

PHONOLOGICAL PROCESSING DIFFERENCES  
BETWEEN GOOD AND POOR READERS  
AT THE COLLEGE LEVEL

By

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## CHAPTER I

### INTRODUCTION

Literacy is a basic concern politically, economically, socially and culturally (Chisholm, 1988). In the United States, adult illiteracy has been recognized as a barrier to increasing United States' competitiveness due to the fact that one-fifth or more adult workers need improvement in their basic skills to become fully productive in the workplace (Imel, 1988). Illiteracy is often equated with poverty. Limage (1990) says, however, "Illiteracy does not cause poverty, but it is highest among school leavers, minority groups, the long-term-unemployed, and the severely disadvantaged." In the early 1980's, functional illiteracy cost the national economy \$6,000,000 in social welfare alone in addition to the excessive amount of decreased productivity (Hovey, 1982). Estimates vary, depending upon the source; but in 1988, the United States Department of Education reported the adult illiteracy rate as 13% of the population or 17-21 million persons (Irwin, 1988). In a recent publication by the Oklahoma Branch of the Orton Dyslexic Society (1992) it is reported that in the state of Oklahoma alone, one out of every 4.7 adults is functionally illiterate. Therefore, there can be no doubt of the importance of reading and reading ability.

It is a commonly accepted fact that reading ability varies with the individual. It is also well-known that the ability to read is influenced by many factors (Harris & Sipay, 1985). There is considerable data regarding characteristics of prereaders that best predict success in learning to read (Adams, 1990). Two important characteristics which are predictive of early reading achievement are knowledge of letter names and the ability to discriminate phonemes auditorily (Adams, 1990; Bond & Dykstra, 1967; Chall, 1967, 1983a; Durkin, 1966). After reviewing several studies, Stanovich (1986) found that phonological processes were strongly linked to reading ability and that phonological awareness accounts for a statistically significant and sizeable portion of variance in this ability after the variance associated with standardized intelligence measures has been partialled out.

During the last 25 years, several research studies have looked seriously at the strong relationship between children's reading and their awareness of sounds. Findings indicate that phonological awareness is a prime factor in learning to read (Adams, 1990; Blachman, 1989; Bradley & Bryant, 1983, 1985; I. Liberman & Shankweiler, 1985; A. Liberman, Shankweiler, & I. Liberman, 1989; Lundberg, Frost & Petersen, 1988; Mann & I. Liberman, 1984; Pratt & Brady, 1988).

A landmark study illustrating this was conducted by Bradley and Bryant (1983, 1985). This study involved English

children who were four and five year olds, and combined a longitudinal design with a training study. Over a period of four years, these children proved to be better at rhyming and alliteration ability, broke the code sooner, and read sooner and better than those who had not been trained. Another study by Lundberg, Frost and Petersen (1988), also found that by providing children with phonemic awareness training before they had any formal reading instruction, these children were able to read more effectively. The subjects of Lundberg et al. (1988) were six-year-old Danish kindergartners. In Denmark children begin kindergarten at age six. Lundberg and his associates concluded that improvement in these children's reading was a direct result of their increased sensitivity to phonemes. They also found that the acquisition of reading and spelling in grade one was facilitated by this preschool training (Lundberg, 1987).

While many researchers indicate the strong relationship between phonological awareness and reading success, conversely they have found that deficits in phonological processing are related to reading failure in a large number of otherwise normally developing children (Frith, 1981; I. Liberman & Shankweiler, 1985; Stanovich, 1986). In fact, Gough and Tunmer (1986) state that children who cannot phonologically recode do not become good readers. Just what constitutes a "good " reader will be addressed later in this paper. Ehri (1991) refers to studies done by Firth and Vellutino as also indicating that disabled readers are uni-

formly deficit in phonological recoding skill. Vellutino and Scanlon (1982, 1987) conducted two studies which provide correlational and experimental evidence for causal relationships between linguistic coding deficits and reading disability. Another study conducted by Mann and I. Liberman (1984) constituted a two-year longitudinal study with 62 Connecticut kindergartners which showed that inferior performance on phonological processing tests in kindergarten presaged problems in first grade. Mann (1984) also replicated these same results in a follow-up study. In several other documented studies, poor beginning readers tend to be less aware of the phonological structure of spoken words (Fox & Routh, 1975; I. Liberman, Shankweiler, Fischer, & Carter, 1974, Rosner & Simon, 1971).

Although it is commonly understood that decoding skills are important in beginning reading, they are just as important in skilled reading. Without this skill the reader's ability to pronounce unfamiliar and uncommon words is hampered at any age (Aaron & Baker, 1991). Skilled reading does not develop spontaneously, and an adult's reading background is reflective of current reading ability.

According to Felton, Naylor, and Wood (1990), research regarding the cognitive skills of adult poor readers indicates results which are consistent with current research with children. This research identifies phonological processes as the underlying cognitive deficit in reading disabilities. Adult poor readers are even found on college and university

campuses (Cohen, 1984).

There is strong evidence that a significant number of students at the university level evidence symptoms of reading disabilities which have not been clinically diagnosed and hence have not been sufficiently accommodated (Cohen, 1984; Dinklage, 1971; Kitz & Tarver, 1989). Estimates vary on the percentage of college students in the United States with reading difficulties (Aaron & Baker 1982, 1991; Cohen, 1984; Nash, 1989; Sandoval, 1988); however, these students comprise a sizeable proportion of the student population, and are often considered "at risk" because of these reading difficulties (Aaron & Baker, 1991). It is estimated that at a "comprehensive" university of about 20,000 students, 100 of these students will have severe reading disabilities; and in universities where the admission criteria are less stringent, this figure could be significantly higher. Sandoval (1988) estimated that as many as 0.5% of the student body in a highly selective university, such as the University of California, may have symptoms of reading disability, while Fishlock (1987) estimated that as many as 14% of the 1.66 million (approximately 233,000) first-time college freshman were learning disabled.

Many of these students have found compensatory ways in which to achieve academic success (Cohen, 1984); however, a significant number of college students drop out because of language-related processing problems. Other studies of college students with reading difficulties also indicate that

phonological dysfunctions may underlie reading difficulties (Aaron & Baker, 1982; Apthorp, 1988; Campbell & Butterworth, 1985; Rudel, 1981). The unique problem presented by learning disabled students is the invisibility of their disability (Nash, 1989). Because of their outward appearance of normalcy, many instructors are less willing or unaware of the need to accommodate learning disabled students. Stone (1980) states, "Some learning disabled students are unwilling to admit to others, and in some cases themselves, that they at times need special accommodations to enable them to succeed, until it becomes too late and they are on academic probation or suspension."

#### Statement of the Problem

Many students enter college with inadequate reading skills despite twelve or more years of formal education, adequate intellectual ability, and no visual or auditory problems (Cohen, 1984). Although much research has contributed an increased understanding of reading disability, there is still a need for a unified perspective on the causes and treatments for reading disability (Wixom & Lipson, 1991), particularly among adults. There is also a need for more research regarding the relationship of phonological processing skills and adult reading abilities. There is not sufficient research to indicate whether phonological coding continues to play a significant role in reading past the early developmental stages for these skills, according to Levinthal and



Hornung (in press).

Pennington, Lefly, Van Orden, Bookman, and Smith (1987) attempted to prove that phonological coding is important early in normal readers' development; but as they mature this is superseded by faster, orthographic coding which bypasses phonology. Instead, they found that phonological coding skill continued to develop in nondisabled readers through adulthood. The first study of Pennington et al. looked at the reading and spelling performance of three age leveled groups of reading disabled and nonreading disabled subjects from the same families - children, adolescents, and adults. They found that there was no significant difference between the reading disabled and nonreading disabled children's phonological awareness, but that there were "robust" ( $p < .01$ ) differences between the two older ages, with reading disabled subjects being poorer. They concluded that 40% of the variance in adult reading and spelling performance can be accounted for by a simple measure of phonological coding skill based on spelling errors.

In their second study, Pennington et al. (1987) tested their developmental bypass hypothesis by using the Word Attack subtest of the Woodcock Reading Mastery Test, a standardized nonword reading measure. Once again they found robust differences between the reading disabled and nonreading disabled at both ages. In summary, they found that, phonological coding skill is an emergent rule-like property, which is never bypassed, and its developmental course

is therefore protracted.

### Objectives

Several studies have been conducted with children and have proven that a strong relationship exists between phonological processing deficits and reading failure. However, fewer studies have been conducted with adults and even fewer with college students. It is the purpose of this study to add support as well as additional information to the already existing body of knowledge regarding phonological processing deficits and their relationship to reading failure, particularly in college-age adults. This study will be different from other studies done in this field who have utilized college-age adults. The sampling size will be larger and the methods of assessment will be different, including the use of both standardized and nonstandardized measures.

### Assumption

It is assumed that these subjects are of average to above average ability due to the fact that they have completed twelve year of formal education and are currently enrolled in college courses, having met the academic requirements for acceptance at a comprehensive university.

### Scope and Limitations

No singular intact group was available at the university where this study was being conducted which would provide

enough participants for equal groups of good and poor readers. Therefore, an advertisement was placed in the local campus newspaper, soliciting students who felt that they had any reading problems to participate in this reading research project. Similar advertisements were also posted around campus also requesting participants. Students enrolled in a reading study skills program at the university, and those students who were on academic probation and enrolled in the university academic assessment and evaluation course were encouraged to participate. All participants were volunteers. Subjects consisted of 23 good and 23 poor readers as determined by the Nelson-Denny Reading Test Form E (Brown, Bennett, & Hanna, 1981). Eight of the good readers were female and 15 were male; while, 15 of the poor readers were female and 8 were male. These subjects ranged in age from 18 to 43, and all were enrolled at the university for the spring semester. They also ranged from freshmen (grade 13) to a graduate student (grade 16+) in terms of grade in school.

Testing for this study was begun in the sixth month of the school year. Therefore, a second semester college freshman, in order to be on grade level, would need to score at the 13.6 grade level on the Nelson-Denny Reading Test total score. Six subjects whose total score on the Nelson-Denny fell between 77 (11.6 grade level) and 95 (13.6 grade level) were eliminated from the study as neither good nor poor readers. Six others were also eliminated from the study whose native language was not English. Others who were eliminated

were those who did not possess a high school diploma or GED, and any students with learning problems which were the result of visual, hearing, motor handicaps, or any other handicapping condition.

This study will contribute to a better understanding of the relationship between phonological processing skills and adult reading abilities. It will specifically contribute to a better understanding of phonological processing differences of good and poor readers at the college level.

#### Definitions

**Phonological processing** - Phonological processing is defined as the use of the speech sound structure (phonological information) for processing written and oral languages. It commonly refers to various linguistic operations that make use of information about the phonological (speech sound) structure of the language. The ability to perform these linguistic operations appears to be somewhat independent of general cognitive ability, but highly related to reading development (Stanovich, 1986, 1988; Wagner & Torgesen, 1987).

**Phonological awareness** - Phonological awareness is the ability to recognize that a spoken word consists of a sequence of individual sounds which can be synthesized (blended) and analyzed (segmented). I. Liberman (1987) distinguishes between phonics and phonology. She defines phonics as an instructional approach which introduces readers to words in print by their letter-sound correspondences. How-

ever, phonology is an internal system which is used for producing an indefinite number of words from a few abstract, meaningless elements. In the English language, these abstract elements are the letters of the alphabet. Singularly or in combination, these letters represent sounds or phonemes. Some letters and letter combinations represent more than one phoneme, and some individual phonemes correspond to more than one letter or letter cluster. Thus words are made up of phonemes which are representations of speech sounds.

**Reading disability** - This term is used interchangeably with dyslexia. The most commonly used definition for dyslexia is that of the World Federation of Neurology which defines it as a disorder manifested by difficulty in learning to read despite conventional instruction, adequate intelligence and sociocultural opportunity (Snowling, 1987). In this study reading disability and reading difficulties will be used instead of dyslexia, all of which refer to the same problem.

**Poor reader** - For the purpose of this study, poor readers will refer to those university students who are reading two or more grade levels below the 13.6 grade level on the Nelson-Denny Reading Test Form E (Brown et al., 1981).

**Good reader** - For the purpose of this study, good readers will be those university students who are reading at or above the 13.6 grade level on the Nelson-Denny Reading Test Form E (Brown et al., 1981). Good readers are equated with fluent readers, those whose decoding processes are automatic

(LaBerge & Samuels, 1974).

**Coding** - In reading, coding refers to changing information. Encoding is changing a message into symbols (or oral language into written language), and recoding refers to changing written language into oral language.

**Orthography** - Orthography constitutes the graphemic patterns of a written language and their mapping onto phonology, morphology, and meaning (Henderson, 1984). More simply, it is the representation of the sounds of language by literal symbols, or in an alphabetic language it is the sequence of letters which make up words.

#### Research Questions

It is hypothesized that poor phonological processing skills are predictive of poor reading. Therefore, the question arises: Do poor readers at the college level possess fundamental phonological processing deficits? It is also hypothesized certain phonological awareness tests are strongly related to one another. Therefore, the question also arises: Are certain phonological awareness tests related and is this relationship significant?

#### Hypotheses

**Hypothesis 1:** There will be a statistically significant difference between the mean score of the good and poor readers on the Stanford Diagnostic Reading Test (SDRT) Part 4 (Phonetic Analysis).

Hypothesis 2: There will be a statistically significant difference between the mean score of the good and poor readers on the Stanford Diagnostic Test (SDRT) Part 5 (Structural Analysis).

Hypothesis 3: There will be a statistically significant difference between the mean score of the good and poor readers on Coltheart's Regular Word List.

Hypothesis 4: There will be a statistically significant difference between the mean score of the good and poor readers on Coltheart's Irregular Word List.

Hypothesis 5: There will be a statistically significant difference between the mean score of the good and poor readers on Aaron and Joshi's Nonword List.

Hypothesis 6: There will be a statistically significant difference between the mean score of the good and poor readers on the Woodcock Reading Mastery Test-Revised (WRMT-R) Part 3 (Word Identification).

Hypothesis 7: There will be a statistically significant difference between the mean score of the good and poor readers on the Woodcock Reading Mastery Test-Revised (WRMT-R) Part 4 (Word Attack).

Hypothesis 8: There will be a statistically significant difference between the mean score of the good and poor readers on the Lindamood Auditory Conceptualization Test-Revised (LACT-R).

Hypothesis 9: There will be statistically significant relationship as measured by the Pearson Correlation Coeffi-

cient between Coltheart's Regular and Irregular Word Lists and the Woodcock Reading Mastery Test-Revised (WRMT-R) Part 3.

Hypothesis 10: There will be a statistically significant relationship as measured by the Pearson Correlation Coefficient between Aaron and Joshi's Nonword List and the Woodcock Reading Mastery Test-Revised (WRMT-R) Part 4.

Hypothesis 11: There will be a statistically significant relationship as measured by the Pearson Correlation Coefficient between the Stanford Diagnostic Reading Test (SDRT) Part 4 and the Lindamood Auditory Conceptualization Test-Revised (LACT-R).

Hypothesis 12: There will be a statistically significant relationship as measured by the Pearson Correlation Coefficient between the Stanford Diagnostic Reading Test (SDRT) Part 5 and the Lindamood Auditory Conceptualization Test-Revised (LACT-R).



## CHAPTER II

### REVIEW OF LITERATURE

#### Introduction

What makes a poor reader a poor reader? Many of the tasks that distinguish good and poor readers require effective processing of the sound elements of language and the regular patterns among them (Mann, Cowin, & Schoenheimer, 1990). That is, they require effective processing of the phonological structure of spoken language.

This chapter will look at the studies dealing with phonological processing, first in children and then with adults. A correlational relationship between phonological processing skills and reading ability is established in these studies as well as a significant relationship between phonological processing deficits and reading failure. Phonological processing is not just a phenomena of the English language. This review will also illustrate the international nature of the research.

Byrne (1992) found that by developing an explanation of reading success, researchers are in a better position to study reading failure. This is indeed indicative of most of the research in this area. One of the most robust findings in reading research over the past few decades is the strong

relationship between children's reading ability and phonological awareness (Lundberg, 1987) and most of this evidence is correlational. He states that this association is not necessarily sufficient to show that poor phonological awareness skills cause poor reading. On the other hand, I. Liberman (1987) felt that, as a result of her vast research in this field, there is sufficient evidence that deficits in phonological processing do underlie many of the difficulties that poor readers have.

Phonology provides the basis for constructing a large and ever expandable set of words. According to I. Liberman (1987), phonology is an inborn system that all members of the human race use for producing an indefinitely large number of words out of a few dozen, abstract, meaningless elements (alphabetic letters). She goes on to say that words are always phonological structures. Lundberg (1987), however, makes the point that the level of linguistic awareness required in the acquisition of an alphabetic script is not spontaneously developed in childhood. Thus, many young children do not possess the ability to manipulate linguistic units consciously in tasks requiring segmentation, comparison, counting, or deletion of phonemes (Lundberg, 1987).

An explanation of this can be found in the study done by A. Liberman, Cooper, Shankweiler, and Studdert-Kennedy (1967). They noted that acquiring knowledge of the phonemic structure of speech may be a difficult task since due to the complex nature of the acoustic signal no simple physical cri-

criterion for segmentation of phonemes exists. In this study, A. Liberman et al. (1967) explain that some children fail to benefit from either letter-name knowledge or letter-sound knowledge because in an alphabetical system there is no one-to-one sound correspondence between phonemes and segments of the acoustic signal, making it impossible to pronounce many phonemes in isolation. Thus, simply sounding out a word proves to be an ineffective word recognition strategy (I. Liberman & Shankweiler, 1985). Letter sounds and letter names are only imprecise physical analogues of the phonemes in spoken words. Whether children learn to associate the sound 'duh' or the name 'dee' or both with the letter d, they must still be able to segment the sound or name to make the connection between the letter d and the phoneme /d/. In short, the children must be phonologically aware (Tunmer & Rohl, 1991, p. 5).

The English language is based on the alphabetic principle and is made up of 26 letters which represent some 44 sounds (phonemes). Whereby, in this language, words can only be constructed from a limited amount of symbols, the alphabet. Although there is a correspondence between letter and sounds in English, there is no simple one-to-one relationship (Williams, 1986). Some letters and letter combinations represent more than one phoneme, and some individual phonemes correspond to more than one letter or letter cluster. Knowledge of these phonemes or sounds of the language appears to be vital to learning to read (I. Liberman, 1987). Without

phonology it would not be possible to construct an ever-expanding set of words. Pratt (1985) states that "It is essential for learners of an orthographic system to understand what is being represented by the symbols they are learning" (p. 28).

Thus it appears that in order to read, an understanding that print is represented by a sequence of phonological units is necessary. According to Adams (1990), readers will never obtain fluency unless they can decode words rapidly and automatically. A fluent reader is one whose decoding processes are automatic (LaBerge & Samuels, 1974), and the term fluent reader is often equated with "good reader". Several other studies have indicated that some minimal level of explicit phonological awareness is necessary for children to be able to discover the systematic correspondences between letters and sounds. This knowledge of phonemes would allow beginning readers to identify unfamiliar words and to gain the levels of practice required for developing fluent reading (Gough & Hillinger, 1980; Gough & Tunmer, 1986; Jorm & Share, 1983; Stanovich, 1986). Thus research continues to assert that knowledge and skill of the alphabetic principle is a necessity for the acquisition of reading (Adams, 1990; Chall, 1967, 1983a; I. Liberman & Shankweiler, 1979; Perfetti, 1985; Williams, 1986).

#### Phonological Studies with Children

Considerable research has gone into factors which

influence early reading ability, and over the past twenty-five years, much of this research has been in the area of phonological awareness. Some of the earliest research in phonological awareness was done in the sixties and much of the research today is based on this work. Two Russian psychologists, Zhurova (1963) and Elkonin (1963, 1973) showed that there is a strong relationship between phoneme segmentation abilities and subsequent success in early reading. Zhurova found that many children between the ages of three and six could not isolate the first phoneme of simple words. She also found that attempts to teach this skill were unsuccessful and concluded that these children would have difficulty in learning to read.

Elkonin (1963) developed a method for training children to isolate and identify individual phonemes within words. Simple line drawings, representing the word to be segmented (e.g. man, lamp) were shown to the subject. By looking at the picture of the object the child would not need to rely on auditory memory of the word being analyzed. Below the drawing were boxes corresponding to the number of phonemes in the pictured word. "The child was taught to say the word slowly, pushing a counter into each square as each successive sound was articulated" (Blachman, 1987). Originally discs were used to count out the phonemes; however, these were replaced later with the appropriate letters (Elkonin, 1973).

Figure 1 shows examples of what the teachers in Blachman's study (1987) called "Elkonin cards".

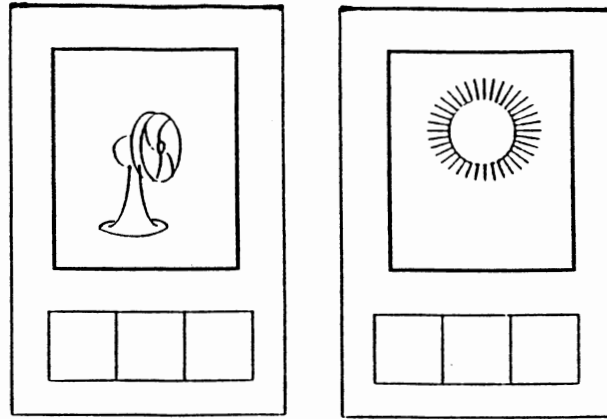


Figure 1. These cards were designed to facilitate the development of language analysis skills. The procedure was adapted from Elkonin (1973).

This example was taken from the article by Blachman (1987), and written permission was obtained from the publisher, The Orton Dyslexia Society to reproduce it in this study.

As a result of this early research, several tasks which synthesize and analyze syllables and phonemes were developed in order to determine phonemic awareness. In 1971, Rosner and Simon developed a test entitled the Auditory Analysis Test whereby 284 children in kindergarten through grade 6 were asked to repeat a spoken word, then to repeat it again without certain specified phonemic elements such as syllables (e.g. "say /cowboy/, now say it again without the /boy/"). These children were also asked to delete phonemes (e.g. "say /mat/ without the /m/"). The authors found positive correlations between the children's success in the deletion task and their reading levels (Rosner & Simon, 1971).

Rosner and Simon's study is an outgrowth of Bruce's (1964) pioneer work in the field of phonological awareness. According to Goswami and Bryant (1990), it was through Bruce's research study in Cambridge, England, that researchers first learned not to take phonological awareness for granted in young children. Bruce studied the ability of children at different levels of mental ability to make a simple phonetic analysis of spoken words. The intent of his study was to support his conjecture that at some stage of reading it is important for children to appreciate that the sound pattern of a word is divisible into smaller units and that these units are common to the sound patterns of other words. Sixty-seven children ranging in age from five to seven and a half were given a word analysis task. The task was presented orally and individually, and contained 30 words -- 26 monosyllable, 3 bisyllables and 1 trisyllable. Each subject was asked to say what word would be left if a particular letter sound were taken away from the test word. In this deletion task children had to remove only part of the onset (e.g. /snail/ to /sail/). These children found this task quite difficult, and Bruce concluded that children below the mental age of seven cannot analyze words into individual speech sounds.

I. Liberman, Shankweiler, Fischer, and Carter (1974) continued to support Bruce's findings. They also concluded in their study that the explicit analysis of words into phonemes was significantly more difficult for young children

than analysis into syllables. This latter skill develops later. Their subjects were 135 kindergartners and first graders. Each was given a series of words or sounds and asked to tap out the number of segments with a wooden dowel. Most of the five year olds found the phoneme task impossible.

Fox and Routh (1975) drew the same conclusion as the two previous studies. In addition, they also found clear differences with Bruce's (1964) study. However, their results actually provided further support for Bruce's position that ability to manipulate phonemes is age related. Fifty children, ages three through seven, were the subjects for Fox and Routh's study. These children were asked to "say a little bit" of either a sentence, a word, or a single syllable. The authors were concerned with developing the child's ability to divide sentences into words, words into syllables, and syllables into phonemes. The authors found that all the children managed the word and sentence tasks very easily. In contrast though, their ability to handle the phoneme task was more dependent upon their age. The older the children were, the easier it was for them to perform the phoneme tasks. Yet, even three year olds were able to do some phoneme analysis if the task were presented very simply and if appropriate guidance was given (Williams, 1986). Fox and Routh's findings contradict Bruce's (1964) study, since in their study even the four year olds got half of the syllables segmented correctly. The authors concluded that children find it particularly difficult to 'remove' phonemes,



yet, other speech units such as words and syllables do not cause them any particular problem (Fox & Routh, 1975). Their study proved important because they recognized the fact that children have phonological awareness skills at an earlier age than was previously thought.

Fox and Routh (1983) did a follow-up study on some of their original severely disabled and normal subjects. At the time of this second study, the children were nine years old. The disabled readers continued to score below the normal readers on the segmentation tasks and were found to be more than two grades below the normal group in reading as determined by their scores on the Camp-Dolcourt adaptation of the Boder test. Fox and Routh suggested that these disabled readers will continue to have reading and spelling problems into adulthood.

Goswami and Bryant (1990) hypothesized that the children performed poorly on Bruce's task because they had to manipulate segments which were only part of the onset or only part of the rime. The onset is the initial consonant or consonant cluster of the syllable, and the rime is the vowel and any following consonants (Treiman, 1991). Calfee (1977) had five and six year olds play a game similar to Pig Latin where they took the initial phoneme from each word. With a brief amount of training (e.g. "When I say 'greet', you say 'eat'") these children were able to delete a single phoneme in a word provided that this phoneme was the onset of the word. These children were much more successful at this task than they had

been with Bruce's. The children were correct in over 90% of the trials. Also, the children's age made no difference. The five year olds did as well as the six year olds. Clearly, children could delete a single phoneme in a word provided that the phoneme was the onset of the word (Calfee, 1977).

The study done by Content, Morais, Alegria, & Bertelson (1982) is similar to the task required in Calfee's (1977) study. Content et al. asked five year olds to delete the initial phoneme in a series of words. Three types of sounds were to be deleted, a vowel, a fricative consonant and a plosive consonant. When the vowel was deleted, it was always a whole syllable, but the consonants were the words' onsets. The words were in French, but an English equivalent of the vowel would be /apart/ to /part/ and the consonant task would be /beak/ to /eak/. Children listened while a puppet spoke an invented language and kept making mistakes which the another puppet corrected. The mistake was to put an extra phoneme at the beginning of the word which had to be removed. The children were then asked to take over for the second puppet. The children proved to be very good at deleting initial vowels and with some training on consonant tasks improved dramatically. A control group which did not receive this training did not do as well. Further, the children who were trained retained this advantage over the control group six months later. Both this study and that of Calfee (1977) refute Bruce's (1964) findings that it is nearly impossible for

children to work out what a word sounds like if a single phoneme is detached from it.

The fact that children achieve an awareness of syllables before they achieve an awareness of phonemes continued to be supported in the 1980's by Treiman & Baron (1981). Treiman and Baron gave children the syllable and phoneme tapping test and found similar results to that of I. Liberman's group at the Haskins Laboratory. Treiman (1987) suggests, however, that there is an additional level of awareness intermediate between syllables and phonemes, claiming that the ability to segment by phonemes is preceded by the ability to segment syllable units into the intrasyllabic units of onset and rime.

Awareness of phonemes appears to only come after a child is aware of larger units (Adams, 1990). Awareness of words develops earlier and easier than awareness of syllables; while, awareness of syllables precedes awareness of intrasyllables (onset and rime); and an awareness of intrasyllables develops earlier and easier than an awareness of phonemes (Adams, 1990; Kirtley, Bryant, MacLean, & Bradley, 1989; I. Liberman et al, 1974; I. Liberman, 1987; Treiman, 1985, 1991, 1992). However, from this it should not be misconstrued that phoneme manipulation is minimized.

Manipulation of phonemes is directly related to reading success (Calfee, Lindamood, & Lindamood, 1973). In a test developed to measure auditory perception and conceptualization of speech, Calfee et al. (1973) looked at children's

phonemic awareness. The Lindamood Auditory Conceptualization Test (LAC Test) (1971) required the manipulation of phonemes, and the findings of Calfee et al. (1973) supported the research indicated above that performance improved with age. Calfee et al. claimed that there was a relationship between children's ability to judge how many phonemes a word contains and their reading skills. They tested 660 school children, ages 6-18, on the LAC Test, concluding that the children's test scores were directly related to their reading and spelling ability. The Lindamoods also developed The Auditory Discrimination in Depth (A.D.D.) program to be used in consonance with the LAC Test in order to train beginning students, or students of any age who are functioning below their potential. Students were taught the basic auditory-perceptual skills they needed in order to read and spell accurately (Lindamood & Lindamood, 1975).

Treiman and Baron (1983) conducted a further study attempting to demonstrate that phonemic analysis training helps children take advantage of spelling-sound rules in learning to read. It was their intent to find out if a causal link exists between phonemic analysis ability and the ability to learn spelling sound rules. Eight preschoolers were used in Experiment 1, and 20 kindergartners participated in Experiment 2. Once again they used the puppet that "talked funny." Children were taught segmentation and blending of spoken syllables. Then they were taught to read four items that corresponded to the spoken syllables used in the first

part of the training (e.g. /h/, /em/, /hem/, and /lig/). Lig was the control item. It was predicted that learning the two small items would speed the learning of the related item, but would be of no help with the unrelated item. Treiman and Baron found their prediction to be true and concluded from this that there was a causal relationship.

In 1985, Treiman conducted four other experiments of the effects of syllable structure on the development of phonemic analysis and reading skills. Experiment 1 showed that eight year olds more easily learned word games that treated onsets and rimes as units than games that did not. In Experiment 2 and 3, the author found that it was more difficult for four and five year olds to recognize a spoken or printed consonant target when it was the first phoneme of a cluster than when it was a singleton. Experiment 4 extended these results to the printed words by showing that CCV nonsense syllables were more difficult for beginning readers to decode than CVC syllables. Treiman's work continues to be in the area of onset and rime.

This causal relationship pointed out by Treiman is especially noted in the study done by Bradley and Bryant in 1983. This is considered a landmark study for supporting the causal affect of phonological awareness to reading acquisition. Their study was twofold. Four hundred and three four year old children in Oxford, England, were the subjects for the initial study. Their skills with sound categorization were assessed before they had started to read, and these were re-

lated to their progress in reading and spelling over a period of four years. Sixty-five children with low scores on the original sound categorization tasks were selected from the original 403 to receive intensive training in sound categorization and rhyming. All of these 65 children had severe problems with sound categorization, falling at least two standard deviations below the mean at the beginning of this training project. By teaching them about sound categories and how these sound categories are represented by similar letter strings, they made significant progress. This progress was maintained, as is noted in a study done with these children four years later. Therefore, the results of less than ten hours of training showed that intervention was remarkably effective. In fact they had a higher spelling level than the other approximately 300 children who had had no sound categorization difficulty initially. Four years later these advantages continued while most of the children in the control group had attended remedial reading (Bradley, 1987). Bradley and Bryant state, " Although others have suggested a link between phonological awareness and reading, our study is the first adequate empirical evidence that the link is causal" (p. 421).

Earlier research of this nature had been done in Sweden, by Lundberg, Olofsson, and Wall (1980). They had looked at the issue of whether phonological awareness developed spontaneously as part of general cognitive development or if indeed it developed only after specific training and/or as a

spin-off effect of reading instruction. Lundberg et al. conducted a longitudinal study with kindergartners, ages six and seven. Swedish children start kindergarten later than children in many other countries. These children were given linguistic tasks of segmenting words into syllables or phonemes and an analysis of phoneme position test. In the latter, they had to say whether a particular phoneme came at the beginning, middle, or end of a word. Then they were asked to make up words that rhymed with other words given to them by the experimenter. A year later these subjects' progress in reading and spelling was measured. These children's scores on the initial tests of their ability to detect and manipulate syllables and phonemes were related to their reading skills at the end of the first year at school (even when the effects of differences of IQ were controlled). This study indicated that phonological awareness may be necessary but not sufficient for the acquisition of reading. A later study done by Olofsson and Lundberg (1983) showed that it was possible to increase phonological awareness among preschool children by a relatively short training period of six to eight weeks.

The study carried out in Denmark, by Lundberg, Frost and Petersen (1988), not only answered the question posed by Lundberg earlier in 1980, it also confirmed the findings of Bradley and Bryant. In August, 235 kindergartners in one part of Denmark were used as an experimental group, and 155 kindergartners in another part of Denmark were used as a con-

trol group. Children were given tests which measured their ability to detect words, syllables, phonemes and also rhyme. During the rest of the preschool year, September to May, the experimental group was given daily metalinguistic exercises and games. All of these students were assessed again in grade one. The prereaders who were trained to segment speech into phonemes before they received any reading instruction, learned to read and spell better than the control group who did not receive any instruction. They concluded that phonological awareness could be developed before reading ability and independently of it, and that this phonological awareness facilitated subsequent reading acquisition. This they felt, "provided unconfounded evidence of a causal link" (p. 282).

Wagner and Torgesen (1987) reviewed the literature regarding phonological processing and recount evidence which supports the causal relationships between phonological processing skills and the acquisition of reading skills. Their review includes both longitudinal, correlational, and training studies.

Several studies have shown the relationship between children's reading and their awareness of sounds. In this phonological awareness research, these studies found that the better children are at reading, the more sensitive they are to a word's constituent sounds. Tunmer and Rohl (1991) point out that although some awareness of phonemic segmentation is necessary for learning to read, some skills may be acquired or improved as a result of learning to read. These abilities



include: (a) forming and maintaining a phonological code in working memory; (b) generating orthographic images; and, (c) applying written orthographic rules. From this it suggests that phonological awareness may have a reciprocal relationship to reading. According to Tunmer and Rohl, this might explain why phonological awareness tasks that draw heavily on the spinoff skills of reading can only be performed by respondents who have already acquired some reading skills. They go on to say that this may account for why some readers in a nonalphabetic script are unable to perform the more complex phonological awareness tasks of phoneme reversal and deletion.

This is evident in the study done by Mann (1986a). She made a comparison between children who read an alphabetic and those who read a nonalphabetic script. Her study involved Japanese children in grades one through six. They were given a Japanese version of the syllable and phoneme counting tasks used by I. Liberman et al. (1974) and the syllable and phoneme deletion tasks used by Morais et al. (1979). In a comparison of the Japanese first graders performance on these tasks with American first graders on these same tasks, Mann found that both groups of six year olds did well on the syllable tasks, but that the American children did better on the phoneme tasks. She concluded that children become aware of phonemes as a result of being taught an alphabet.

Other studies have also indicated that phonological awareness occurs reciprocally with learning to read

(Perfetti, Beck, Bell, & Hughes, 1987). Their longitudinal study was initiated to add support to earlier studies which suggested that phonemic awareness and learning to read are mutually supportive. The performance of 82 first grade beginning readers was examined on tasks that tapped abilities of phoneme synthesis and analysis. Three tasks were designed, one for synthesis and two for analysis, and three groups were formed. Two of the three groups were taught by a basal reading series, and one group by systematic direct code instruction. Their findings supported the reciprocity hypothesis of phonemic awareness and learning to read. Perfetti et al. (1987) stated that studies have also shown that phoneme awareness benefits from learning to read, and vice versa.

This is supported in other research as well (Ehri, 1979, 1984; Goldstein, 1976; Perfetti, 1985). Yopp (1992) found that in order to benefit from formal reading instruction, learners need a certain level of phonemic awareness. Reading instruction then heightens their awareness of the language. In this, the research has come full-circle. Phonological awareness continues to be vital to the reading process. Evidence exists to indicate that at school entry, phonological awareness is dissociated from other cognitive skills to such an extent that it could be the source of a specific reading disability (Stanovich, 1986). Stanovich hypothesized that if there is a specific cause of reading disability, it resides in the area of phonological awareness. His 1986

study offers strong evidence that early identification and subsequent training in phonological awareness can partially overcome the reading deficits displayed by many children whose phonological skills develop slowly.

There have also been other training studies that show specific effects on reading success following training in phonemic segmentation (Perfetti et al., 1987). As noted earlier, Rosner and Simon (1971) observed higher reading scores in first graders who were trained in the analysis of words into syllables and phonemes. Treiman and Baron's (1983) prereaders trained in segmentation were successful in reading words specifically using the spelling-sound correspondences related to the trained segments. Bradley and Bryant's (1983) children who were trained for over two years to categorize words according to their similar rhyme patterns showed gains in reading. The gains were largest if training included alphabet letters in addition to sound categorization (Perfetti et al., 1987). Content, Morais, Alegria, and Bertelson (1982) also found that training kindergartners in phonemic awareness had significant effects after only four sessions of training. Lundberg et al. (1988) in their study used at-risk students and found that with phonological awareness training, the experimental group exceeded the reading and spelling ability of the control group which did not receive any training. In another study, Felton and Brown (1990) looked at phonological processes as predictors of specific reading skills in children at-risk for reading failure. Prediction

of poor reading was their primary interest. For their study they selected children who were already at-risk for reading failure, also. Eighty-one subjects were assigned to experimental and control groups for a two-year intervention study of the effects of different methods of teaching reading in the classroom to at-risk children. These were chosen from 991 kindergartners in a North Carolina city-county school system. Although their results were not conclusive, the data did provide support for the importance of lexical access ability in early reading acquisition and suggested that different aspects of reading may be predicted by different combinations of phonological processing skills.

Blachman (1987), too, worked with at-risk students in the New Haven, Connecticut schools. She found that by providing an alternative classroom reading program for low-achieving children in grades one through three, students' reading achievement increased well above the national norm. In this longitudinal study teachers were taught to use a specific code emphasis approach to reading which included providing students with specific phonological awareness training. This intervention study also resulted in other positive benefits to teachers: (a) they learned effective ways to teach hard-to-teach children, (b) fewer discipline problems occurred because children were actively learning, and (c) standardized reading test scores increased substantially.

Phonological awareness studies done with children are not only abundant, but diverse. It is well-documented that

phonological awareness is significantly related to children's reading success as noted by the studies mentioned above. There is a plethora of other similar studies with children available in the literature. The ones mentioned are representative of the field and adequately make the point that phonological awareness is an important factor in children's learning to read. There are not, however, that many studies which have been conducted with adult subjects in this field. Yet, despite the limited amount of research available, much of the information obtained by the studies with children is similar to that found with illiterate and reading disabled adults.

#### Phonological Studies with Adults

It should be noted here that many studies which have been done in phonological awareness focus primarily on children who are beginning to learn to read. Also, skills of phonemic manipulation, and skill at manipulating the sounds of a word are associated with learning to read (I. Liberman, 1973). When phoneme manipulation was taught to preschoolers, it increased their early reading achievement (Bryant & Bradley, 1983). These skills may be defective in adult illiterates (Campbell & Butterworth, 1985; Marcel, 1980). Thus, research concedes that early training in phonological awareness has significant benefits for later reading ability.

Because the ability to decode words is a much needed skill when children begin to learn to read, lack of decoding

skills produces a domino effect or what Stanovich (1986) calls the Matthew Effect. Deficiencies in decoding cause children to rely on outside help for word recognition. If this is not readily available, they then tend to guess at words. Incorrect guesses cause further breakdowns, making reading such a difficult task that some readers tend to finally give up on reading. Consequently, the readers' sight vocabulary would tend to remain small, which in turn would limit their ability to access whole word pronunciation of the written word through the associative process. These children, therefore, grow up to be poor readers, and their decoding deficit can persist through college age and well into adulthood. Phonology, therefore, plays a vital role in reading (Aaron & Baker, 1991).

Russell's (1982) findings, that deficient phonological sophistication may account for the reading difficulties of reading disabled adults, continue to be confirmed. All of this is as a result of what is known as the Matthew Effect in reading. According to Stanovich (1986), "Lack of exposure and practice on the part of the less skilled reader delays the development of automaticity and speed in the word recognition level. Thus reading for meaning is hindered, unrewarding reading experiences multiply, and practice is avoided or merely tolerated without real cognitive involvement. The downward spiral continues--and has further consequences" (p. 364).

Although it is commonly understood that decoding skills

are important in beginning reading, they are just as important in skilled reading. Without this skill the readers' ability to pronounce unfamiliar and uncommon words is hampered at any age. Decoding skills, alone, are not sufficient to produce successful reading performance; however, they are vital to this performance (I. Liberman et al., 1989). Aaron and Baker (1991) found that poor phonological skills impede the decoding process and have secondary effects which may be viewed as characteristics of poor phonological processing skills. These are (a) poor short-term memory, (b) difficulty in retrieving the name of a word quickly, (c) poor ability in reading nonwords and multisyllable words, and (d) poor spelling.

Some of the most notable work done with adults and their phonemic awareness was done by a group of Belgian researchers who concluded that awareness of phoneme segmentation does not develop spontaneously even by adulthood, but arises as a concomitant of reading experience. This study was conducted by Morais, Cary, Alegria and Bertelson (1979) in a rural community in Portugal. The subjects, 30 illiterate Portuguese adults were compared with 30 Portuguese adults who had recently learned to read. Illiterate adults are defined here as those living in a rural area in Portugal who had not had the opportunity for schooling. The two tasks administered were deletion and addition of initial phonemes. The illiterate adults were unable to delete or add a phoneme at the beginning of nonwords while their counterparts could. The

study indicated that the ability to deal explicitly with the phonetic units of speech is not acquired spontaneously. The conclusion was drawn that people become aware of the sounds in words as a result of learning to read. In their study, it was found that adult illiterates lack phonemic awareness, and that adults who had recently acquired literacy showed phonemic awareness. This was conclusive evidence to them that print promotes phonemic awareness.

In 1986, Morais, Cluytens, Alegria and Content compared illiterate adults again to adults who had been illiterate. This time the adults were given syllable and phoneme deletion tasks and also rhyming tasks. The deletion tasks involved only nonsense words and the unit to be detached was always the same one. In the phoneme task the subjects were given only nonsense words beginning with /p/ and they had to say the words without the consonant. In the syllable task, the sound that was to be deleted was the vowel /u/ followed by a consonant. The illiterate adults were much worse at all the tasks; however, they did better with syllables than with phonemes, finding the syllable deletion tasks easier than the phoneme ones.

Building on their previous work, Morais, Content, Bertelson, Cary and Kolinsky (1988) conducted a study just with illiterate adults. These subjects were given quite explicit instruction and provided with corrective feedback. All the illiterates were able to achieve perfect scores with just a few trials. The people were given a deletion task in



which they were asked to delete either a consonant or a vowel from a nonsense word (e.g. fak-ak or aki-ki). This time though, Morais et al. (1988) told their subjects whether their responses were correct or not. They concluded that while the experience of learning to read may make people aware of sounds, there are other ways to promote this awareness.

I. Liberman et al. (1974), had looked specifically at explicit syllable and phoneme segmentation ability in young children and found that breaking words down into syllables was easier than segmenting phonemes. Morais and his colleagues found similar results in all their studies with adults subjects. Although the illiterate adults were worse at both tasks, they were at a much greater disadvantage in the phoneme tasks than they were in the syllable task (Morais et al, 1979; Morais et al., 1986). However, this difficulty was not confined just to phonemes, the illiterate people were also worse at detecting "rimes" in a rhyming task where they were to say which two out of a set of five words rhymed (e.g. had, cat, has, mit, mat) (Morais et al., 1986).

In mainland China, Read, Zhang, Nie and Ding (1986) conducted a similar study to that done by Morais et al. (1979). The authors compared Chinese people who had been taught an alphabetic version of written Chinese (pinyin) as well as the traditional Chinese script (which is logographic rather than orthographic) to Chinese people who had only learned the logographic script. Those Chinese adults who had

been taught pinyin (an alphabetic version of written Chinese) did much better on the segmentation tasks than those who had only learned the traditional logographic script. Read et al. states, "It is not literacy in general which leads to segmentation skill, but alphabetic literacy in particular" (p. 41). His findings were similar to those noted by Mann (1986a) earlier in this paper.

Byrne and Ledez (1983) also attempted a confirmation of the Morais et al. (1979) study in Australia. The experimental group contained 25 males and 6 females ranging from 17-45 years of age. Many of these were recruited from adult literacy classes; most of whom had been to school for the minimum legal period. Although the intent was to replicate the study of Morais et al. (1979), finding a matching control group was problematic. The control group consisted of 14 females and 5 males. Nine of the 19 were from occupations similar to the experimental group, while 10 were from a community college. It should be noted, that the control group was possibly more intellectually able, in general. The researchers basically wanted to know if near-illiterate adults have a working awareness of the phonemic principle. "Overall, the results look very much like comparable data from work with children" (Byrne & Ledez, 1983, p. 195). This study showed reading disabled adults to be deficient in the phonetic encoding of spoken words in a continuous word recognition task. However, their performance was comparable to that of normal readers in nonword recognition.

In 1987, Simpson and Byrne did a similar study, comparing reading disabled and normal reading adults on these same tasks. In addition, they controlled for ability by selecting subjects in the low average range on two mental ability tests, the Peabody Picture Vocabulary Test Form M and the Standard Progressive Matrices of the Raven. This time 24 subjects were used, matching 12 poor adult readers from literacy classes with 12 good adult readers who were selected from adult education classes other than literacy. In comparing results of this study with the earlier study of Byrne & Ledez (1983), the authors concluded that employment of phonetic encoding may be ability linked. Once again reading group membership did not predict the size of the phonetic confusion effect with nonwords. Simpson and Byrne (1987) concluded that there is no clear distinction in the use of phonetic coding between weak and coping adult readers. Their particular choice of good readers for this study may account for this.

In England, Campbell and Butterworth (1985) found just the opposite results in a case study they conducted of a highly literate adult who could not read nonwords. Although, this adult possessed normal auditory phoneme discrimination, she performed poorly on tasks requiring rhyme judgment as well as on homophone matching that required awareness of phonemic structure. She was also impaired at segmenting "heard" words into their component sounds. Campbell and Butterworth (1985) suggested (a) that good word

reading and writing may yet coexist with a range of problems leading to impaired nonword reading and writing, and (b) that the particular impairment of their subject suggests a more general and deeper impairment than that indicated by examining her word and nonword reading and writing in isolation. They concluded that the subject showed a deficit in the ability to reflect upon and manipulate phonemic information, which is necessarily most pronounced when nonwords rather than real words are the stimuli.

Another study which illustrates the importance of nonword reading as a predictor of successful reading ability was also conducted with college students. Cunningham, Stanovich and Wilson (1990) conducted a study of 76 college students on word recognition and reading-related cognitive processes. This multivariant investigation included a criterion reading comprehension measure as well as measures of vocabulary, listening comprehension, intelligence, reading rate, letter matching, digit span, and working memory. The study also included measures of letter, number, and symbol naming speed; a word decoding task; and the ability to name rapidly and accurately a set of pseudowords. Students were designated as good and poor readers on the basis of the median split on the comprehension portion of the Nelson-Denny Reading Test. Thirty-nine subjects answered 26 or less of the 36 comprehension questions correctly and were considered the poor readers. Those answering 27 or more of the comprehension questions correctly were considered the good readers

(27 correct corresponds to a grade equivalent of 15.1). The importance of this study to this paper is that pseudoword naming explained a significant proportion of the variance and continued to account for significant variance in reading comprehension when all the other measures were analyzed.

Cunningham et al. stated, "The uniqueness of the linkage between pseudoword naming skill and reading ability was established repeatedly, even in analyses considerably biased against the decoding factor" (p. 154).

Another study with college students was conducted by Kitz & Tarver (1989). The intent of these researchers was to determine if the phonemic awareness skills of college-aged reading disabled students differed from those of their non reading disabled peers. Twenty students participated in the study, 10 reading disabled and 10 non-reading disabled. These reading disabled subjects had all received considerable language remediation and were all succeeding at their college studies at a level that did not significantly differ from the nondisabled subjects. However, they performed significantly poorer on two measures of phonemic awareness: (a) reading of nonsense words, and (b) reversal of common three phoneme words. The results of this study suggest that although the reading disabled subjects had improved their reading skills, there remained a fundamental deficit in their ability to process phonological information quickly and accurately.

An earlier study than that of Kitz and Tarver (1989) was conducted by Aaron and Baker (1982). Students were solicited

via a newspaper advertisement to participate in a reading research-remediation project. After testing 22 respondents, 17 qualified as having reading deficits. Five were female and 12 were male. The basic intent of this project was to classify the students' disabilities rather than to remediate them. Although the authors did not look critically at the relationship of these students' phonological awareness to their reading deficits, they do explain in a later work (Aaron & Baker, 1991) that the previous deficits of these students was significantly related to their lack of phonological processing skills.

Pratt (1985) did a comparison study with children and adults showing that success at learning to reading is related to the extent to which they are aware of the phonological structure of spoken language. In the adult portion of this study 26 Adult Basic Education (ABE) and Literacy Volunteers students were selected and divided into equal groups of good and poor readers. Poor readers were beginning and intermediate ABE students and from the Literacy Volunteers. The good readers were from the advanced ABE classes. Pratt found that good and poor readers' scores were significantly different on all three of the phonological awareness variables. She concluded that phonological awareness appears to be related to reading skill in adults, as well as in children.

Levinthal and Hornung (in press) used college-age subjects with reading and spelling scores within a normal range for a phonological coding match/nonmatch study. Students

were asked to make judgments on word pairs on the basis of phonological similarity (a rhyme match) (e.g. /make/ and /ache/) or orthographic similarity (a visual match) (e.g. how and low). It was concluded that poorer readers were less vulnerable to phonological interference when making visual discriminations, and poorer readers and spellers were more vulnerable to orthographic interference when making rhyme matches. This showed that a deficiency in phonological coding and an over-reliance upon orthographic coding can be seen in relatively poor readers and spellers within a normal adult population.

In a study of adults in a community literacy class, I. Liberman, Rubin, Duques, and Carlisle (1985) found that these adults' performance on both reading and spelling of nonsense words was quite poor. On a task of phoneme analysis, requiring subjects to identify the initial, medial, or final sound in words they managed to produce correct responses on only 58% of the items. Although this is a common enough task in first grade classroom, these adults found the task frustrating and unpleasant (I. Liberman et al. 1985). In their article, I. Liberman and Shankweiler (1985) state that this inability of adults with literacy problems to perform well on tasks requiring explicit understanding of phonological structure supports the findings of other investigators in this field such as Byrne & Ledez, 1983; Marcel, 1980; Morais et al., 1979; and Read et al., 1986.

Felton, Naylor, and Wood (1990) conducted a study of 115

adults with well-documented childhood reading status. These subjects, 18 female and the rest male, underwent a series of neuropsychological tests in order to define the neuropsychological profile of reading disability in adulthood. The hypothesis that deficits in phonological processing comprise the core cognitive deficits in adults with a history of reading disability was supported. Felton et al. found difficulty in nonword reading interesting since many of the subjects had received intensive tutoring designed to teach sound/symbol associations and blending. "Clearly, nonword reading is a difficult task for many reading disabled adults even when specific instruction in decoding has been provided" (Felton et al., 1990, p. 494).

#### Summary

There is a great deal of similarity between the studies done with children and those done with adults in the area of phonological awareness. Studies in this review indicate that phonological awareness is not just a common denominator in English but an important factor in any language that makes use of an alphabetic script (Goswami & Bryant, 1990; Mann, 1986a; Tunmer & Rohl, 1991).

Although there is consensus regarding the importance of phonological awareness there are conflicting views as to whether phonological awareness is the cause or consequence of reading. As children are taught to read they may learn how to divide words into their constituent sounds. In this case



learning to read causes phonological awareness (Perfetti, 1985; Perfetti et al., 1987; Tunmer & Lally, 1986; Yopp, 1988, 1992). Morais and his colleagues found this also to be true with adults (Morais et al., 1979; Morais et al., 1986).

Another possibility is that before children learn to read they acquire phonological skills which may effect how well they learn to read. Here phonological awareness is the cause of learning to read. Support for this theory may be found in the work of Fox & Routh (1975), Bradley & Bryant (1983), and Lundberg et al. (1988). Whether phonological awareness is consequential, causal, or reciprocal, it is clear that it plays a critical role in learning to read (Ball & Blachman, 1991; Goswami & Bryant, 1990; Stanovich, 1986; Tunmer & Rohl, 1991; Wagner & Torgesen 1987).

When I. Liberman (1971) wrote of phonemic awareness she was referring to the reader's explicit, conscious awareness of the sounds which are assigned to written symbols in words. Although it is described as a single skill by Olofsson & Lundberg (1983), according to Lundberg et al. (1988), it is influenced by three ability factors: (a) recognition of initial phonemes, (b) phonemic segmentation, and (c) phonemic synthesis. Others consider that there are two types of phonological awareness skill, synthesis (blending) and analysis (segmentation). The studies in this review indicate the wide variety of tasks used to assess and train synthesis and analysis skills in children and adults. Goldstein (1976) suggests that synthesis may be independent of and easier to

acquire than analysis skills, while Fox and Routh (1975) suggest that acquisition of synthesis skills may depend on the availability of some minimal level of segmentation ability. This latter view seems to elicit more support (Lundberg et al., 1988; Perfetti et al., 1987).

This review also discusses the developmental aspects of phonemic awareness as illustrated in research. This research notes that it is easier to divide sentences into words (Fox & Routh, 1975) than it is to divide words into syllables and that is easier than dividing syllables into phonemes (I. Liberman et al. 1974; Morais et al., 1979). Treiman (1987) illustrates the value of dividing syllables into intra syllables or onset and rime and this is supported by the work of Fox & Routh (1975), Calfee (1977), and Content et al. (1982). Awareness of phonemes seems to come only after readers are aware of larger units; although, it is the one most directly related to decoding skills (Adams, 1990).

Finally, this review has cited the correlational relationship between phonological processing deficits and reading failure both in children and adults. Several researchers have noted that effective processing of the phonological structure of spoken language distinguishes between good and poor readers (Jorm & Share, 1983; I. Liberman & Mann, 1984; Mann, 1986b; Wagner & Torgesen, 1987). According to the literature, the most discriminant factor between good and poor readers continues to be the accuracy and speed with which they can read nonwords (Ehri, 1991; Perfetti &

Hogaboam, 1975; Snowling, 1987; Tunmer & Rohl, 1991). This has been true particularly in the studies which have been conducted with adults.

Although learning to read as a process generally occurs in childhood, many adults experience reading difficulties despite years of instruction (I. Liberman, 1987). Lack of reading skills as a child hinders reading in adulthood. The need for phonological awareness is paramount to reading fluency at any age.

## CHAPTER III

### METHOD AND PROCEDURES

#### Introduction

The purpose of this study is to determine if phonological processing deficits have a significant relationship to the reading difficulties of college students. This chapter discusses the subjects studied in the investigation, the instruments and procedures used to assess reading ability and phonological awareness, and the data analysis procedures.

#### Subjects

Two hundred eighty five students attending a medium-size university in the Midwest were screened for reading ability on the Nelson-Denny Reading Test (Brown et al., 1981). Forty-six of the 58 students who volunteered, qualified as good and poor readers (those reading at or above 13.6 grade level and those reading at or below 11.6 grade level respectively on the Nelson-Denny). Those whose raw score ranged between 77 and 95 on the Nelson-Denny were considered neither good nor poor readers for the purpose of this sampling. Twenty-three were good readers and 23 were considered poor readers. Subjects ranged in age from 18 to 43. All the students had graduated from high school and had gained admission

to the university by normal admission procedures. All were current university students and were in their second semester as freshmen or at higher grade levels (see Table I).

TABLE I  
DISTRIBUTION OF SUBJECTS BY SEX AND GRADE

Subjects	Sex	Grade Level					N
		13	14	15	16	16+	
Good Readers (N=23)	F	2	1	2	3	0	8
	M	5	5	2	2	1	15
Poor Readers (N=23)	F	9	1	4	1	0	15
	M	3	3	1	1	0	8
Total		19	10	9	7	1	46

Prerequisites to this study were (a) English must be their native language, and (b) none could have any known handicapping conditions which impaired their reading ability. There were non-native speakers who volunteered for this study. They were tested, but the results of the tests were not included in the data analysis. No known handicapping conditions existed for any of the subjects which had impaired their reading ability.

Students who were enrolled for the spring semester in a Reading Study Skills class and those students on academic probation who were enrolled in the Academic Assessment and

Evaluation course constituted the core of the subjects. Volunteers from these classes were then asked to participate in a further evaluation of their reading ability and phonological awareness. In addition to these two groups, other college students who qualified as good or poor readers were asked to participate in this study. They were solicited by means of a flyer advertising this study posted around campus. This flyer (Appendix A) asked students who felt they had any reading difficulties and/or reading related problems to participate in this study. An advertisement (Appendix B) was also placed in the campus newspaper soliciting subjects for this study.

#### Instruments and Procedures

Students were asked to complete a short Personal Information Questionnaire (Appendix C) indicating gender, date of birth, college, native language, graduation from high school, and any information regarding their previous reading problems or those of their immediate family (problems which might be physically or biologically related to their reading, and any environmental, socioeconomic or educational experience which could have affected their reading ability). Students were also asked their age and their grade in school.

In a group setting, students were given the Nelson-Denny Reading Test Form E (Brown et al., 1981). This test measures three areas of reading achievement: reading comprehension, vocabulary development, and reading rate. According to the

authors, these are the three most important skills involved in the reading process and are related and interdependent. The Nelson-Denny consists of two subtests: Vocabulary and Comprehension. The Vocabulary test consists of 100 items, each with five answer choices. It has a time limit of 15 minutes. The Comprehension test contains eight reading passages and a total of 36 questions, each with five answer choices. It has a time limit of 20 minutes. However, the first minute of this portion of the test is used to determine reading rate. The raw score is determined by the formula vocabulary plus two times the comprehension score ( $V + 2C$ ).

Parts 4 and 5 of the Stanford Diagnostic Reading Test (SDRT) Blue Form G (Karlsen & Gardner, 1985) were also administered in a group setting. The SDRT is a group-administered, norm and criterion referenced test which measures decoding, vocabulary and comprehension. The decoding portion consists of parts 4 and 5, and measures phonetic analysis and structural analysis of words respectively. The Blue Level is designed for students at the end of eighth grade through college.

Aaron and Joshi (1992) noted that five different statistics could be obtained from the SDRT. However, for the purpose of this study, only the raw score will be analyzed. The raw score is the number of questions a student has answered correctly. The SDRT is a timed diagnostic reading test. Part 4 takes 12 minutes while Part 5 takes 9 minutes. Part 4, Phonetic Analysis, measures the student's ability to

recognize the same consonant or vowel sounds represented by the same spelling or two different spellings. Part 5, Structural Analysis, measures the student's ability to divide three-syllable words according to rules for dividing words with affixes, and also the ability to divide three-syllable words according to the V-CV, VC-V, VC-CV, and C + le syllabication rules. Each of these two subtests contain 30 items.

The Nelson-Denny and the SDRT were given as group tests in a classroom setting. In order to assess student's phonological awareness more thoroughly, the following tests were individually administered to university students who agreed to participate further in this study: Coltheart's Regular and Irregular Word Lists (Coltheart, Davelaar, Jonasson, Besner, 1977), Aaron and Joshi's Nonword List (Aaron and Joshi, 1992), and Parts 3 and 4 of the Woodcock Reading Mastery Test-Revised (WRMT-R) Form H (Woodcock, 1987), and the Lindamood Auditory Conceptualization Test-Revised (LACT-R) (Lindamood, 1992).

Students were asked to orally read the Regular and Irregular Word Lists adapted from Coltheart et al. (1977). Each of the lists consisted of 36 words. Regular words follow the grapheme-phoneme structure of the language. This word list assessed the student's ability to decode words by following letter-sound rules and blending procedures. Irregular words are generally considered more difficult to read than regular words (Goswami & Bryant, 1990). Irregular words



are also similar to regular words in that they are commonly used and easily recognizable; although, they do not have a direct correspondence between sound and symbol. There are two types of irregular words: (a) those in which the sequence of letters represent different sounds from the ordinary sequence of sounds such as /come/ or /love/ and, (b) those that contain sequences of letters which make different sounds in different words such as /broad/ and /board/.

The Nonword List of Aaron and Joshi (1992) was also administered in like manner. This, too, is a list of 36 one and two syllable words which students were asked to orally read. The term nonwords is used interchangeably with pseudowords or nonsense words in phonological awareness research. They are defined as words which cannot be found in any mental lexicon (Snowling, 1987). Although nonwords are not real words, they do follow basic grapheme-phoneme rules and therefore knowledge of these rules allows for their pronunciation. Since they cannot be assessed or pronounced by identifying their meaning first, they are a good indicator of whether a student has learned the grapheme-phoneme rules. Schwartz (in press), Felton, Naylor and Wood, (1990), and Kitz and Tarver (1989) all found in their studies that, "Accuracy of nonword reading is a potent indicator of a history of reading disability even in subjects with relatively intact single word reading and comprehension skills" (Felton et al., 1990, p. 495).

Next students read aloud Parts 3 and 4 of the Woodcock

Reading Mastery Test-Revised (WRMT-R). The WRMT-R was individually administered and has six subtests that measure reading readiness, decoding and comprehension. The decoding portion of this test includes Part 3 Word Identification and Part 4 Word Attack. Again, this test provided several types of scores; however, the raw score was used for analysis purposes in this study.

Part 3 (Word Identification) of the WRMT-R requires the subject to identify isolated words that appear on a word list of 106 items arranged in order of difficulty. As subjects proceed through the items, they encounter words that appear less and less frequently in written English. For an answer to be scored correct, the subject must produce a natural reading of the word within five seconds. According to the test manual, the average raw score for a college senior on Test 3 is 98.

Test 4 (Word Attack) of the WRMT-R requires the subject to read either nonsense words or words with very low frequency of occurrence in the English language. The test measures the subject's ability to apply phonic and structural analysis skills in order to pronounce words with which he or she may be unfamiliar. Nonsense words have been chosen as the main stimuli for this test because the task faced by a subject encountering a nonsense word closely simulates the real-life task of a person encountering an unknown, though real word. The Word Attack contains 45 items arranged in order of difficulty. The average raw score for a college se-

nior is 37 on Test 4 (Woodcock, 1987).

Finally the Lindamood Auditory Conceptualization Test-Revised (Lindamood, 1992) (LACT-R) was given to students individually to test their phonological awareness. The LACT-R is a revision of the LAC Test (1971) and is not published as yet. Just as its predecessor, it is an individualized test designed to measure auditory perception and conceptualization of speech sounds. It is suitable for administration at any chronological or functional age and at any academic level with individuals who understand the concepts of sameness and difference, numbers to four, and left-to-right progression (Lindamood & Lindamood, 1979). The test consists of a series of encoding tasks similar to those inherent in reading and spelling. The auditory-conceptual skill that is measured involves the ability to discriminate one speech sound from another, as in distinguishing the sound of /p/ from the sound of /b/ or /sh/ from /ch/. It also measures the ability to perceive and compare the number and order of sounds within spoken patterns, as in discerning the difference between /at/, /pat/, /tap/, and /apt/. In addition to measuring sameness and difference of syllables, word pairs and auditory patterns, the LACT-R also provides a precise conceptualization of how and where patterns differ by judging the identity, the number, and the sequence of sounds in spoken patterns, and conceptualizing the points of contrast between patterns.

The LACT-R is divided into seven subtests. Category IA

measures the subject's ability to perceive isolated sounds in a sequence, and it contains 10 items. Category IB measures the order of that sameness or difference, and it contains six items. Different sounds are measured by different colored blocks. For example, if the examiner says /s/ /s/ /s/, the subject uses three colored blocks of the same color to represent the three sounds. If the examiner says /sh/ /ch/, the subject uses two blocks of different colors. Category I actually verifies that the encoding task is understood.

Category I and IB were also used to assess whether any differences the subjects may have had on this test were due to analytic deficits rather than linguistic ones.

Category II measures the subject's ability to discriminate sounds and perceive their order within a syllable pattern. Category II originally contained 12 items, but has now been revised to contain 18 items. These last six items not only extend the task in Category II, but they also increase the difficulty level. They are titled Category IIXXX for future purposes of item analysis. In the tasks of Category II and Category IIXXX, the subject must track and represent changes that occur in these patterns as single sounds are added, substituted, omitted, shifted, or repeated. According to the authors of the test, once the initial syllable pattern is represented by a row of blocks, the subject uses this row to indicate changes in the next syllable pattern by adding or taking away blocks, shifting their order or making substitutions. In this way, each block pattern executed cor-

rectly becomes the base for the pattern that follows (Lindamood & Lindamood, 1979).

Category IIIA measures the subject's ability to break words into syllables. The task in Category IIIB is similar to Category II, only felt squares are substituted for the blocks, and the subject must track and represent changes that occur in multisyllable nonsense words as syllables are added, substituted, omitted, shifted, or repeated. Category IIIC is a combination of Category IIB and IIIB where the subject manipulates both syllables represented by the felt squares and sounds represented by the blocks which are placed on just one syllable. This entire test takes approximately 30 minutes to administer.

#### Data Analysis

This study is designed to compare differences in reading ability (the dependent variable) on seven measures (the independent variables) of phonological awareness. Reading ability was determined by the Nelson-Denny Reading Test. Utilizing a t-test, differences were judged significant at  $p < .05$ .

For each of the phonological awareness tests, a corresponding test was given to corroborate the research findings. A correlational analysis, using the Pearson Correlation Coefficient, was computed to show how these tests scores are related to each other. It was predicted that there would be a significant relationship between the following: the SDRT

Parts 4 and 5 and the LACT-R, the Regular and Irregular words and the WRMT-R Part 3, and the Nonwords and WRMT-R Part 4.

According to Perfetti and Hogaboam (1985), accuracy and speed of naming nonwords are two tasks that most clearly differentiate good and poor readers. This continues to be supported in the literature (Aaron and Joshi, 1992; Ehri, 1991; and, Tunmer and Rohl, 1991). Therefore, a strong relationship should exist between the inability to read nonwords and poor readers. This would be illustrated on the subject's ability to read Aaron and Joshi's Nonword List and the WRMT-R Part 4.

The Nelson-Denny Reading Test is a commonly used standardized reading achievement test given to adults. It has been used in other studies of phonological awareness to distinguish good and poor readers (Cunningham et al, 1990). The SDRT and the WRMT-R are standardized tests and are normed for use with adult subjects also. The WRMT-R is a revision of the WRMT both of which have also been used by other researchers in their studies of phonological awareness (Calfee et al., 1973; Aaron, Frantz, & Manges, 1990).

The LACT-R is a new version of the Lindamood Auditory Conceptualization Test (1971) which has been used often in the assessment of phonological awareness skills (Calfee et al, 1973; Cunningham et al., 1988; McCarty, 1990; Pratt, 1985). The LACT-R has not been published as yet, but this new version was offered by Patricia Lindamood for the purpose of this study. The Regular and Irregular Word Lists of

Coltheart's have been used in several research studies (Coltheart et al. 1977; Coltheart, Masterson, Byng, Prior, & Riddoch, 1983; Joshi & Aaron, 1990; Hulme and Snowling, 1988; Snowling, 1987; and Snowling and Hulme, 1989). The Nonword test found in Aaron and Joshi (1992) has not been used as frequently, but it was used in the study done by Aaron et al. (1990). It is considered an acceptable test for assessing phonemic awareness (Aaron & Joshi, 1992).

None of these tests have been used in combination before and the statistical analysis will indicate not only their relationship to one another, but also their usefulness in determining the phonological awareness of good and poor college readers.

## CHAPTER IV

### ANALYSIS OF DATA

#### Introduction

The purpose of this chapter is to present the statistical analysis utilized to test the hypotheses in this study. One goal of this study was to distinguish good and poor readers at the college level. A second goal was to determine if there was any significant difference between these two groups in their phonological processing skills. Finally, a third goal was to examine the relationship of the phonological tests administered in this study in order to see if there was any correlation between tests, and just how significant this correlation was between these tests. As stated in Chapter III there should be a strong relationship among phonological tests.

For clarity, the analyses is organized in a sequence which first addressed the definition of groups. Next a brief discussion enumerated the different tasks which measure phonological skills. Then the hypotheses are stated and the analysis presented, followed by the correlation between tests and the correlation analysis. Finally, the summary of results is presented.



### Definition of Groups

The Nelson-Denny Reading Test was used to determine the groups for this study. Good readers were designated as those with the total raw score of 95 and above, while poor readers were those with a total raw score below 77. A minimum of two grade levels existed between groups and the poor readers were those whose scores were a minimum of two grade levels below the 13.6 grade level. All the subjects for this study were classified as at least second semester freshmen or at least at the 13.6 grade level and above when they took this test.

Since grade level was the determining factor in designation of groups, a more definitive look at the Nelson-Denny is offered by grade equivalent. The Nelson-Denny total score consists of a vocabulary score and a comprehension score. The mean, standard deviation and grade equivalent are presented for the vocabulary and comprehension score as well as the total score for both groups in Table II. The good readers did well on the vocabulary portion of the Nelson-Denny (Mean 72.30, grade equivalent 16.4). The ceiling on the vocabulary test is 16.9. The poor readers were significantly poor readers by definition of grade equivalent with a mean of 33.83 and a grade equivalent of 10.6. On the comprehension portion of the test the good readers' mean was 52.52 with a grade equivalent of 15.1. The ceiling on the comprehension test is 16.5. The poor readers had a mean of 30.26 with a grade equivalent of 8.6. The total mean for good readers was

124.86 with a grade equivalent of 16.0, while the poor readers had a mean of 64.52 with a grade equivalent of 10.1 (see Table II). The ceiling for the total score is 16.9. Therefore, for the purpose of this study two groups were defined and used to assess differences of phonological processing skills. One group was designated as good readers and this group was significantly different from the second group which was designated as poor readers. Both groups were defined by their Nelson-Denny total score.

TABLE II  
MEAN, STANDARD DEVIATION AND GRADE EQUIVALENCE  
FOR GOOD AND POOR READERS ON THE  
NELSON-DENNY READING TEST

Test	<u>Good Readers</u> (N=23)			<u>Poor Readers</u> (N=23)		
	Mean	SD	GE	Mean	SD	GE
ND Voc	72.30	12.35	16.4	33.83	7.10	10.6
ND Comp	52.52	8.64	15.1	30.26	7.61	8.6
ND Total	124.83	18.15	16.0	64.52	9.32	10.1

#### Phonological Tasks

Phonological skills are measured by different tasks such as the ability to break words into their constituent parts (syllables, intra syllables and phonemes) and the ability to

manipulate these word parts. Phonological awareness is also measured by the ability to accurately read nonwords and multisyllable words. In this study these tasks were measured by the following standardized and nonstandardized tests. The Stanford Diagnostic Reading Test (SDRT) measured students ability to distinguish similar phonemes in words (SDRT Part 4 Phonetic Analysis) and to correctly divide a word into syllables (SDRT Part 5 Structural Analysis). The ability to accurately read word lists of regular, irregular and nonwords is characteristic of fluent or good readers. The Regular Word List, Irregular Word List and the Nonwords List used in this study contain one and two syllable words. The Woodcock Reading Mastery Test-Revised (WRMT-R) Part 3 (Word Identification) is a list which progresses from one syllable to multisyllable regular and irregular words. The WRMT-R Part 4 (Word Attack) is a nonword test which also progresses from one syllable to multisyllable words. The Lindamood Auditory Conceptualization Test-Revised (LACT-R) is made up of tasks which combine skills in adding, deleting and manipulating syllables and phonemes in nonwords. The means and standard deviations are presented for each of these tests in Table III.

TABLE III  
COMPARING GOOD AND POOR READERS ON PHONOLOGICAL TESTS

Test	<u>Good Readers</u> (N=23)		<u>Poor Readers</u> (N=23)		t	Prob.
	Mean	SD	Mean	SD		
SDRT 4	23.13	7.05	20.96	5.93	1.13	NS
SDRT 5	24.87	2.69	24.09	3.04	0.92	NS
RegWords	35.78	0.52	33.74	5.49	1.78	NS*
IrrWords	34.61	1.41	32.30	2.14	4.31	0.0001
Nonwords	31.35	3.04	24.83	3.86	2.46	0.02
WRMTR 3	97.48	3.64	87.52	5.96	6.84	0.0001
WRMTR 4	37.30	3.95	33.48	4.98	2.89	0.01
LACTR	54.13	8.76	49.17	7.89	2.02	0.05

\* For t where the heterogeneity of variance was different df equaled 22.4; all the other scores were homogeneous with a df of 44.0.

On all of the tests, the groups were equally divided into 23 good readers and 23 poor readers constituting a total sample of 46 subjects (df 44.0). For all of the hypotheses, a separate  $t$ -test was computed with the level of significance being equal to or less than .05. All of the tests were reported using the equal variance  $t$ -score, with the exception of the Regular Word List. On this test the degrees of freedom were 22.4, and the unequal  $t$ -score was recorded due to the heterogeneity of variance.

A correlational analysis was also computed for all the tests administered in this study using the Pearson Correlation Coefficient (see Figure 2). It was originally hypothesized that certain of these tests would show a strong relationship to one another due to similarity of phonological tasks. In Figure 2, the correlation value is stated in a matrix format for the Nelson-Denny and all the phonological tests with the level of significance below each score. Anytime  $p$  is less than .05, there is a significant linear relationship between variables.

	ND Voc	ND Comp	ND Total	SDRT 4	SDRT 5	RegWords	IrrWords	Nonwords	WRMT-R 3	WRMT-R 4	LACT-R
ND Voc	1.00000 0.0										
ND Comp	0.80250 0.0001	1.00000 0.0									
ND Total	0.97015 0.0001	0.92102 0.0001	1.00000 0.0								
SDRT 4	0.29996 0.0428	0.29373 0.0476	0.30437 0.0397	1.00000 0.0							
SDRT 5	0.11305 0.4544	0.05571 0.7131	0.09981 0.5093	0.16856 0.2628	1.00000 0.0						
RegWords	0.30049 0.0425	0.33738 0.0219	0.33255 0.0239	0.00466 0.9755	0.02962 0.8451	1.00000 0.0					
IrrWords	0.58664 0.0001	0.49973 0.0004	0.58186 0.0001	0.36938 0.0115	-0.00742 0.9610	0.21873 0.1442	1.00000 0.0				
Nonwords	0.39471 0.0066	0.29048 0.0502	0.36474 0.0127	0.33128 0.0245	-0.05487 0.7172	0.14572 0.3339	0.44919 0.0017	1.00000 0.0			
WRMTR 3	0.77042 0.0001	0.67356 0.0001	0.76255 0.0001	0.38853 0.0076	0.04757 0.7536	0.39471 0.0066	0.73665 0.0001	0.63354 0.0001	1.00000 0.0		
WRMTR 4	0.46511 0.0011	0.37082 0.0112	0.43212 0.0027	0.23660 0.1134	0.09024 0.5509	0.47432 0.0009	0.43735 0.0024	0.63026 0.0001	0.74695 0.0001	1.00000 0.0	
LACTR	0.44411 0.0020	0.30800 0.0373	0.40989 0.0047	0.58359 0.0001	0.21572 0.1499	0.36355 0.0130	0.39392 0.0068	0.24605 0.0993	0.46285 0.0012	0.38066 0.0091	1.00000 0.0
	ND Voc	ND Comp	ND Total	SDRT 4	SDRT 5	RegWords	IrrWords	Nonwords	WRMT-R 3	WRMT-R 4	LACT-R

Figure 2. Pearson Correlation Matrix

### Statement of Hypotheses

It is hypothesized in Chapter I of this study that poor phonological processing skills are predictive of poor reading. It is also hypothesized that there is a significant relationship between phonological tests. The following hypotheses have been tested and the results discussed in this chapter. These hypotheses may be broken down in the following manner.

Hypothesis 1: There will be a statistically significant difference between the mean score of the good and poor readers on the Stanford Diagnostic Reading Test (SDRT) Part 4 (Phonetic Analysis).

Hypothesis 2: There will be a statistically significant difference between the mean score of the good and poor readers on the Stanford Diagnostic Reading Test (SDRT) Part 5 (Structural Analysis).

Hypothesis 3: There will be a statistically significant difference between the mean score of the good and poor readers on Coltheart's Regular Word List.

Hypothesis 4: There will be a statistically significant difference between the mean score of the good and poor readers on Coltheart's Irregular Word List.

Hypothesis 5: There will be a statistically significant difference between the mean score of the good and poor readers on Aaron and Joshi's Nonword Test.

Hypothesis 6: There will be a statistically significant

difference between the mean score of the good and poor readers on the Woodcock Reading Mastery Test-Revised (WRMT-R) Part 3 (Word Identification).

Hypothesis 7: There will be a statistically significant difference between the mean score of the good and poor readers on the Woodcock Reading Mastery Test-Revised (WRMT-R) Part 4 (Word Attack).

Hypothesis 8: There will be a statistically significant difference between the mean score of the good and poor readers on the Lindamood Auditory Conceptualization Test-Revised (LACT-R).

Hypothesis 9: There will be a statistically significant relationship as measured by the Pearson Correlation Coefficient between Coltheart's Regular and Irregular Word Lists and the Woodcock Reading Mastery Test-Revised (WRMT-R) Part 3.

Hypothesis 10: There will be a statistically significant relationship as measured by the Pearson Correlation Coefficient between Aaron and Joshi's Nonword List and the Woodcock Reading Mastery Test-Revised (WRMT-R) Part 4.

Hypothesis 11: There will be a statistically significant relationship as measured by the Pearson Correlation Coefficient between the Stanford Diagnostic Reading Test (SDRT) Part 4 and the Lindamood Auditory Conceptualization Test-Revised.

Hypothesis 12: There will be a statistically significant relationship as measured by the Pearson Correlation



Coefficient between the Stanford Diagnostic Reading Test (SDRT) Part 5 and the Lindamood Auditory Conceptualization Test-Revised (LACT-R).

### Results Related to the Hypotheses

Hypotheses and 1 and 2 were rejected. There was no significant difference between good and poor readers on Part 4 of the SDRT, nor was there any significance difference between good and poor readers on Part 5 of the SDRT.

The means and standard deviations for these two groups on Parts 4 and 5 of the SDRT are as follows. Good readers on Part 4 had a mean of 23.13 and a standard deviation of 7.05. Poor readers had a mean of 20.96 and a standard deviation of 5.93. On Part 5, good readers had a mean of 24.87 and a standard deviation of 2.69 while poor readers had a mean of 24.09 and a standard deviation of 3.04.

Hypothesis 3 was also rejected. There was no difference at the .05 level of significance between the good and the poor readers on the Regular Word List, although the variance in the groups was distinct. For the good readers there was not much variability on this test (minimum 34 maximum 36). This was not the case for the poor readers. On all of the other phonological tests the equal  $t$ -score was recorded for variance and all of the degrees of freedom (df 44.0) were homogeneous. However, for the Regular Word List (df 22.4), the unequal variance score was recorded because of the heterogeneity of variance (minimum 9 maximum 36). The mean for this

test was 35.9 with a standard deviation of 0.51, and for the poor readers the mean was 33.74 with a standard deviation of 5.49. The  $t$ -score was 1.78 and the significance level was 0.089.

For the rest of the hypotheses, the results of the  $t$ -test indicated a significant difference between groups at the .05 level. The most distinct significance occurred in the results of the Irregular Word List and Parts 3 of the Woodcock Reading Mastery Test-Revised, Hypotheses 4 and 6. These two tests consisted of similar tasks which measured phonological processing skills.

Hypothesis 4: There was a statistically significant difference between good readers (Mean 34.61, SD 1.41) and poor readers (Mean 32.30, SD 2.14) on the Coltheart's Irregular Word List. The  $t$ -score was 4.31 and this test was significant at the .0001 level.

This same level of significance was obtained in Hypothesis 6. There was a statistically significant difference between good readers (Mean 97.48, SD 3.64) and poor readers (Mean 87.52 SD 5.96) on the WRMT-R Part 3. The  $t$ -score was 6.84 and the level of significance was .0001.

In Hypothesis 5 there was a statistically significant difference between good readers (Mean 31.35, SD 3.04) and poor readers (87.52, SD 5.96) on Aaron and Joshi's Nonword List. The  $t$ -score equaled 2.46 and the level of significance for this test was .02.

In Hypothesis 7 there was a statistically significant

difference between good readers (Mean 37.30, SD 3.95) and poor readers (Mean 33.48, SD 4.98) on the WRMT-R Part 4. The t-score for the WRMT-R Part 4 was 2.89 and this test was significant at the .01 level.

Hypothesis 8 was supported. There was a statistically significant difference at the .05 level between good readers (Mean 54.13, SD 8.76) and poor readers (Mean 49.17, SD 7.89) on the LACT-R. The t-score for the LACT-R was 2.02.

Hypothesis 9 was accepted as significant at the .0001 level. The Irregular Word List and the WRMT-R Part 3 did prove to have a strong relationship. The WRMT-R Part 3 contained more words and more syllables than Coltheart's Irregular Words and proved to be more difficult overall than the latter. None of the words on the Irregular Word List followed the grapheme-phoneme pattern while the words on the WRMT-R Part 3 were a combination of regular and irregular words.

Hypothesis 10 also was supported. The Nonword List and the WRMT-R Part 4 were significantly related at the .0001 level. As with the Irregular words and the WRMT-R Part 3, the basic difference in these two tests was the number of syllables. The nonwords on the WRMT-R Part 4 grew increasingly more difficult and contained more syllables than those on the Nonword List.

Hypothesis 11 was supported and proved to be significant at the .0001 level. There proved to be a statistically significant relationship between the SDRT Part 4 and the LACT-R.

Hypothesis 12 was rejected. There was no significant relationship between the SDRT 5 and the LACT-R. The SDRT Part 5 did not correlate with any test in this study (see Figure 2).

Conversely, the LACT-R correlated with all of the tests administered in this study at a statistically significant level with the exception of the SDRT Part 5 and the Nonword List. In fact, there was a strong correlation among most of the tests. Another notable exception was the Regular Words List. In addition to not correlating with the SDRT Part 5, the Regular Words List did not correlate with the SDRT Part 4, the Irregular Words List, nor the Nonword List (see Figure 2).

#### Summary

As shown by the findings of this study there is a significant difference among good and poor readers at the college level on the phonological processing tasks. The Nelson-Denny proved to be an appropriate test for determining good and poor readers, while the majority of the phonological awareness tests pointed out the distinct differences in these two groups of readers in addition to their relationship to one another. The Stanford Diagnostic Reading Test (SDRT) Parts 4 and 5 and the Regular Word List were neither significant indicators of difference in good and poor readers nor significantly related to the other tests. Both the t-test and the correlation analysis, used to determine the

intensity of association between phonological tests, provided sufficient support for the hypotheses in Chapter 1 that poor readers possess phonological processing deficits, and there is a significant relationship between phonological awareness tests. The results are shown in Table III and Figure 2.

All of the tests used in this study have been widely used elsewhere, yet this particular combination of tests has not been used for the purpose of assessing phonological awareness or differences in good and poor readers.

## CHAPTER V

### SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

#### Introduction

Various government reports indicate that 10 to 15 percent of children and adults have severe reading difficulties (Carroll & Chall, 1975). More recent studies indicate that while many of these students drop out of school earlier than those without reading problems, increasing numbers now remain in school, and many continue on to college (Chall, 1987). Cohen (1984) also found that many students enter college with inadequate reading skills despite 12 or more years of formal education, adequate intellectual ability, and no visual or auditory problems. Estimates vary on the percentage of college students in the United States with reading disabilities. However, at a comprehensive university with a student population of approximately 20,000, such as the one in this study, it is estimated that at least 100 of them will have severe reading disabilities (Aaron & Baker, 1991).

This is explained by studies which found that adults who had problems as children still continue to have reading difficulties in adulthood (Felton et al., 1990; Snowling, 1991). Snowling argues that these problems are a result of an underlying language deficit affecting phonological process. She

believes that deficits of this nature prevented the acquisition of letter-sound skills at a critical time in these adults' lives. Thus their reading development had to proceed by means of compensatory strategies. Although these adult readers gradually acquired lexical knowledge by compensatory means, this lexical knowledge continued to remain impaired.

This is also supported by a study done by Cohen (1984). His study showed that college students with reading difficulties had found compensatory ways to achieve academic success. However, he goes on to report that a significant number of these students eventually drop out of college because of their language-related problems.

#### Purpose and Objectives

The purpose of this study was to investigate the reading difficulties of college students. It was hypothesized that reading disabled college students possessed fundamental phonological processing deficits and that these deficits are significantly related to their poor reading ability. The first objective of this study was to identify good and poor readers for the purpose of assessing a significant difference in their phonological awareness skills. Next, it was the intent of this study to measure these college readers' phonological awareness on various phonological tasks, also comparing differences between good and poor readers. Finally, this study examined the relationship between the phonological

tasks which were used to assess significant differences between these good and poor college readers.

Evidence strongly indicates that reading difficulties, experienced by both children and adults, stem from a lack of phonological awareness. Historically, much of the early reading disability research centered on the visual aspects of reading, blaming reading disabilities on the visual domain. (Aaron & Joshi, 1992; Harris & Sipay, 1985; Mann, Cowin, & Schoenheimer, 1990). However, now there is a general consensus in the field that only a few instances of reading disability can be traced to a difficulty in visual processing (Stanovich, 1985, Vellutino, 1979). Instead of being visually based, research indicates that reading disabilities are language-based. Language-based skills are those which require effective processing of the sound-elements of language. These problems with spoken language can be characterized as phonological processing deficiencies (Mann et al., 1990).

Not only does research show that reading disabilities are language-based, it also indicates that spoken language skills are stronger associates of early reading skill than visual skills, intelligence, or other general cognitive abilities (Jorm & Share, 1983; I. Liberman, 1983; Mann, 1984a, 1986; Stanovich, Cunningham, & Freeman, 1984). Also, Mann et al. (1990) found that the difficulties experienced by poor readers was attributable to some type of language impairment rather than auditory deficits, attentional deficits, deficient intelligence or general memory impairment. It is



widely acknowledged that phonological processing deficits are strongly related to reading failures. Over a period of almost 30 years, phonological research has brought about a radical change in views regarding reading disabilities. This is due to the robust findings in reading research of the strong relationship between reading ability and linguistic awareness (Stanovich, 1991).

#### Summary of Findings

This study looked at the literature regarding this strong relationship between phonological processing skills and reading success in both children and adults as well as the relationship between poor phonological processing skills and reading failure. Considering the amount of phonological awareness research which has been conducted with children, this experimenter chose to explore adult's phonological awareness. Few studies have been done with adults in this area and even fewer with college students.

The Nelson-Denny Reading Test Form E (Brown, Bennet & Hanna, 1981) was used as a screening device to assess college student's reading ability, and differentiate two distinctly different reading groups for this study. These groups were termed good and poor readers. All of the scores which fell in the middle range between good and poor readers were rejected as neither good nor poor readers and hence not used in any further data computation. Out of the 285 students who were given the Nelson-Denny Reading Test, 53 of them scored

below the 11.6 grade level. This constitutes 18.59 percent of the population sampled for this study. Twenty-three of the 53 poor readers agreed to participate further in the study. A total of 153 of the 285 students scored at or above the 13.6 grade level on the Nelson-Denny, constituting 53.68 percent of the students screened, leaving 27.71 percent of the students as neither good nor poor readers. Twenty-three of these 153 students remained in the study.

After the administration of the group reading ability test to the 285 students, volunteers who wished to participate further were given eight measures of phonological awareness which assessed student's ability to perform phonological processing tasks. The tests used to assess phonological awareness were the Stanford Diagnostic Reading Test Blue Form G (SDRT) Parts 4 and 5 (Karlsen & Gardner, 1985), an adaption of the Regular and Irregular Word List (Coltheart, Davelaar, Jonasson, Besner, 1977), a Nonword List (Aaron & Joshi, 1992), the Woodcock Reading Mastery Test-Revised Form H (WRMT-R) Parts 3 and 4 (Woodcock, 1987), and the Lindamood Auditory Conceptualization Test-Revised (LACT-R) (Lindamood, 1992). Scores on these tests were then computed by means of a  $t$ -test in order to determine the statistically significant difference between good and poor readers.

The SDRT did not prove to be appropriate for the purposes of this study. Students in both groups scored well and poorly on both of the subtests, Parts 4 and 5, and no statis-

tically significant difference between the mean was evidenced for either group on either test. It was noted that although there was no significant difference between means, there was considerable difference between the percentile and stanine scores for good and poor readers. No statistical analysis data was computed on this finding, however. There was a significant correlational relationship between the SDRT Part 4 and some of the other tests, yet there proved to be no significant correlation between any of the tests and the SDRT Part 5.

It was expected that the greatest significance found on any of these measures of phonological awareness would occur with the nonword tasks. This assumption was due to the reported findings in other studies which pointed out the strong relationship between the inability to read nonwords and phonological processing deficits. However, this did not prove to be the case in this study. The greatest significance level was found on the measures of irregular words, particularly the reading of multisyllable irregular words. The results of the Coltheart's Irregular Word List and the WRMT-R Part 3 were both significant at the .0001 level. The WRMT-3 contained both monosyllable and multisyllable regular and irregular words. In general, students had the most difficulty with the multisyllable words, but the poor readers had difficulty with both regular and irregular multisyllable words.

The results of the  $t$ -test on both nonword measures also proved significant. The results of the Aaron & Joshi Nonword

List was significant at the .02 level and the results of the WRMT-R Part 4 was significant at the .01 level. The Coltheart test proved relatively simplistic for the majority of students sampled in this study. It was made up of one and two syllable words while the WRMT-R Part 4 consisted of monosyllable to multisyllable words and proved more discriminating. Again students had more difficulty with pronouncing the multisyllable words in the later test. It was found that all the students with decoding deficits had difficulty with the nonword tasks. Nonwords are considered some of the best discriminators between good and poor readers because they cannot be found in any mental lexicon. Since they cannot be assessed or pronounced by identifying their meaning first, they are a good indicator of whether a student has learned the grapheme-phoneme rules. It should be recalled that these college students had had at least 12 years of formal education and still many of them had problems with pronunciation of irregular words and nonwords.

On the LACT-R there proved to be a slightly significant difference between good college readers and poor college readers. Category I and IB assessed whether any differences the subjects may have had with the LACT-R were due to demands of the task other than conceptualization of the phonemic segments. It was concluded from this portion of the test that none of the students had any general analytic deficits. This supports the evidence that the poor readers' deficiencies were phonologically based rather than the result of general

analytic deficits since no linguistic deficits were evidenced when they had to sequence sounds in isolation.

On the LACT-R, as with some of the other tests, the greatest difficulty occurred with multisyllable words. This was particularly evident in Category IIIC where the students had to manipulate both phonemes and syllables. In this subtest the difference between good readers (Mean 8.91, SD 3.35) and poor readers (Mean 6.56, SD 3.50) proved significant ( $t = 2.32$ ) at the .02 level.

The new addition to Category II, Category IIXXX, proved the most difficult task of all. In this extension of Category II, students were asked to discriminate sounds and manipulate their order within a syllable pattern. Students experienced the most difficulty when they had to reverse combinations of medial sounds (e.g. slest to slets, sleps to selps). On Category IIXXX where maximum was six and minimum was zero, the good readers (Mean 3.56, SD 1.90) did not do significantly better than the poor readers (Mean 2.56, SD 1.87). In order for this portion of the LACT-R to be significant  $t$  had to equal 1.79 and  $p$  had to be equal to .0798.

Certain issues have arisen over the last 20 years regarding adult's phonological awareness skills. These have been addressed in the literature and this study lends support to these previous findings. One of the issues with regard to adults is whether phonological awareness improves spontaneously with age or requires some form of instruction. This

of phoneme segmentation does not develop spontaneously even by adulthood, but arises as a concomitant of reading instruction and experience. Additional support for the findings of Morais et al. may be found in the studies done by Bryne and Ledez (1983), I. Liberman et. al. (1985), Marcel (1980), and Read and Ruyter (1985) who found that adults with literacy problems performed poorly on tasks demanding explicit understanding of phonological processing. In the study conducted by Pennington et al. (1987), they found that phonological coding skills continued to develop in nondisabled readers through adulthood.

These same findings were evident in this present study of college readers. It was found that the college students designated as poor readers also performed poorly on tasks demanding explicit understanding of phonological processing, while the good readers in this study performed significantly better on these same tasks. Even in adulthood, these college poor readers still possessed fundamental phonological deficits.

Another issue which arose in regard to adults' phonological awareness was whether or not their reading deficiencies could be attributed to general analytic deficits. Morais et al. (1984) addressed this in their study with six to nine year old children who had severe reading disabilities. They found that these children were poorer than normal readers in segmenting words into their constituent parts, but performed just as well as normal readers on tasks

that required them to deal analytically with words, but with musical tones. Pratt (1985) also addressed this issue in her dual study of children and adults. No difference was found at either age level with the nonlinguistic tasks, but there were significant differences between the good and poor readers at both age levels on the linguistic awareness measures. Both of these studies indicate that the deficiencies of poor readers are specifically language-related and more specifically phonological in nature.

The significant difference on the LACT-R score between good and poor readers in this present study with college students corroborates these findings also. The good readers performed significantly better than the poor readers in segmenting words into their constituent parts. On the LACT-R, Category I and IB were used as a control task. Both the good readers and the poor readers' apt ability to manipulate isolated phonemes in both groups indicated that neither group possessed any general analytic deficits. This study concluded that the deficiencies of the poor readers was language-based rather than the result of deficits in general analytic ability.

### Conclusions

Out of the 285 students who were given the Nelson-Denny Reading Test, 23 good readers and 23 poor readers agreed to participate fully in this experimental study. As noted earlier, 53 students qualified as poor readers on the basis of

their Nelson-Denny score. All of the 285 were encouraged by their instructors to participate, and extra credit was offered for their participation. Those students designated poor readers were particularly encouraged both by their instructors and the experimenter to participate on several occasions during the semester. Thirty of them chose not to participate.

An issue that was not investigated in this study, but one that bears further investigation is that of self-concept. Those students who participated, unequivocally brought up their concerns regarding their own reading disabilities. Many of them spoke of how they have hidden this disability as much as possible and found a variety of means for accommodating the rigors of their academic studies. Some had classmates who sat in class with them and read the text for them or interpreted what was read. Others had classmates take notes for them, while some taped the lectures. Others spoke of reading and re-reading text material several times in order to understand it, while some just did not read the material, hoping to get by with paying close attention in class. Only three of those volunteering, came to the study considering themselves "good" readers.

The majority of students screened were enrolled either in the Academic Assessment and Evaluation course because they were on academic probation or enrolled in the Reading Study Skills course because of a need or a desire to improve their reading or study skills. Those students responding to the



advertising in the newspaper and on the flyer came because they felt that they had a reading problem. All of the students participating were desirous of information on how they could become better readers. Many came because they wanted to know why they were poor readers and what they could do about it. Some came only because of the offer of extra credit.

Following the testing, students were shown their scores and the results were discussed. Specific strengths and weaknesses were pointed out, and recommendations for remediation were offered if the student so desired. A brief explanation of the reading process proved enlightening for the students. In Aaron and Baker's (1982) study, students appreciated knowing that their reading difficulties could be considered an isolated problem unrelated to their cognitive ability. This also proved the case in this present study. It was a relief to some of the students to know that they were not "dumb". Stanovich (1991) refers to the existence of reading disabilities "if anything, more likely to occur in very bright people". In addition, it was an even greater relief for most of these students to know that despite years of reading difficulties their reading abilities could be improved and/or remediated. Several studies indicate that adults who still have severe reading disability can learn to read, despite their previous failure (Chall, 1987b). Research indicates that significant gains from remedial instruction have been made at all ages (Blachman, 1987; Bradley & Bryant, 1983;

Chall, 1987b; Content et al., 1982; Lundberg et al., 1988). This has strong implications for future research.

Phonology plays an important role in reading as evidenced by this study and others. It has been noted that phonological deficiencies exist for various age groups, language communities, and cultures. This being the case, then the question arises, "How is phonological awareness acquired?" It is not acquired spontaneously as a result of going to school or learning to read as noted by Ehri (1991). The study of I. Liberman et al. (1974) raised the issue of what importance reading instruction had in the development of phonological awareness. Morais et al. (1979) and Alegria et al. (1982) both addressed this in their studies. They found that reading instruction, specifically a phonics based approach, facilitates the development of linguistic awareness. However, these authors cautioned against an oversimplification of this data and indicate that there is a probable interaction between development and instruction. Pratt (1985) notes in her experiments with adults and children that despite the fact that both had received at least some phonics-based reading instruction, many had not acquired linguistic awareness skills. She concluded that while phonics instruction facilitates explicit knowledge of the structure of the language, it is not a sufficient basis for the acquisition of linguistic awareness.

Chall (1983a) found that methods of reading instruction influence reading achievement, while Tunmer and Rohl

(1991) found that methods of instruction may also influence the development of phonological awareness. Chall's (1983a) research indicated that not only is students' reading achievement affected by methods of reading instruction, it is also affected by textbooks. She also found that although many believe that methods and materials for higher grades influence the abilities of students in higher grades, it is also generally acknowledged that the methods and materials for the early grades also influence higher levels of reading achievement. Therefore, students' reading ability in high school and college is affected when they have not learned to decode words or do not have good word recognition skills (Chall, 1983a). Paralleling this, Cohen's (1984) research indicates that college students with reading problems had difficulty learning to read in childhood.

Although the issue of which method of reading instruction is best has been debated for a long time, it is now more generally accepted that decoding skills are necessary in order to address unfamiliar words (Aaron & Baker, 1991). Dykstra (1974) states that "early systematic instruction in phonics provides the child with the skills necessary to become an independent reader at an earlier age than is likely if phonics instruction is delayed and less systematic" (p. 397). Williams (1979) also found that despite the intense debate since Chall's book, Learning to Read: The Great Debate (1967), research continues to suggest that a decoding approach teaches basic skills more effectively. Later in her

research she states that there are no studies in which reading programs that do not emphasize decoding are superior (Williams, 1986).

Alegria, Pignot, & Morais (1982) found that children receiving phonics instruction developed phonological awareness faster than those who were taught by the whole word method. Jorm & Share (1983) also found that students who were taught phonics progressed further in reading than children taught by the whole word method. Tunmer & Rohl (1991) agreed with this research and indicated that even though they are not taught as phonological awareness, learning phonics generalizations and rules have in fact developed children's phonological awareness skills.

It must be kept in mind, though, there are good readers, who learn to read by the whole-word method. Williams (1986) accounts for this by stating that children who have been taught by a nondecoding method do pick up information about correspondences inductively. She goes on to say that, "Presumably, these children have been able, without direct instruction, to isolate orthography and sound units, and note their correspondences" (Williams, 1986, p. 400).

Not all children are able to do this, though. Reading disabled children are most likely to have difficulty in the early stages of reading, specifically in the development of decoding skills and fluency (Chall, 1983a). Methods which are optimal for teaching students with reading disabilities continue to be those where they receive direct, systematic

instruction (Chall, 1987a). All of this points to the importance of instruction in obtaining a knowledge of phonetic and phonological awareness. According to Shankweiler & I. Liberman (1988), it may be concluded that decoding skills, alone, are not sufficient to produce successful reading performance; however, they are vital to this performance.

I. Liberman (1987) states that phonics instruction is one way to help readers see that words have an internal phonological structures, and phonology continues to be the core by which an indefinite number of words may be produced from a few dozen abstract elements known as phonemes.

As has been pointed out, phonological awareness does not come all at once. Awareness of words develops earlier and easier than awareness of syllables, and awareness of syllables develops earlier and easier than awareness of phonemes. Awareness of phonemes comes only after readers have become familiar with larger units. Sensitivity to syllables may be the beginning which leads to phonemic awareness and the learning of letter-sound correspondences, according to Adams (1990). Treiman (1987) refers to the importance of intra syllables or onset and rime in paving the way for eventual phonemic awareness.

Nursery rhymes help children become aware of onset and rime, and MacLean, Bryant and Bradley (1987) found a strong relationship between young children's knowledge of nursery rhymes and success on tasks of phonological awareness. Bradley (1987) states that the study conducted by MacLean et

al. (1987) and other studies she has conducted suggest that the origins of phonological skill lie in the child's early word play.

Bradley and Bryant (1983, 1985) investigated this issue of rhyming and found that it was possible to identify children who have difficulty recognizing rhymes in spoken words before they learn to read. The results of their study demonstrated that less than 10 hours of training resulted in "remarkable" gains and these were maintained more than four years later (Bradley, 1987).

Several studies show the specific effects on reading success as a result of phonological awareness training. Rosner (1971) observed higher reading scores in first graders who were trained in the analysis of words into syllables and phonemes. Treiman and Baron's (1983) prereaders were taught segmentation. Bradley and Bryant (1983) trained children to categorize words according to their similar rhyme patterns. Morais et al. (1982) trained kindergartners in phonemic awareness. Lundberg et al. (1988), Felton and Brown (1990), Blachman (1987), and Williams (1987), all indicated that training at-risk students in phonological awareness improved their reading skills.

All these training studies which are referred to have been conducted with children. Adolescent and adult phonological training is indeed an area which bears further investigation.

## Recommendations

This study was limited to volunteers, and motivation to participate was not sufficient to attract large numbers of students. Therefore, it is recommended that further research be done using an intact group of college students as well as providing sufficient motivation to participate in such a study.

English as a native language was controlled for in this study. However, many international students at the university showed an interest in this research, although the data used to compute the statistical significance of this study did not include any of the information gathered from testing these international students. While this study also concentrated on a population which used an alphabetic script, some of the English as a Second Language (ESL) students who were tested came from backgrounds in which a logographic script predominated. All of the international students volunteering for this study evidenced phonological processing deficits. Further investigation of the phonological awareness of college students whose native language is not English is recommended as well as further study of adults who have learned a logographic language. It would be interesting to see if they possessed phonological difficulties in their own language as well.

Age and IQ were two items that were not expressly controlled for in this study. Grade level was not of much con-

cern since all were college students; however, the ages in this study were very diverse. Also a measure of cognitive ability would be useful for making judgements about the findings, so it is recommended that both age and IQ be controlled for in future studies.

This study found that the ability to pronounce and manipulate multisyllable words was an extremely discriminating task of phonological awareness for adults. It would be interesting to see if this is a more discriminating task than the ability to pronounce nonwords. More research in this area is needed and it is recommended that tasks using more multisyllable nonwords be administered in future studies conducted with adults.

Finally, this study did not investigate previous methods of instruction which produced or failed to produce phonological awareness in college adults. Therefore, it is recommended that further research look at the relationship between methods of reading instruction and phonological awareness in adults. And most importantly, this study did not address self-concept. Despite varying methods of reading instruction, those students who fail to acquire reading fluency evidence poor self-concepts. It is highly recommended that future research investigate the relationship of methods of instruction and reading failure as well as the effects of reading failure on student's self-concepts.



## Implications

Literacy is an issue vital to a nation's well-being (Chisholm, 1988). Implications from this study may well effect instructional methods which will provide preventative practices and remedial relief to a vast amount of people.

Teaching phonological awareness and phonological processing skills to children at an early age could well prevent reading disabilities occurring in adulthood. Phonological awareness training at any age improves reading skills despite years of reading failure. Detection of phonological deficits will enable informed parents, classroom teachers, and qualified professionals to provide remedial opportunities which will address these deficiencies. Teacher training programs need to provide prospective teachers with more knowledge of the importance of phonological awareness and its role in reading achievement. The field needs to recognize this importance, too. This will only occur if the effects of training are more readily available, classroom teachers and parents see the usefulness of early phonological awareness, and more literature continues to be available on the subject of phonological awareness. Phonological awareness is the heart of reading success, and reading is vital to democracy.

According to Congresswoman Shirley Chisholm, effective citizenry is important in a democracy. This will not occur without the populace's ability to read the facts, digest them, and critically evaluate them in order to make informed

decisions regarding the welfare of the nation (Chisholm, 1988). It is important that everyone has the opportunity for achieving reading success, and as this study indicates, the development of phonological processing skills make this a present possibility.

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**APPENDIXES**

APPENDIX A

FLYER ADVERTISING STUDY



# Having Reading Problems ???

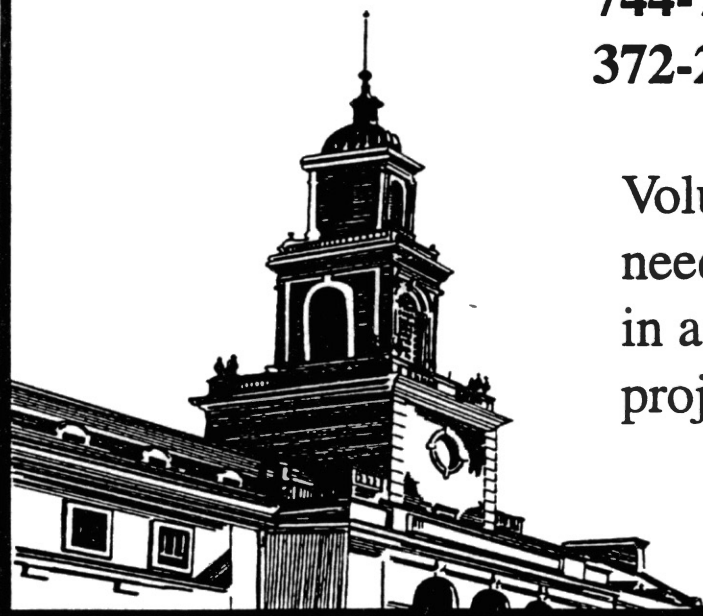
1. Do you feel you are a slow reader?
2. Are you experiencing poor academic success?
3. Do you have trouble with comprehending text?
4. Are you a poor speller?

If the answer is yes to any of  
these questions call Suzanne:  
(or stop by 104 Gundersen)

**744-7119**

**372-2095**

Volunteers are  
needed to participate  
in a reading research  
project **this** spring.



APPENDIX B

NEWSPAPER ADVERTISEMENT ADVERTISING STUDY

The Daily O'Collegian Wednesday, April 15, 1992

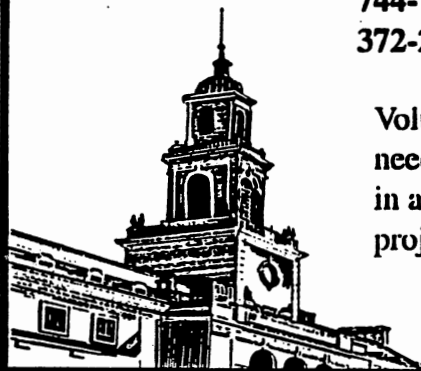
## Having Reading Problems and Need Help???

1. Do you feel you are a slow reader?
2. Are you experiencing poor academic success?
3. Do you have trouble with comprehending text?
4. Are you a poor speller?

If the answer is yes to any of  
these questions call Suzanne:  
(or stop by 104 Gundersen)

**744-7119**

**372-2095**



Volunteers are  
needed to participate  
in a reading research  
project this spring.

APPENDIX C

PERSONAL INFORMATION QUESTIONNAIRE

PHONOLOGICAL PROCESSING STUDY  
Personal Information Questionnaire

Please answer the following questions briefly and to the best of your ability. All questions must be answered, and if the question is not applicable to you, please respond N/A.

1. Indicate your sex by circling M for male or F for female.
2. State your birth date (include month, day and year).
3. What is your major college and your field of study?
4. Is English your native language? Circle Yes or No.
5. Are you fluent in any language(s) other than English? Circle Yes or No. If Yes, please list the language(s).
6. Have you ever lived for any length of time outside of the U.S.? Circle Yes or No.
7. If you answered Yes to Question 6, please indicate in what country you lived and for how long.
8. Did you graduate from high school? Circle Yes or No.
9. Circle which one you have, a high school diploma or GED.
10. Have you repeated a grade in school? Circle Yes or No.
11. Have you ever received any remedial reading instruction? Circle Yes or No.
12. Have you ever been diagnosed as learning disabled or reading disabled? Circle Yes or No.
13. Has anyone in your immediate family ever received any remedial reading instruction? Circle Yes or No.
14. Has anyone in your immediate family ever been diagnosed as learning disabled or reading disabled? Circle Yes or No.
15. To your knowledge, has any physical, psychological, sociological or economic condition impeded your reading ability? Circle Yes or No.

VITA?

Suzanne Hinrichs

Candidate for the Degree of  
Doctor of Education

Thesis: PHONOLOGICAL PROCESSING DIFFERENCES BETWEEN GOOD AND  
POOR READERS AT THE COLLEGE LEVEL

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