phonemes together to make a word. For example, when /c/-/a/-/t/ are blended together they make the word cat. It can also be recognized by the syllable-splitting task or word analysis, the inverse of blending. In this task the child is asked to break a syllable up into separate phonemes. For example, what are the phonemes in cat? (/c/-/a/-/t/).

The fourth level requires the child to segment phonemes fully; that is, break words down into all the individual phonemes. This skill is measured through the tapping test, in which the child is asked to tap or clap each phoneme in a word. In the example of cat, the child would tap three times representing the /c/, /a/, and /t/.

At the most difficult level the child is able to add, delete, and move phonemes around to make words. For

example, the child would be asked what word results when /g/ is added to the end of the word do (dog).

Phonological Coding in Working Memory

Phonological coding in working memory involves the use of verbal short-term memory to recall digits, word strings, and sentences (Catts, 1991). Verbal short-term memory allows the reader to recall what has just been read, such as a sentence or paragraph. Children who are poor readers are less likely than good readers to retain information that can be verbally coded (Fowler, 1991). In an example taken from the book, Winnie the Pooh and Tigger too, a child with good working memory would have little difficulty remembering the following paragraph, while a child with poor working memory would have great difficulty remembering the paragraph. "One morning Winnie-the-Pooh was on his way to visit his friend Piglet. Although Pooh's head was stuffed with fluff, he was a cheerful fellow. As he walked along through the woods, he was humming a song to himself" (p. 1).

Phonological Coding in Lexical Access

Phonological coding in lexical (vocabulary) access involves the rapid naming of letters and pictures (Felton & Pepper, 1995). Research has found that the ability to rapidly name letters is a good predictor of reading ability (Felton, 1992). Coding in working memory is frequently

measured using a Rapid Automatized Naming (RAN) test, which requires the child to name objects, letters, and colors as quickly as possible.

Phonemic awareness has been studied in relationship to reading (Hurford et al., 1994; Felton, 1992; & Lundberg, Olofsson, & Wall, 1980), spelling (Griffith, 1991; Rohl & Tunmer, 1988; & Perin, 1983), training in phonemic awareness (Castle, Riach, & Nicholson, 1994; McGuinness, McGuinness, & Donohue, 1995; & Weiner, 1994), and the reciprocal relationship between phonemic awareness and reading (Bentin, 1993; Perfetti, Beck, Bell, & Hughes, 1987; & Wagner, Torgesen, & Rashotte, 1994). In addition to being studied in relation to a variety of content areas, phonemic awareness has also been studied using a variety of methods.

Basic Techniques for Measuring Phonemic Awareness

Several tests have been used to measure phonemic awareness comprising phonological awareness, phonological coding in working memory, and lexical access. Phonological awareness is often measured with a variety of tests. One such test is the tapping test. This task requires the subject to tap or clap the number of phonemes in a spoken

word. Internal consistency reliability of this test was found to be .83 and predictive validity was found to be .66 (Yopp, 1988). Another test frequently used is the oddity task. In this task the subject is required to identify the odd word in a set of three words, the word that either begins, ends, or has a different middle sound (dog, pie, and day). No reliability or validity coefficients were given for this task. Another test is some form of a rhyming task. The subject is required to list as many words as possible that rhyme with the word presented by the examiner. Internal consistency reliability of rhyming tests was found to be .76 and predictive validity was found to be .47 (Yopp 1988). Blending tasks are also frequently used. These tasks require the subject to blend together several phonemes. For example, /c/-/a/-/t/ makes cat. A .96 internal consistency reliability coefficient was found for blending tasks and a .63 predictive validity coefficient was found (Yopp, 1988). The inverse of the blending task is the syllable-splitting task or the segmentation task. These tasks require the subject to split or segment words into phonemes. For example, the word cat is comprised of three phonemes, /c/-/a/-/t/. Internal consistency reliabilities were .88-.95 for this task and predicative validity was from .67-.71 (Yopp, 1988). Deletion tasks require the subject to

say the resulting word when a phoneme is deleted. For example, at remains when the /c/ is removed from cat. Yopp (1988) found the internal consistency of deletion tasks to be .78-.92 and predictive validity to be .55-.67.

Phonological coding in working memory is often measured with a verbal memory test. These tasks require the subject to repeat back a string of words presented by the examiner. The strings usually consist of four to six rhyming and nonrhyming words.

Phonological coding in lexical access is measured with the Rapid Automatized Naming test. This task requires the subject to name as quickly as possible letters, numbers, objects, and colors presented on a card to the subject.

Basic Design and Analysis Procedures for the Study of the Relationship between Phonemic Awareness and Emergent Literacy

Most of the studies investigating the relationship between phonemic awareness and emergent literacy use longitudinal studies and correlational data analysis. Longitudinal studies allow the same children to be followed over the course of several years. This longer amount of time is conducive to investigating the predictive abilities of pre-reading skills. Through correlational data analysis the magnitude of the relationship between phonemic awareness

and emergent literacy can be deciphered. However, longitudinal studies and correlational data do pose some limitations.

Similar to many longitudinal studies, many of the studies relating to phonemic awareness have high attrition rates. While attrition can not be avoided, it does pose problems in the research. The sample may no longer be representative, following the removal of some subjects. If this is the case, the results of the studies may not be generalizable outside of that sample. Another problem surrounding this research is the use of homogeneous samples. In many of the studies the subjects are from white middle-class families, or are minority children from lower-class families. The homogeneous make-up of the sample may make the results less generalizable.

Other criticisms relate to the type of tests used to measure reading. In the majority of the studies, reading ability is measured by some measure of word recognition. Critics argue that simple word recognition is not reading (Goodman). Goodman believes that reading should be measured through comprehension and understanding the printed text, since reading is making sense of text (Goodman, 1996).

Other critics argue that in these studies factors affecting reading are not controlled for such as,

kindergarten reading ability and verbal intelligence (Badian, 1994). Badian believes that kindergarten reading ability, however limited, directly impacts phonemic awareness skills and later reading. If reading ability is not controlled for, it may be the factor affecting later reading ability, instead of phonemic awareness skills.

Research design can also affect the results of a study. Many researchers have performed correlational analyses. While this type of data analysis can establish relationships between variables, it cannot establish causal relationships. Although phonemic awareness and reading are correlated, it is quite possible that a third, unknown variable is causing the relationship. For example, it is possible that the connecting variable is general intelligence. Intelligence is one of the variables that schools are unable to influence greatly. Many studies fail to control for such factors as general intelligence and socioeconomic level which may confound the results of these studies.

A final criticism is that researchers have a difficult time defining phonemic awareness. Some researchers refer to it as phonemic awareness (Lundberg, Oloffson, & Wall, 1980), while others refer to phonological awareness (Stahl & Murray, 1994) and others talk of metalinguistic abilities (Tunmer, Herriman, & Nesdale, 1988). Although researchers

are calling phonemic awareness by a different name, they are all measuring it in the same general ways. Most studies use a variety of the same tests (oddity, tapping, blending, and segmenting). Thus, although the name may be different, researchers seem to be measuring early readers' knowledge of sounds to words and word patterns.

CHAPTER 3

Literature Review

Phonemic Awareness and Reading Achievement in the Early Grades

Research throughout the past two decades has shown the effectiveness of using phonemic awareness skills to identify students who are more likely to experience difficulty in reading. In a classic study, Lundberg, Olofsson, and Wall (1980) investigated the ability of kindergartners' phonemic awareness skills to predict later reading ability.

One hundred and thirty-three Swedish kindergarten children were followed through the end of second grade. The children were given a variety of tasks to measure phonemic awareness in kindergarten. In first and second grade they were given measures of reading and spelling ability. The first two kindergarten tasks required half the children to synthesize syllables and half to synthesize phonemes. Each syllable or phoneme was presented to the child in association with a peg on a pegboard. The pegs were used to help alleviate some of the memory load required for the tasks. In the example of cat, the examiner would place a peg in the pegboard as each phoneme /c/, /a/, and /t/ was pronounced or place one peg on the board for the syllable cat. The child would then blend the syllables or phonemes

together to pronounce the desired word. The next two tasks were similar to the first except this time the pegs were removed and the child was told to blend syllables or phonemes (depending on the group) presented on a tape recorder.

Following these tasks the child was asked to segment words into syllables and phonemes. Next, the child was asked to indicate if a given word contained a target sound indicated to the child (does "dog" have a /g/ sound?). In another task the child was asked to pronounce a word backwards. All words chosen for this task were meaningful words when pronounced backwards, for example, "on" and "no." The final kindergarten linguistic task was a rhyme task where the child was asked to give as many rhyming words as possible for a target word.

The children were also given nonlinguistic tasks to control for other factors such as memory and attention. One task required the child to identify a geometric shape in a lively picture and another task required the child to pay attention to two independent meaningful parts of an object. For example, one picture was of fruit, but as a whole the fruit made a picture of a man. The children were also given a preschool reading test. They were asked to read words and sentences typed on a page.

In first grade the children were given a silent reading test (OS 400). Test re-test reliability was indicated as .89. Words were presented in a column with four pictures beside each word. The child was asked to identify which picture represented the word. The children were also given a spelling test consisting of thirty words. The classroom teachers rated each child using a three point scale on reading ability, spelling and writing ability, language comprehension and production. No information was given indicating the type or format of rating used or the reliability and validity of these measures.

In second grade the children were given the same version of the silent reading test and a more difficult version of the spelling test. These tests were used to measure reading and spelling ability in grade two.

Results of the study showed the most powerful predictor of reading ability to be the ability to analyze and reverse phonemes in kindergarten. The ability to analyze and reverse phonemes was also found to be the greatest predictor of spelling and writing ability as rated by the teacher. This study helped to build a foundation for the use of phonemic awareness measures in predicting reading and spelling ability.

Juel, Griffith, and Gough (1986) conducted a study testing the simple model of reading acquisition. The simple model states that reading is comprised of decoding and listening comprehension, and writing is comprised of spelling and ideation. In this model, spelling and decoding share a set of spelling-sound correspondence rules referred to as orthographic cipher. Knowledge of this orthographic cipher comes through phonemic awareness and exposure to print.

Subjects of the study were children from a large lower middle class school in Texas. One hundred twenty-nine children began the study in first grade; however, only 80 were available in second grade.

Each subject's general intelligence was measured using the block design and vocabulary subtests of the Wechsler Intelligence Scale for Children-Revised (WISC-R). Oral language and listening comprehension were measured using the Metropolitan Readiness Test and the listening comprehension subtest of the IOWA test. The IOWA test has been found to have .98 test re-test reliability.

Phonemic awareness was measured through a phonemic segmentation test, a blending test, a test for deletion of first and last phonemes, and tests for substitution of first and last phonemes. Exposure to print was measured by each

subject's place in their basal text. Many children in the study reported never reading outside of school. Although place in basal text was not a perfect measure of print exposure, it was judged to be fairly accurate. Cipher knowledge was measured by the Bryant Test of Basic Decoding Skills, which consists of reading 50 nonsense words.

Lexical knowledge was measured with the spelling subtest of the IOWA test. The spelling and reading subtests of the Wide Range Achievement Test were used to measure spelling and word recognition. Reading comprehension was measured with the reading comprehension subtest of the IOWA and a writing sample was taken from each child. The subjects were also asked to tell an oral story about a picture.

Results of the study showed that listening comprehension and phonemic awareness have a strong relationship to spelling, word recognition, writing, and reading comprehension. Phonemic awareness was found to contribute to cipher knowledge, whereas children with low phonemic awareness scores were unable to decode any of the nonsense words. This implies that children will not be able to acquire spelling-sound correspondence knowledge until a certain basic level of phonemic awareness is present.

Juel (1988) conducted a similar study. The study began with 129 first graders and 54 remained at the end of fourth grade. Reading instruction was from basal series and included sight words, phonics, and contextual approaches to word identification.

Subjects were assessed with a phonemic awareness test measuring segmentation, blending, deletion of first and last phonemes, and substitution of first and last phonemes. Decoding and word recognition were also measured. Reading and spelling were measured with the Wide Range Achievement Test. Listening comprehension was measured with the Metropolitan Readiness Test and the Iowa Test of Basic Skills (ITBS). Reading comprehension was also measured with the ITBS. The subjects' places in their basal series was measured as well as home reading behavior and attitude toward reading. The block design and vocabulary subtest of the WISC-R were used to measure general intelligence. The children were also asked to write a story about a friendly ghost and then later asked to tell a story orally.

Results of the study found that 21 of the 24 poor readers in first grade were still poor readers in fourth grade. The probability of remaining a poor reader was .88. Similar results were found for good readers in first grade, they remained good readers in fourth grade. The children

who were poor readers in first grade had low phonemic awareness, poor spelling-sound knowledge, poor listening comprehension skills, and poor decoding skills. Several factors were identified that seemed to prohibit improvements among poor readers. One such factor was their poor decoding skills. Lack of decoding could have contributed to frustration which resulted in less reading, which, in turn led to less exposure to print. Good readers were exposed to almost double the number of words as poor readers. Poor readers read less at home and did less reading voluntarily. These results demonstrate the possible importance of identifying children with low phonemic awareness early on and providing interventions to remediate the problems.

Bryant, Bradley, MacLean, and Crossland (1989) investigated the relationship between children's knowledge of nursery rhymes and reading. Subjects of the study were 64 children from a wide range of backgrounds. The average age of the children at the beginning of the study was 3.4 and the average age at the end of the study was 6.3. Children were measured on knowledge of nursery rhymes, phonological sensitivity, reading, spelling, general intelligence, and vocabulary. The measure of nursery rhymes consisted of five popular rhymes. The child was asked to say each specific nursery rhyme. This task was created by

the authors and no reliability and validity coefficients were given.

The phonological sensitivity measures consisted of a measure of rhyme detection (peg, leg), a rhyme oddity task, a phoneme oddity test, an opening phoneme test, an end phoneme test, and an object naming test. For the rhyme oddity test the child was shown three pictures and asked which one did not rhyme with the other two. These words shared a cluster coda that rhymed (fish, dish, and book). The phoneme oddity task was similar except the child was required to identify the words that shared a single phoneme (dog, day, and pen). The opening phoneme test asked the child to say four words and identify which word sounded different based on the beginning phoneme. The end phoneme test was the same except the end sound was identified. The object naming test required the child to name as quickly as possible ten pictures presented on a board. Reading and spelling were measured with the SPAR Reading and Spelling test. The British Picture Vocabulary Scale was used to measure general intelligence. This test is the British version of the Peabody Picture Vocabulary Test.

Results of the study showed a .59 correlation between nursery rhyme knowledge and reading ability three years later. Through the use of a fixed-order multiple

regression, it was determined that when intelligence, social background, and phonological sensitivity were controlled for the relationship was still evident. The study also found that nursery rhyme knowledge predicted a child's phonological sensitivity. The results supported the use of early literacy experiences to enhance children's reading.

Bryant, MacLean, Bradley, and Crossland (1990) conducted a study investigating the relationship of phoneme detection and rhyme and alliteration detection to reading ability. This study also investigated three models explaining the link between phonological awareness and reading. Model 1 states that rhyme and alliteration have no connection to reading and that reading and spelling ability lead to phoneme detection. Model 2 states that rhyme and alliteration lead to phoneme detection, which leads to reading and spelling. Model 3 states that rhyme and alliteration and phoneme detection contribute to reading and spelling, but do not contribute to each other.

Subjects were 64 children who began the study at an average age of 4 years 7 months and were followed until the average age of 6 years 7 months. The subjects came from a wide variety of backgrounds. General intelligence scores of the sample were obtained using the British Picture Vocabulary Test (a version of the Peabody Picture Vocabulary

test), the Wechsler Preschool and Primary Scale of Intelligence, and the Wechsler Intelligence Scale for Children-Revised. Overall, the children in this sample were found to have relatively high general intelligence scores.

The ability to detect rhyme and alliteration was measured using the rhyme-oddity task. Phoneme detection was measured through the use of two tests, the phoneme deletion test and the phoneme tapping test.

In the last session, when the subjects were 6 years 7 months old they were tested in reading, spelling, and arithmetic ability. The France Primary Reading Test was given as a measure of reading comprehension. The Schonell Graded Word Reading Test involves reading single words from a list. The Schonell Spelling Test was given to measure spelling ability. Finally, the WISC-R arithmetic subtest was given as a measure of math ability.

Results of the study found a strong relationship between rhyme and alliteration and phoneme detection, disproving the first model. It was also found that rhyme and alliteration have a strong relationship to reading and spelling. However, rhyme and alliteration were not related to the arithmetic test. All the measures of phoneme detection were also related to the reading and spelling measures. These measures were found to account for 65%-71%

of the variance in reading and spelling ability. Support was also found for both models 2 and 3 in the relation among reading, spelling, phoneme detection and rhyme and alliteration.

Mann (1991) followed children from kindergarten through first grade, testing the ability of phonemic awareness measures to predict reading ability. One hundred and six children began the study in kindergarten; however, only 70 were available in the first grade. The vocabulary and block design subtests of the Wechsler Preschool and Primary Scale of Intelligence were given in kindergarten to measure the children's general intelligence. In kindergarten and first grade the students were given the Word Identification and Word Attack subtests of the Woodcock Johnson Reading Mastery Test to measure reading ability. Both years the students were given five phonological tests and four nonlinguistic control tests. The nonlinguistic controls were considered comparable because they measured attention, logic and motor skills, like the phonological tests, without the need for linguistic skills.

The tests of phonological awareness were a syllable counting task, an invented spelling task, a Rapid Automatized Naming task, a task requiring the identification of words when distracted by noise, and a task requiring

repetition of words orally presented. The syllable awareness task was measured through a language game where the children were required to deduce the rules and count the number of syllables in a spoken word. Used previously, this task has proven to be a good predictor of reading ability (Mann & Liberman, 1984). The task measuring invented spelling was designed to measure the children's ability to create a spelling for familiar words. Another test of phonological awareness was the rapid naming of letters. Similar to the task used in other studies, for this task children were asked to name 25 random letters as quickly as possible. Children were also asked to identify words when distracted by noise. The children were told they would be hearing some words recorded in noise. The children listened to a tape of words of a male reading a list of words. Each child was asked to repeat the words immediately. The final test of phonological awareness was the test which required children to repeat six sequences of four nonrelated words.

The nonlinguistic control tests were a test of angle awareness, the Goodenough Draw-A-Man test, a test of environmental sound perception in noise, and a test of visual-spatial sequences. The angle awareness test is similar to a "hidden figures" test in which the child is required to identify angels imbedded into black and white

pictures (Mann, 1986). The Goodenough Draw-A-Man test required the child to draw a human figure which was compared to a standard protocol. The Draw-A-Man test is considered to be a measure of psychological development and intelligence of children (Harris, 1963). The test of environmental sound perception in noise was also administered. This test was similar to the phonological test used. The final test was the visual-spatial test which used the Coris blocks and the child identified different patterns. For this test, a group of blocks were placed between the child and examiner. The examiner would tap the different colored blocks in random order and the child was asked to repeat the tapping order (Mann & Liberman, 1984).

Using cross-lag correlations to analyze the data, Mann (1991) found phonological skills to be predictors of reading ability. A cross-lag correlation compares the strength of the correlations between the kindergarten to first grade and first grade to kindergarten scores. In other words, do the correlations predict more strongly forward (kindergarten to first grade) or backwards (first grade to kindergarten)? Mann found the forward correlations to be stronger than the backward correlations, indicating that the phonological skills precede reading ability. The phonological measures were also more consistent and effective predictors of

reading problems as measured by the Woodcock Reading Mastery Test, than the nonlinguistic comparable measures (such as the Goodenough Draw-a-Man test). Using multiple regressions, Mann found that 60% of the variance in first grade reading test scores was accounted for by the children's performance on the phonological tasks in kindergarten. This study strongly supports the premise that phonological skills do precede and predict children's reading ability.

Felton (1992) conducted a study measuring phonemic awareness skills in kindergarten children as predictors of later reading failure. Subjects of the study were 221 children in a North Carolina school system. In the Spring of their kindergarten and third-grade years, the students were assessed on measures of phonological awareness, phonological coding in lexical access, phonological coding in working memory, alphabet recitation, and finger localization. The kindergarten classroom teacher was also asked to rate the children on their ability to master basic reading skills. The rating was based on the teacher's perception of the students' predicted reading ability. In the third-grade year the students were also assessed on a measure of reading.

Phonological awareness was measured using several tasks. The Initial Consonant Not Same task presented the child with four spoken words and the child was asked to identify the word that began with a different sound. (For example, fox, frog, farm, and pig). The Final Consonant Different task was performed similarly, except the child was asked to identify the word which ended with a different sound. (Example dog, frog, pig, cat). In the Rhyme task, the child was asked to name as many words he or she could that rhymed with a word presented by the examiner. The Lindamood Auditory Conceptualization test required the children to manipulate blocks of different colors to represent their understanding of speech sound patterns. For example, if /c/ was represented by a red block, and /a/ was represented by a blue block, and /t/ was represented by a green block, the child would place a red, blue and then green block to represent cat. The syllable counting test required the child to tap out the number of syllables in a word presented by the examiner. The words were either one, two, or three syllable words.

Phonological coding in lexical access was measured by the Rapid Automatized Naming (RAN) test. For this task the children were presented a chart containing an assortment of colors, objects, letters, and numbers. The speed which the

children completed the task as well as the number of errors made was recorded. Faster speed and fewer errors represent a greater facility for phonological coding in lexical access.

Phonological coding in working memory was measured through the Word String Memory test. This task required the children to repeat back a string of four words presented by the examiner. The examiner recorded the number of errors made, where fewer errors indicated greater coding in working memory.

Additional measures were the Alphabet Recitation test and the Finger Localization test. During the Alphabet Recitation test the child said the alphabet while the examiner recorded the number of letters named correctly regardless of order. For the Finger Localization test, measuring sensorimotor skills, the child's hands were covered and the examiner touched one of the child's fingers. Then the child identified on a picture which finger was touched.

Reading performance was measured with the California Achievement Test vocabulary and comprehension subtests. In kindergarten, the children were given the Otis-Lennon Mental Abilities Test, an individually administered intelligence test, to estimate their general intelligence.

Results showed significant correlations between children's scores on the tests given in kindergarten and third grade reading ability for the Initial Consonant, Final Consonant, Rhyme, Lindamood, all the RAN measures, and the Alphabet Recitation tests. After controlling for general intelligence the strongest correlations were found between RAN-letters and the Initial Consonant Not Same task. After further analysis only three variables were found to be predictive of third grade reading ability, as measured by the California Achievement Test: general intelligence, the speed of alphabet recitation, and the ability to discriminate words based on the beginning sound.

Griffith, Klesius, & Kromrey (1992) studied the effects of Whole Language versus Traditional instruction and phonemic awareness ability on children's literacy development. Subjects of the study were first grade children from a rural district in Florida. The children were either in a whole language or traditional classroom environment. The children were further divided into groups of either high or low phonemic awareness skills based on their performance on the GKR Phonemic Awareness Test. This test measures phonemic segmentation, blending, deletion of the first phoneme, deletion of the last phoneme,

substitution of the first phoneme and substitution of the last phoneme.

Three tests were used to measure spelling performance: a spelling features test, spelling in context, and the Test of Written Spelling. The spelling features test was used to analyze letter-sound correspondence acquired by the children. The spelling in context test, given in a pretest post test format, required the children to write a story about pictures presented to them. The Test of Written Spelling was group administered and required the children to spell both predictable and unpredictable words.

To measure decoding and sound symbol knowledge, the children were asked to read 20 nonsense words. The word recognition subtest of the Comprehensive Test of Basic Skills was also used to measure decoding ability. The comprehension subtest of the Comprehensive Test of Basic Skills was used to measure reading comprehension. Writing fluency was measured by the number of words used and the number of unique words used on the pre- and post tests of the writing samples.

Results of the study found that the children with high phonemic awareness did significantly better than the low phonemic awareness group on each of the measures. However, no difference was found based on type of instructional

environment (whole language vs. traditional) except for the ability to spell unpredictable words (whole language). This study found that level of phonemic awareness at the beginning of the first grade was what was most related to end of the year performance and not type of instruction. Moreover, children from the whole language classroom had letter-sound correspondence and decoding skills equal to that of the children in the traditional classroom.

Cornwall (1992) conducted a study to investigate the relationship between phonological awareness, naming speed, verbal memory, and reading, and spelling. Her sample consisted of 54 children with severe reading disabilities. Subjects ranged in age from 7 years 5 months to 12 years 3 months and were referred for assessment of learning disabilities.

The subjects were measured on socioeconomic status, externalizing behavior (aggression, delinquent behavior), general intelligence, reading and spelling. Measures used were the Wechsler Intelligence Scale for Children-Revised, the Wide Range Achievement Test-Revised reading and spelling subtests, the Gray Oral Reading Test-Revised, and the Word Attack subtest of the Woodcock Reading Mastery Test-Revised. The subjects were also given the Sentence Memory Test, a Rapid Automatized Naming test, and the Rosmer Auditory

Analysis Test, a test measuring phoneme deletion and blending.

Results found that background (SES, age, and externalizing disorders present), general intelligence and the phonological awareness tasks were highly related to achievement in reading and spelling. When age, socioeconomic status, externalizing problems, and intelligence were controlled for, the tests of phonological processing, rapid naming, and word list memory accounted for 36% to 67% of the variance in the various reading and spelling tests.

Hurford, Darrow, Edwards, Howerton, Mote, Schauf, and Coffey (1993) conducted a similar study. Two hundred and nine first-grade students from the same school district as another study participated in this study (Hurford, et al., 1994). The subjects were given similar measures of phonological processing, reading ability, and intellectual ability.

The study found that Word Identification, Word Attack, and the phonemic segmentation task were strongly related to reading ability. These factors accounted for 73.4% of the variance in reading. The first grade measures, phonemic segmentation, Word Attack, and Word Identification, were able to classify children with reading disabilities and

garden variety poor readers with 100% accuracy. The ability to identify children at-risk for reading disabilities may aid in the implementation of interventions to remediate phonological deficits.

Mann (1993) conducted a study measuring the relationship of phonemic awareness to reading. Subjects of the study were 79 children from White middle class homes. This study was designed so that the tests could be group administered. In kindergarten the children were given two measures of phoneme awareness, a phoneme segmentation test, and an invented spelling test. They were also given a figure copying test, and the Draw-a-Man test. The phoneme awareness tests were accompanied with pictures to help remove some of the memory load necessary for these tasks.

In first grade the subjects were given the Word Identification and Word Attack subtests of the Woodcock Reading Mastery Test, and the vocabulary and block design subtests of the Wechsler Intelligence Scale for Children-Revised. For children in one school, scores on the Word Knowledge, Word Discrimination, and Reading subtests of the Metropolitan Primary Battery were also available.

Results of the study found both test of phoneme awareness to be significantly related to reading ability. Results were significant regardless of the reading test

used. The tests of phoneme awareness accounted for 30%-40% of the variance in reading ability. This study also showed that group administration is possible and that reduction of the memory load is possible through the use of accompanying pictures.

Stahl and Murray (1994) conducted a study measuring the effects of phonological awareness on early reading ability. Subjects were 52 kindergarten children and 61 first grade children. Approximately half of the children were from a Catholic school in a small Southeastern city, while the remaining students were from the public school in the same city. The Catholic school children were fairly homogeneous, coming mostly from White middle to upper middle class families. However, the public school children came from more heterogeneous economic and racial backgrounds. Males and females were equally represented.

The children were measured on phonological awareness, written language, and memory. The tests of phonological awareness consisted of blending, isolation, segmentation, and deletion tasks. Each of these tasks were represented in one of four levels of linguistic complexity, analyzing onsets and rimes (CVC words), analyzing vowels and codas within rimes (CVC), analyzing phonemes containing cluster

onsets (CCVC) and analyzing phonemes containing cluster codas (CVCC).

The measures of written language included: alphabet knowledge, a measure of reading, and a spelling measure. In addition, children were tested for working memory. For the alphabet knowledge task the children were asked to name 54 upper and lower case letters presented on a list. An informal reading inventory was used to assess the children's reading ability. For this task the children were asked to read several passages at varying grade levels. Then the children were asked to retell the passage to the examiner. These tasks served as measures of oral reading and whether the child was reading for meaning. The children were asked to spell five words the best that they could. The words were presented to the students in a sentence and were scored based on the accuracy compared to a conventional spelling. The Digit Span subtest of the Wechsler Intelligence Scale for Children-Revised was administered to measure working memory in the children.

Results of the study showed that a level of letter recognition is beneficial for reading, along with the ability to manipulate onsets and rimes within syllables. Results also showed that the ability to isolate a phoneme from the beginning or end of a word is beneficial to

reading. These skills can be classified in a hierarchy of complexity. Knowledge of letter names may allow a child to better manipulate onsets and rimes, which may enable basic word recognition, leading to more complex forms of phonological awareness.

A study by Hurford, Schauf, et al. (1994) examined the development of phonological and reading skills in children through their first and second grade years. Subjects (n = 171) of the study were students from a mid-sized Midwestern town. Subjects were measured four different times on phonological processing, reading ability, and intellectual ability over the two year period. Approximately 228 students were measured at each of the four data collections; however, only the 171 students who were measured all four times were used for the study. Males accounted for 57.3% of the sample.

Two tasks were used to measure phonological processing in the students, the phonemic discrimination task and the phonemic segmentation task. The phonemic discrimination task required the students to identify if a standard pair of syllables was the same or different than a comparison pair (/di/ and /gi/ compared to /gi/ and /gi/). All subjects were evaluated using the same syllable pairs. In the phonemic segmentation task the student was to repeat a word

or pseudoword given by the examiner. The words were all given in consonant-vowel-consonant (CVC) format. The consonants were not always the same within a word. After repeating the word given by the examiner the student was then asked to pronounce the word without one of the consonants. For example, pronounce dog without the /d/ sound. Half of the words had the initial consonant deleted and half had the final consonant deleted.

Reading ability was measured using the Word Identification and Word Attack subtests of the Woodcock Reading Mastery Test-Revised (WRMT-R), which measure ability to read words and to use the rules of phonics respectively. Intellectual ability was measured using the Peabody Picture Vocabulary Test-Revised (PPVT-R).

Results of the study found the segmentation and discrimination tasks to be the strongest predictors of group membership for the subjects. These tasks were able to accurately place students into a nondiasabled, reading disabled, or garden-variety poor reader category in second grade. Nondisabled children were defined as those having no intellectual deficits and having at least average reading ability for their grade. Children with reading disabilities were those who displayed a discrepancy between their reading ability and overall intellectual ability. These children

displayed average intellectual ability and below average reading ability for their grade. Garden-variety poor readers were those children who displayed below average reading ability and below average overall intellectual ability. Hurford and his colleagues (1994) also found at the first measurement that children with adequate phonological skills who were nondisabled readers were able to begin reading prior to formal reading instruction. The difficulty and type of words read was not indicated. This study has shown that children who are likely to display a reading disability as defined by this study can be identified early on in first grade.

Badian (1994) conducted a study measuring the role that phonological processing, naming speed, and orthographic knowledge play in reading ability. Subjects were 118 children from a small school district. The majority of children were White and from middle class families. Reading and writing in these schools was taught with the Won Way method, a multisensory phonetic method. Subjects were tested prior to kindergarten entry, in early first grade and later in first grade.

Prior to kindergarten the subjects were given the information and arithmetic subtests of the Wechsler Preschool and Primary Scales of Intelligence (WPPSI) to

measure verbal intelligence. To measure language subjects were given the sentences subtest of the WPPSI, were asked to tell a story about a picture, and completed the Rapid Automatized Naming test (RAN) objects. To measure preacademic skills, the subjects were asked to name letters, shapes, and colors presented on a card. They also completed a syllable tapping test (phonological awareness) and a visual matching test (orthographic processing), which asked each subject to choose one of four stimuli to match a target item. Visual motor skill was measured through the child's ability to write their name, copy geometric forms, and draw a person. As a measure of preschool reading ability, parents were asked to what extent their child could read.

In November of first grade the subjects were given the Basic Reading and Spelling subtests of the Wechsler Individual Achievement Test (WIAT). For the reading subtest the children are asked to identify sound relationships, word recognition and word reading. The spelling subtest required writing dictated letters, identifying letters associated with a sound, and spelling words.

In March of first grade, the subjects were given the Reading Comprehension subtest of the Stanford Achievement Test (SAT). This test was administered by the school for regular testing purposes.

Results of the study found that the Sentences subtest, the visual matching, and colors tests could predict good and poor readers with 91% accuracy. The measures of phonological awareness (syllable tapping), orthographic processing (visual matching), and object naming speed (RAN objects) accounted for 41% of the variance in first grade reading and spelling and 30% of the variance in first grade reading comprehension. This study indicates that phonological awareness, orthographic processing, and object naming speed can be used to aid in the identification of children at-risk for developing reading difficulties. Ninety-two percent of the subjects in this study were White, with only a few Black, Hispanic and Asian subjects. While all socioeconomic levels were represented, the majority of the subjects were from middle-class families.

In 1995 Badian conducted a similar study measuring the relationships between letter naming, phonological awareness, orthographic processing, and reading ability. Subjects of the study were 92 children from the same small school district. Subjects were given similar measures as in the previous study (Badian, 1994). However, in this study reading ability was measured through sixth grade.

Results of the study found that letter naming and visual symbol matching were the only measures in preschool

that held strong correlations with reading and spelling at most of the grade levels. However, this effect was found only when results were controlled for verbal intelligence and age, which contributed greatly to reading and spelling.

MacDonald and Cornwall (1995) conducted a longitudinal study measuring the relationships between phonological awareness, reading, and spelling. This study collected follow-up data on 24 of 58 students who had participated in another study when in kindergarten. The students in this study were in eleventh grade and between the ages of 16-17. These eleventh graders were given a sound deletion test, the Peabody Picture Vocabulary Test, the Reading and Spelling subtests of the Wide Range Achievement Test-Revised, and the Word Attack and Passage Comprehension subtests of the Woodcock Reading Mastery Tests-Revised. Results found phonological awareness to be a concurrent and long-term predictor of word identification and spelling skills. However, none of the kindergarten measures predicted reading comprehension ability.

Phonemic Awareness and Spelling Achievement in the Early Grades

In addition to studies investigating the relationship between reading, spelling, and phonemic awareness, studies have been conducted investigating spelling and phonemic

awareness alone. Perin (1983) conducted two experiments to investigate the relationship between spelling and phonemic segmentation. Subjects for the study were selected based on their reading and spelling ability. Fifty-one subjects were selected and placed into one of three groups: good readers and good spellers (group A), good readers and poor spellers (group B), and poor readers and poor spellers (group C). Each group contained 17 subjects and consisted of more boys than girls.

In the first experiment the subjects were asked to complete a spoonerism task. For this task the subjects were orally presented with a two word name of a singer or pop group (e.g. Bob Marley). The subjects were asked to repeat the name, switching the first phoneme of each name (Mob Barley). Results (Perin, 1983) showed that group A performed significantly better than groups B and C, however, groups B and C did not differ from each other. Results were also computed in relation to the type of errors made. In all three groups the greatest number of errors were phonemic errors, where the phonemes were improperly substituted. Moreover, groups B and C made a significant amount of non-phonetic errors (spelled wrong and did not make phonetic sense) in comparison to group A. The author stated that the difficulties in phonemic segmentation experienced by the

poor spellers may contribute to poor use of grapheme-phoneme correspondence. This will hinder the attempts to spell unfamiliar words.

The same subjects participated in the second experiment. For this experiment the subjects were asked to complete the segment judgment task individually. This task required the subjects to judge the number of phonemes in a spoken word. A total of 48 words were used that varied from two, three, four, or five phonemes. The subjects were instructed to think of how the word sounded and not what it looked like. Results showed that group A had significantly more correct responses than either group B or C. Similar to the first study, groups B and C did not differ from one another. Results of both of these studies were believed to support the idea that irrespective of reading ability, children who were poor spellers were unable to deal effectively with phonemes. The author believes this finding suggests that phonemic awareness is more closely related to spelling than reading.

Rohl and Tunmer (1988) conducted a study that was similar to the previous study by Perin (1983). Subjects of the study were chosen and placed into one of four groups: poor grade 5 spellers, average grade 3 spellers, good grade 2 spellers, and average grade 5 spellers. The average grade

5 spellers were chosen to serve as age comparisons for the poor grade 5 spellers. The groups were formed based on the results of the Spelling subtest of the Wide Range Achievement Test. Fifty-five subjects were chosen and placed into groups using a spelling-age match. Children in the grade 5 poor spelling group were chosen first and the younger groups were matched based on their test scores.

The subjects were tested over a six week period both individually and in a group. In one individual session the subjects were given the Peabody Picture Vocabulary Test (PPVT) and a phonemic segmentation test. As a group they were administered an experimental spelling test. The subjects were asked to spell 72 words from four categories: regular words, ambiguous words, exceptions, and pseudowords.

Results (Rohl & Tunmer, 1988) showed no significant difference among the groups on the PPVT. However, there was a significant difference by group on the phonemic segmentation task. The grade 2 good spellers segmented the most words correctly, followed by the grade 3 average spellers, and the grade 5 poor spellers. Similar results were found for the experimental spelling test. The poor spellers demonstrated less awareness of the phonemic structure of words and made more errors that were phonetically inaccurate. The authors felt these findings

helped support a causal relationship between phonemic segmentation and spelling. However, this assumption appears to be premature at this time. Since ability toward phonemic segmentation and spelling could be caused by previous exposure to texts, intelligence, as well as a variety of other causes.

Griffith (1991) conducted a study to investigate the relationship between phonemic awareness and spelling development. Subjects of the study were 96 first grade children and 87 third grade children. The subjects came from a variety of socioeconomic levels and ability levels.

The children were given the GKR Test of Phonemic Awareness to measure their ability to segment phonemes, blend phonemes, delete first and last phonemes, and substitute first and last phonemes. The average split-half reliability of the subtests of this test is .70. Based on their phonemic awareness score the subjects were divide into high and low phonemic awareness groups. The subjects were also given an oral spelling test and a word-specific test. The word-specific test measured "the degree to which the children had stored orthographic units for equivocal phonemes in specific words" (p. 220). It is a 60 item test with two alternatives for every item. The subjects were to

chose the correct spelling of a word from a phonetically legitimate alternative.

Results (Griffith, 1991) found that 54% of the variance in spelling was attributed to the phonemic awareness and word-specific tests. In third grade, these two tests accounted for 70% of the variance in spelling ability. Results also indicated that children rarely scored high on the word-specific test and low on the phonemic awareness test. These results lend support to the relationship between phonemic awareness and spelling.

Many of these studies have the same criticisms as the reading studies. There is a fairly high attrition rate. The samples are generally homogenous, and usually quite small. The same troubles surround the definition of phonemic awareness, although it is measured similarly in all studies. Although criticisms surround this research, it has shown a strong relationship between spelling and phonemic awareness.

Reading and Phonemic Awareness: A Reciprocal Relationship

Studies have been done to investigate the possibility of a reciprocal relationship between reading and phonemic awareness. Torneus (1984) conducted a study investigating the causal relationship between reading and phonological awareness. Subjects of the study were 46 children in a

dyslexic experimental group and 44 children in a control group. The subjects were tested in first and second grade.

Prior to beginning the study all children were measured on cognitive development using the Raven Progressive Matrices Test, and were measured on reading and spelling skills. Group membership was determined by scores on the reading test. The dyslexic group was determined first and then the control group was matched to them based on sex, classroom, and Raven score.

Reading was assessed using a silent reading test consisting of 400 isolated words. Children were asked to mark the picture that illustrated the word read. The test was given at the end of first grade and the beginning of second grade.

Spelling was assessed through a dictation test consisting of 30 phonetically spelled words in first grade. At the beginning of second grade 28 different phonetically spelled words were used, and during the middle of second grade 34 words were tested. Seventeen of the words were the same as the words used in the segmentation task discussed below.

Metaphonological skills, those tasks requiring a redirection of attention from the meaning of words to the sound properties, were measured through a segmentation task,

a blending task, a deletion task, and a position analysis test. The position analysis task required the child to indicate which sound in a word followed a target sound. For example, in the word "cat" which sound follows the /a/ sound?

Results of the study found that each of the metaphonological tasks differed in cognitive demands needed to perform the task. Results also found the largest causal influence on spelling was metaphonological abilities. However, metaphonological abilities were dependent on cognitive and language development. Through the use of a goodness-of-fit test, no causal influence was found for spelling ability on metaphonological ability. This indicated no reciprocal relationship between spelling and metaphonological abilities.

Results also showed that metaphonological abilities and cognitive development have a causal influence on reading. Through the use of a goodness-of-fit test, reading ability was found to have no significant causal influence on metaphonological ability. These results do not support a reciprocal relationship between reading, spelling, and phonological awareness.

Perfetti, Beck, Bell, and Hughes (1987) also investigated the reciprocal relationship between reading and

phonemic awareness. The study began with 82 first graders and 17 second graders, however, data is only reported on the 82 first graders. Subjects were either in a basal reading group or a direct code teaching method group. Subjects in the direct code method were taught explicitly to blend.

Subjects completed a synthesis task (blending), a tapping task, and a deletion task in each of four measurements. Subjects also completed a pseudoword reading test and the reading subtest of the Wide Range Achievement Test.

Results found deletion to be the best predictor of word reading, as measured by each students reading progress and the Wide Range Achievement Test scores. However, in the first two measurements synthesis was also a good predictor. Through the use of multiple regressions, the last three scores in deletion accounted for 77% of the variance in word reading. Deletion was also found to be the best predictor of the subjects' curriculum progress. Curriculum progress was determined by each child's place in his or her curriculum.

Partial time-lag correlations were computed to determine if phonemic awareness predicted reading or vice versa. For the synthesis task, phonemic awareness was found to predict success in reading more than reading success was

found to predict phonemic awareness. For deletion, pseudoword reading predicted later deletion ability, which, in turn, led to later reading ability in the basal group. For the direct code group, pseudoword reading predicted later deletion, but deletion never predicted later reading. These results imply that phonemic synthesis influences later reading, and reading enables later deletion, which in some cases enhances reading. Thus, to some extent a reciprocal relationship between reading and phonemic awareness was found.

Bentin (1993) measured a similar relationship in Hebrew. Subjects of the study were 91 children from 15 public kindergartens in Israel. The kindergartens were randomly selected from several middle-class neighborhoods. Subjects were not instructed in reading acquisition or provided with formal exposure to print.

Subjects were measured in phonological awareness and reading. The measures of phonological awareness required the subjects to isolate the first phoneme of spoken words, isolate the first phoneme in picture names, isolate the last phoneme in spoken words, isolate the last phoneme in picture names, select two pictures that had matching phonemes, identify a missing sound in a word and identify what word is left when a sound is deleted. The reading test consisted of

single printed words that the child was required to read aloud.

The subjects were divided into control and experimental groups after being measured in phonemic awareness. The children in the lowest quartile of phonemic awareness were selected for the experimental groups. The experimental groups were then further divided into one of four training groups: phonemic segmentation, phonemic segmentation and letter shapes, general language skill, and no specific training. This last group served as a second control group. Training lasted for an hour a week for ten weeks. Following the training the subjects were measured in phonemic awareness and reading. Results (Bentin, 1993) showed that the groups trained in phonemic segmentation improved in phonological awareness. Following the training, the group initially high in phonemic awareness and the groups trained in segmentation were not significantly different.

After four months of reading instruction, the control group that was originally high in phonological awareness were the best readers. They were followed by the group trained in segmentation. The control group with poor phonological awareness was the lowest in reading achievement. After nine months of reading instruction similar results were found. Following reading instruction

the control group's phonemic awareness increased. These results imply a reciprocal relationship between reading and phonemic awareness. The authors report that "phonemic awareness is a necessary condition for normal reading acquisition, and in most children it is a consequence of reading instruction" (p. 145).

Wagner, Torgesen, and Rashotte (1994) conducted a similar study with American children. Two hundred and eighty-eight children began the study in kindergarten; however, only 244 remained for the entire three years. There was an equal representation of males and females, and the majority of the sample was White.

The subjects were given 22 tests measuring phonological awareness, letter naming, and vocabulary. The tests consisted of a deletion test, an oddity test, a segmentation test, three blending tests, and a test requiring the child to identify a word, from a group of three, that begins with the same sound as a target word (ex. bag: jet, box, tub).

The subjects also listened to sentences and repeated them verbatim. Digit span was measured with digits presented orally and on a computer screen. The subjects were then asked a question, asked to reply "yes" or "no", and then say the last word in the sentence. This test was considered to measure working memory.

The next group of tests required the naming of letters and digits, both individually and together, in isolation and serially. The Word Identification and Word Analysis subtests of the Woodcock Reading Mastery Test were also administered to measure decoding skill. Vocabulary was measured with the Stanford-Binet Vocabulary test. Prereading knowledge was measured by letter-name knowledge and letter-sound knowledge. The tests were administered individually to each child in random order in the Fall of the kindergarten, first- and second-grade years. Tests were administered over four sessions in a two week period.

Results (Wagner, et al., 1994) found that the five phonological abilities have a redundant and simultaneous effect on decoding ability. In other words, all five abilities exerted the same effect at the same time. These abilities were found to be predictors of later reading. Causal influences were found for all five phonological processing abilities and decoding. A causal influence was also found for letter-name knowledge on phonological abilities. This relationship was found to be significantly smaller than the one between phonological abilities and decoding. The authors believe these results indicate a reciprocal relationship between reading and phonological awareness.

One major criticism of these studies is that they take rather small findings and make large generalizations. Most studies found only a small reciprocal relationship, yet made claims supporting this relationship. Further research needs to be done in this area to further establish a reciprocal relationship.

Intervention Studies of Phonemic Awareness and Emergent Literacy

O'Connor, Jenkins, Leicester, and Slocum (1993) conducted a study investigating the effect phonological training would have on children with disabilities. Subjects of the study were 47 four, five, and six year olds with learning disabilities selected from a special education preschool. All children had been previously identified and labeled as learning disabled according to the school criteria. Subjects were pretested using the McCarthy Scales of Children's Abilities and nine tests measuring phonological awareness (rhyming, blending, and segmenting). Only children who were considered low in phonemic awareness were admitted into the study. Subjects were assigned to one of four groups using a randomized block design. Subjects were matched on age and general cognitive ability. The experimental groups consisted of a blender group, a segmenter group, a rhymer group, and a control group. Each

group would later receive training in a specific skill area. For example, the blender group received training in various aspects of blending phonemes.

Phase I of the training lasted for three weeks, and each group was trained in a specific skill area (blending, segmenting, or rhyming). During this phase the subjects were trained only in one aspect of their skill area. For example, the blender group was trained only in blending continuous stretched sounds. At the end of phase I a midtest was given to each group. Each group was tested to see if the training would generalize to other skills in that specific area. For example, the blenders were tested on blending stretched sounds and blending separated sounds. However, they were not tested on segmenting or rhyming.

Phase II lasted four weeks and continued the previously taught task. In addition, training was extended to other skills in the area. Now the blenders were taught to blend completely separated sounds, words beginning with stop sounds, and to blend onset and rimes.

During both phases the control group participated in regular preschool activities. They received no training in any area of phonological awareness.

During posttest assessment each subject was tested individually in all nine phonological subtests and in letter

recognition. The blending training produced significant effects on all three tasks for the blender group: blending continuous sounds, blending onset and rime, and blending separate sounds. Similar results were found for the segmenting and the rhyming tasks. Control subjects performed significantly lower than the trained groups in blending, segmenting, and rhyming. While many of the children did improve slightly in the areas other than their specific training area, the gains were much larger in the training area. When mental age was controlled for, the training accounted for a large proportion of the variance in posttest phonological performance.

These results show that it is possible to train students with learning disabilities in phonological awareness. Furthermore, these skills can be taught before the children begin formal reading instruction.

Hurford, Johnston, Nepote, Hampton, Moore, Neal, Mueller, McGeorge, Huff, Awad, Tatro, Juliano, and Huffman (1994) conducted a follow-up study to investigate the possibility of training students labeled as at-risk for developing a reading disability. Four hundred and thirty-one students from four school systems were subjects of the study. Based on reading scores obtained from the Woodcock Reading Mastery Test-Revised and general intelligence scores

derived from the Peabody Picture Vocabulary Test, students were put into one of three groups: nondisabled (ND), reading disabled (RD), and garden variety poor readers (GV). Nondisabled students were those who evidenced average reading ability and average general intelligence. Reading disabled students were those who evidenced a discrepancy between general intelligence and reading ability, and garden variety poor readers were those students who evidenced below average intelligence and below average reading ability.

During both pretest and posttest the subjects were measured on phonemic segmentation and phonemic discrimination. The Word Identification and Word Attack subtests of the Woodcock Reading Mastery Test-Revised were used to measure the ability to read words and use phonics rules.

Subjects underwent training in intrasyllable discrimination (short and long task) and phonemic segmentation and blending. Training was done through the use of a computer. For the intrasyllable discrimination training short task, each student was auditorily presented with a standard syllable and a comparison syllable over the computer. The two sets of syllables were presented successively, separated by a short pause. By pressing one of two computer keys, the subject was required to

discriminate if the two syllables were the same or different. The subject was immediately provided feedback regarding the correctness of the response. The long task version of this training was identical except the pause between syllable presentation was longer.

Magnetic letters and a magnet board were used for the blending and segmenting training. For the blending training the letters to be blended were placed on the magnet board separated by space. The trainer pointed to each letter as he or she said the sound and the subject was told to "put the sounds together" (p. 650). The same procedure was used for the segmenting task only this time the procedure was reversed.

Results (Hurford, Johnston, et al., 1994) indicated that the experimental and control groups were similar in performance at pretest on the discrimination task, but the training groups performed significantly better after training. Similar results were found for the segmentation task. The training was judged to be effective for improving phonological awareness skills. Prior to training the ND group was significantly different from the RD and GV groups. After training no difference existed among the three groups in discrimination and segmentation.

The effect of the training on reading ability was also examined. While the three groups were significantly different on Word Attack and Word Identification scores prior to training, no difference existed among the groups following training. The RD group that was trained made the largest gains in reading scores, while the control groups made the smallest gains. These results support the use of phonemic awareness training in children who are at-risk for reading disabilities.

Weiner (1994) investigated the effect of phonemic awareness training on reading ability of low and middle achieving first graders. Seventy-nine White, middle-class first graders were subjects of the study. Based on individual scores on the Gates-MacGinitie Reading Test, students were either placed in the low-achieving group (scores below the 32nd percentile) or the middle-achieving group (scores between the 32nd and 68th percentile).

Pretest data were collected using the Gates-MacGinitie Reading Test, a phonemic segmentation test, a phonemic deletion test, and a phoneme deletion and substitution test. The students were also given a decoding test and an oral reading test. The oral reading test was designed to measure word recognition strategies and comprehension.

The subjects were then randomly assigned to a treatment condition: phonemic awareness training only, phonemic awareness training and decoding, phonemic awareness training, decoding and reading, or the control group. The phonemic awareness only group received training in segmentation, blending, deletion, and substitution of phonemes. This was considered a "skill and drill" (p. 283) method because no emphasis was given to the conceptual connection between these skills and reading.

The phonemic awareness and decoding group (semi conceptual training) received the same training. In addition, at the end of each lesson the students were given the opportunity to relate the skills to a decoding activity. Decoding activities consisted of having the student decode target words and transfer words that differed by one sound from the target word (Tab is a cat.).

The phonemic awareness, decoding, and reading group (conceptual training) received the same training as the previous group. In addition, they were allowed to apply phonemic awareness skills learned in training to reading a narrative text. The trainer made specific links between words in the story and previous phonemic awareness skills and to learning to read.

The control group remained in the regular classroom during the intervention phase and received no additional training. They were included to discern the impact of training versus no training.

Regardless of training group there were significant improvements on all of the dependent variables (segmentation, deletion, deletion and substitution, decoding, and the Gates-MacGinitie). Low-ability and middle-ability subjects responded to the training differently. For the low-ability subjects, the semi-conceptual and the conceptual training were the least effective.

In relationship to reading, phonemic training vs. no phonemic training did not improve decoding, as measured by the decoding test, Gates-MacGinitie, or oral reading scores. The only difference found in relation to comprehension was from the "skill and drill" group. They displayed the steepest increase in comprehension from pre- to post test. Since the training did not make a significant difference in phonemic awareness and/or reading ability, the author believes that the change in reading ability may have been due to the phonics-oriented reading instruction in the classroom.

Castle, Riach, and Nicholson (1994) conducted an experiment to test the effects of phonemic awareness training in a Whole Language classroom. Fifty-one students who were judged to have very low phonemic awareness skills were selected to be in the study. At pretest and post test the subjects were given the Peabody Picture Vocabulary Test, a ten item concrete operativity test, several tasks measuring segmentation, deletion, blending, and substitution of phonemes, the Bryant Test of Basic Decoding Skills, the Burt Word Reading test, and the Clay Word Reading test.

Based on the Peabody and phonemic awareness scores the subjects were matched into three groups: phonemic training, alternative training, and unseen control. Both training groups was taught for 20 minutes a week for 15 weeks.

The phonemic training group received training in segmenting, blending, rhyme, and alliteration skills. The alternative training group received training in the meaning of words. Focus was given to the names of letters instead of sounds and some time was spent with the researcher reading to the group.

The phonemic training group experienced the largest gain scores from pretest to post test. However, all groups experienced significant increases in scores. The phonemic training did impact reading skills. This was determined by

the phonemic training group's significantly higher reading post test scores as compared to their pretest scores. This study also found support for the effectiveness of phonemic awareness training.

Gillon and Dodd (1995) investigated training effects on a small sample of Australian children. Ten students between ten and twelve years of age with specific reading disabilities were the subjects of this study. The subjects had also been involved in a larger longitudinal study by the same authors. The students received regular reading instruction during this intervention period, however, any additional interventions were stopped at this time. All subjects were found to be of average intelligence.

Reading accuracy and reading comprehension were measured using the Neale Analysis of Reading Ability-Revised. This is a standardized reading test frequently used in Australia. Knowledge of semantic and syntactic structures in expressive language was measured using the Formulated Sentences subtest of the Clinical Evaluation of Language Fundamentals-Revised (CLEF-R). Phonological processing was measured through spelling real and nonwords and the spoonerism task. This task requires the transposition of the initial phoneme of a word pair. The

Lindamood Auditory Conceptualization Test (LAC) was also used.

The ten students were randomly divided into one of two groups. Group 1 received phonological training and then semantic-syntactic training, group 2 received the training in the opposite order.

The phonological training consisted on a similar program to the Tracking Speech Sounds section of the Auditory Discrimination in Depth Program-revised (ADD). This program requires students to use colored blocks to represent sounds. Students used the blocks to identify the order, number, similarities, and differences of the sounds in syllables.

The semantic-syntactic training was composed of worksheet activities working with the structure of sentences. Activities included: identifying complete sentences, forming complex and compound sentences, reducing complex and compound sentences, expanding sentences, recognition of nonsense sentences, and combining information to make sentences.

Results (Gillon & Dodd, 1995) indicated that the students made accelerated progress in reading performance as compared to their growth in the previous two years. Group 1 made significantly more improvements in spelling real words,

nonwords, and the spoonerism task than group 2. After receiving just one of the training programs, each group made significantly more improvements in that area than the other group. For example, after receiving only the semantic-syntactic training, group 2 made significantly more progress in the ability to formulate compound and complex sentences. After each group received both training sessions, the differences decreased. Significant increases in reading accuracy were found, but not in comprehension, following the training. These results again support the use of training to enhance phonemic awareness and reading.

McGuinness, McGuinness, and Donohue (1995) also investigated the effects of training in phonemic awareness. Subjects of the study were 45 children enrolled in either a Montessori school or another local private school. The children were found to have above average intelligence and were from high socioeconomic levels. The Montessori group formed one of the experimental groups. Children from the private school were randomly assigned to one of two first grade classrooms. One was chosen to be an experimental group along with the Montessori class and the remaining first grade classroom was the control group.

The two experimental teachers received training in the Auditory Discrimination in Depth program (ADD). This

program "provides explicit instruction in English phonology (phonological awareness) and in how each sound is connected to print" (McGuinness, McGuinness, & Donohue, 1995, p. 844). Teachers and children were informed of the goals and general beliefs of the program prior to beginning. In addition, the students receiving ADD training were taught the rest of the curriculum in the usual way. The teacher in the control group used a modified whole language approach to teaching which included minimal phonics instruction.

Subjects were tested using the following tests: Woodcock Reading Mastery Word Identification and Word Attack subtests, Peabody Picture Vocabulary Test, an oral comprehension test, the Lindamood Auditory Conceptualization Test (LAC), tests of short-term memory for rhyming and nonrhyming words, Rapid Automatized Naming of colors and pictures, and the Probe Test of Visual sequential memory. The Probe Test measured visual memory, and consisted of the child being shown single digits on a laminated card. Each card was placed face down and to the right of the previous card. After four, five, or six digits were placed down, the subject was given a target digit and asked to point to the place of the target digit on the table.

Results showed that training in the ADD program significantly increased reading scores of the subjects

compared to their own previous performance. Both experimental groups performed better than the control group on the Word Identification and the Word Attack subtests. Word Attack scores improved more than Word identification scores. Therefore, the authors believe that the ADD program has a greater effect on decoding as opposed to word recognition.

For the most part, training studies in phonemic awareness have been found to be effective. This research offers some hope for children who enter school with limited literacy experiences and poor phonemic awareness.

CHAPTER 4

SUMMARY AND RECOMMENDATIONS FOR FUTURE RESEARCH

It is a commonly held belief that the ability to read is essential within our society. It has become evident throughout this paper that there are many children in schools today that are experiencing great difficulty learning to read. Phonemic awareness has consistently been found to be a fairly good predictor of later reading ability. However, at this time, more research is needed in a variety of areas to further enhance our understanding of exactly how phonemic awareness is related to emergent literacy.

One area for future research is to investigate the relationship between phonemic awareness and reading comprehension. Many studies have investigated the ability of phonemic awareness to predict word identification, however, few have looked at reading comprehension. Since comprehension is the main goal of reading, it is important to know if phonemic awareness can also predict a child's ability to comprehend what he or she reads. Longitudinal studies can be conducted to help determine the long term effects of phonemic awareness on reading comprehension. However, results of any longitudinal study would result in limitations which must be considered.

Another area for future research is related to training/intervention studies. The current studies have all used a variety of training techniques. Additional research should be conducted to investigate which type and aspect of phonemic awareness training is most beneficial to children with poor phonemic awareness. These investigations could lead to the identification of the specific skills and activities that are most useful for facilitating the phonological awareness of students with reading problems.

Training studies can also be conducted to investigate the effectiveness of phonemic awareness training for spelling and reading comprehension. Training studies can go beyond word identification skills and investigate these more complex areas of literacy. It is possible that phonemic awareness training may benefit a child in all areas of literacy development.

Although much research has already been conducted on phonemic awareness, much research still needs to be done. The exact nature of the relationship between phonemic awareness and emergent literacy and the extent to which training can be beneficial are important to understand. This research may lead to more appropriate and beneficial instruction in the classroom.

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