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Word Reading Processes
In Children and
Adult Literacy Students
by
Daphne Greenberg

A dissertation submitted to the Graduate Faculty in
Educational Psychology in partial fulfillment of the
requirements for the degree of Doctor of Philosophy,
The City University of New York.

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Abstract

Word Reading Process In Children
and Adult Literacy Students

by

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Advisers: Professors Linnea Ehri and Dolores Perin

Very little is known about similarities and differences between adults and children who appear to have similar reading levels. This study investigated factors which predict isolated word recognition, sight word reading, and nonword decoding ability in adult literacy students and children. Seventy-two adults and 72 children whose word recognition abilities ranged between the third and fifth grade levels served as the subjects. Tasks measuring sight word reading, nonword decoding, phonological, orthographic, amalgamation, and receptive vocabulary knowledge were administered. To investigate whether adult literacy students and children performed similarly on the various reading measures, a series of analysis of variance tests were conducted. The results indicated that the children were stronger than the adult literacy students in nonword decoding, phonological knowledge, amalgamation ability, and spelling skills. The adults were stronger than the children in their sight word reading and receptive vocabulary. The

two groups were similar in their orthographic knowledge involving letter positions and letter patterns.

Intercorrelation matrices of the reading measures indicated more significant correlations for the children than for the adult literacy students. Therefore, in addition to the adults' specific reading subskill weaknesses, their reading subskills were less integrated.

Regression analyses were conducted to analyze which reading process variables were predictive of word recognition, sight word reading, and nonword decoding scores, and whether subjects' status as child or adult interacted with the predictor variables. A second round of regression analyses was conducted separately on the adults' and children's scores. The central question was how much variance was accounted for by the important process variables. Results indicated that with the exception of the added importance of rhyme word reading (one of the amalgamation tasks) for the adult literacy students, the same process variables accounted for the bulk of the variance in word recognition, nonword decoding, and sight word reading for both groups. However, less overall variance was accounted for in the adult literacy sample, suggesting that there may be other important reading processes yet to be identified in this population.

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Mrs. Sharon Heikus, an adult literacy and third grade teacher was instrumental in my research project. I was new to Minneapolis, and she took me under her wing. She graciously let me pilot my tasks with her students, and encouraged her students to help me. She convinced other teachers and principals to let me work with their students, and taught me about the adult literacy and public elementary school system.

I would like to thank all of my advisors who helped me with this dissertation. Dr. Ehri taught me everything that I know about word recognition and reading research. She was always there for me and always introduced me to other professionals in the reading field. My only regret is that she came to the Graduate School in my third year, and therefore my exposure to her theories were not as prolonged as I would have liked.

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since my first year of graduate school. Without her, I probably would have never been exposed to the field of adult literacy. She instilled in me the importance of adult literacy research and taught me the importance of both applied and basic research.

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Section I INTRODUCTION

1.1 Overview

This study explored factors which predict word recognition ability in adult literacy students (hereafter cited as AL students) and children. Sight word reading and nonword decoding strategies in reading were tested. This study investigated whether AL students and children who read between the third and fifth grade levels exhibited similar phonological, orthographic, amalgamation and vocabulary knowledge. In addition, analyses were conducted to explore which reading process variables predicted word recognition, nonword decoding and sight word reading performances in these two populations. Finally, analyses were conducted to examine what proportion of the variance was accounted for by the significant process variables in the performance of the children and in the performance of the AL students.

As will become apparent from the literature review, there is a paucity of research on the reading processes of AL students. Therefore, this study tried to make an original contribution to the AL field by attempting to isolate the gaps in AL readers' knowledge. The rationale for this study will be presented first, followed by a literature review of word recognition theory. A discussion of normal childhood reading development will be followed by a review of studies involving AL students. Since many claim that AL students have enhanced language skills, which could

be argued to affect reading skills, a brief review of language skills will end the literature review section. Finally, the current study will be presented.

Although AL students are often called adult basic education students, there is no widely accepted operational definition of the adult basic education student (Darkenwald, 1986). Adults receiving basic educational services in the United States range from non-readers to those performing at approximately seventh grade level (As will be discussed below, the applicability of the grade-level concept to adults is debatable. However, the concept is employed in the present study because an alternative metric on which both children and adults have been measured is currently lacking). The AL students studied here possessed word recognition skills between the third and fifth grade levels.

1.2 Rationale

Adult Literacy Students

Many adults in the United States and abroad have reading difficulties. According to Chall, Heron, and Hilferty (1987) approximately 27 million adults in the United States read below the fourth grade level on standardized reading tests. According to a recent adult literacy survey conducted by Kirsch, Jungeblut, Jenkins, and Kolstad (1993), approximately 90 million adults in the United States have difficulty performing basic literacy tasks such as writing a letter explaining an error on a

credit card bill. Although many programs have been designed to help AL students improve their reading, researchers have not studied their learning processes nearly as extensively as those of children and adolescents. Therefore, we know very little about how adults acquire literacy (Charles, 1980).

There is a controversy whether AL students are similar or dissimilar to children in their acquisition of literacy skills (Chall, 1990; Sticht, 1982). Many practitioners assert that adults' experiences give them knowledge not available to children (Perin, 1988). Adults are thought to possess more mature language abilities and vocabulary (Hoffman, 1978). These claims foster the belief that AL students should be able to accomplish in months of sessions lasting a few hours each per week what children accomplish in years of full-time schooling (Balmuth, 1985; Gold & Johnson, 1982). On the other hand, adult poor readers may, rather, than being dissimilar to children, in fact be similar to children, especially to those who have reading problems. In this case, AL students may be yesterday's child poor readers whose difficulties were either unrecognized or unremediated.

Understanding how adults develop literacy skills is important for both theoretical and practical reasons. Theoretically, such knowledge will settle the debate whether literacy acquisition is similar or dissimilar in adults and

children. On a practical level, improved understanding could help to develop instructional approaches that could decrease the high attrition rates reported in many adult literacy programs (Dirkx & Jha, 1994; Lytle, Marmor, & Penner, 1986).

Measuring reading ability is a problem faced by all reading researchers, at both child and adult levels. Although standardized psychometric tests are utilized to assess grade level scores, they do not convey information about particular aspects of the person's underlying processes (Bear & Barone, 1989; Chall, 1983). They are narrow in focus, tapping only a limited number of reading skills, and they do not represent reading activities as they occur in "the real world" (Sternberg, 1991). As Chall (1983) states: "It would help to know, for example, what an eighth grade reading level on a standardized reading test means when it is achieved by a fourth grader, an eighth grader, a twelfth grader, or an adult seeking a high school equivalency certificate. Does such a score indicate mastery of decoding, fluency, and reading for facts and concepts? Tests of these different qualities would help us in research and in practice." (p.33).

Interpreting AL students' performance on standardized tests is even more controversial, because the notion of grade equivalency is derived from children's data (D'Amico-Samuels, 1991). The tests usually consist of material taken

from children's basal readers and they address children's interests. Tests such as the Test of Adult Basic Education (CTB/McGraw-Hill, 1987) have been developed in an attempt to remedy some of these problems, although they remain widely criticized. For instance, there is a lack of similarity between the test items on the Test of Adult Basic Education, and "real-life" reading (Perin, 1991). In addition, they are rarely administered to adults below the 3.0 grade level (D'Amico-Samuels, 1991).

Reading grade equivalency is a confusing concept when applied to adults (McCullough, 1993; Perin, 1991). As Lytle and Wolfe (1989) state, "When an adult is identified as reading at a 3.2 level, this denies the relevance of the abundant life experience and knowledge that adults bring to the act of learning..." (p.44). Despite many problems, grade level equivalence is used extensively with adults (Lytle, et al., 1986). D'Amico-Samuels (1991) argues that while administrators of adult literacy programs may need to make decisions which are best justified by quantitative measures (i.e. standardized tests), instructors gain more from qualitative measures which are sensitive to progress in a variety of ways.

Word Reading

Some theorists espouse the "simple model" to depict reading (Gough & Tunmer, 1986). In this model, reading is conceived of as having two components: comprehension and

word recognition (Fowler & Scarborough, 1993). Comprehension involves understanding text; recognition involves identifying the words. Although the goal of reading is to comprehend, this study focused on word recognition which is the sine qua non of reading. There were many reasons for this decision. Word recognition is a building block for reading comprehension (Durgunoglu, Nagy, & Hancin-Bhatt, 1993); one cannot comprehend without being able to recognize at least 80% of the words in a text. In addition, word recognition is a purer measure of reading ability than reading comprehension, which is influenced by written word recognition skill as well as general comprehension of spoken language (Fowler & Scarborough, 1993; Shankweiler, Crain, Brady, & Macaruso, 1992).

Methods used to study the mechanisms underlying reading have been criticized. Carr, Brown, Vavrus, and Evans (1990) note that investigators often concentrate on a single task to support their theories and ignore other factors. Carr, et al. (1990) advocate looking simultaneously at the various components which underlie reading and integrating them in theoretical explanations. This study followed this advice.

This study explored general word recognition ability, irregular sight word reading ability, (reading words that do not follow basic spelling-sound correspondences) and decoding ability (reading nonsense words). The study also focused on key components of word recognition: phonological

skills - the ability to use the sounds in a language to help process oral language and print; orthographic skills - memory for particular visual and spelling patterns; and amalgamation skills - visual and phonological associations between the spellings of printed words and their pronunciations in memory. In addition, because of the controversy over AL students' language abilities (Hoffman, 1978), receptive vocabulary was addressed.

The study addressed the following questions:

1. Do AL students and children at the same word reading grade level perform similarly on tasks measuring sight word reading, nonword decoding, phonological, orthographic, amalgamation, and receptive vocabulary knowledge?
2. Are phonological, orthographic, and amalgamation processes predictive of word recognition ability? Is the nature of the predictive relationship different for children and AL students (i.e. is there an interaction between the status of the subject as adult or child and the processes which explain word recognition variance)?
3. Are phonological, orthographic, and amalgamation scores predictive of nonword decoding processes? Is the nature of the predictive relationship different for children and AL students (i.e. is there an interaction between the status of the subject as an adult or child and the processes which explain nonword decoding variance)?
4. Are phonological, orthographic, and amalgamation scores

predictive of sight word reading processes? Is the nature of this predictive relationship different for children and AL students (i.e. is there an interaction between the status of the subject as an adult or child and the processes which explain sight word reading variance)?

5. Is the proportion of variance accounted for by the reading process variables for word recognition, sight word reading, and nonword decoding similar for AL students and children?

Section II
Literature Review - Part I: Theories of Reading

2.1 Word Recognition Theory

According to Baron (1979) "there is little doubt that learning to read isolated words is an important component of learning to read" (p.60). Adams and Huggins (1985) concur and state, "it is repeatedly found that word recognition abilities are the single best class of discrimination between good and poor readers" (p. 263). The ability to read individual words provides independence so that a reader does not have to rely on guessing, an unreliable strategy. A good test of word recognition skill is the ability to read single words out of context.

Ehri (1991) has discussed several ways to recognize words out of context. One method is sight word reading. Knowledge of words, including pronunciation, spelling and meaning, is assumed to be stored in memory in a lexicon (an internal dictionary). A reader recognizes a word by directly locating it in the appropriate lexicon. This rapid route is apparent when for example, the reader reads the word without pausing, or reads it faster than a nonsense word with an analogous spelling pattern (Ehri, 1991; Foorman & Liberman, 1989).

Phonological recoding (decoding), which is a slower method of word recognition, involves the application of grapheme-phoneme (spelling-sound) correspondence rules to transform a printed spelling into a pronounced word (Ehri,

1991). Examples of such rules are: a) when two vowels appear together in a word, the first vowel says its name (such as in the word eat); b) when the letter c is followed by the letter a, such as in the word cat, the letter c is pronounced /k/ (Foorman & Liberman, 1989).

Since early readers do not have an extensive store of words in their lexicons they tend to rely more on phonological correspondence rules to help them read words (Jorm & Share, 1983). Reliance on phonological recoding also facilitates eventual sight word reading. As the child is repeatedly exposed to an initially unfamiliar word, each exposure becomes a learning trial. As the child becomes familiar with the word he or she creates a memory which facilitates visual recognition of it. As readers mature, they utilize visual information to recognize familiar words. However, when advanced readers are presented with unfamiliar words, they often rely on phonological recoding.

Adams and Huggins (1985) constructed a word recognition task to assess the utilization of sight word reading and decoding processes. They presented a list of 50 increasingly unfamiliar words which are spelled irregularly (i.e., they do not conform to basic spelling-to-sound correspondence rules, such as the word "ocean") to children in grades 2-5. The performance of the students followed a specific pattern. At first they read the words very rapidly and correctly which reflects the use of sight word reading

processes. As the words became less familiar to the subjects, they then began to slow down and make occasional errors. Finally, on words that were totally unfamiliar, all responses were incorrect and error analyses indicated that the subjects pronounced the words according to spelling-sound correspondence rules.

Reading by analogy is another strategy that may be used to identify isolated words. Individuals read the targeted word by thinking of specific words that resemble it. For instance, if the targeted word is "sat" and the reader is reminded of the word "hat", and substitutes /h/ for /s/, then he or she is utilizing an analogy strategy (Glushko, 1979).

The use of orthographic patterns to help a reader identify an unfamiliar word, is the final strategy described by Ehri (1991). She gives the example of a pseudoword "tashion". It is assumed that if a reader is reminded of the word "fashion", then he or she is reading by analogy. However, if the reader recognizes that "tashion" includes "ash" and "ion," and he or she combines these to read the word, then the reader is relying on orthographic patterns rather than analogy to help identify the word (Ehri, 1991).

2.2 Phonological Processing

Phonological processing involves the ability to use the sounds in a language to help process oral language and print (Wagner, Torgesen, & Rashotte, 1994). It is an "umbrella"

term which includes processes such as phonological awareness, and phonological recoding in lexical access (Wagner & Torgesen, 1987). Phonological awareness entails awareness of the sound structure of language (Stahl & Murray, 1994). It refers to the "ability to reflect on and manipulate the subunits of spoken language, the phonemes and words" (Tunmer, Herriman, & Nesdale, 1988, p. 136).

Although it is obvious to adults who have been exposed to the English writing system that letters of the alphabet represent sounds, this knowledge does not come naturally. Sounds do not occur in isolation; rather they are embedded within other sounds. For example, /t/ sounds differently in the words "ten" and "stop"; and it is impossible to pronounce /b/ without adding a vowel sound to it (Fowler & Scarborough, 1993; Wagner & Torgesen, 1987).

For children who are developing language normally, rudimentary phonological awareness develops during the preschool years. This development is crucial, because children need to realize that words consist of phonemes in order to learn to use letter-sound correspondences (Fowler & Scarborough, 1993). Examples of tasks utilized to measure phonological awareness include asking the subject to tap to represent the separate sounds heard in an orally presented word, or asking the subject to reverse the sounds heard in a word (such as fit/tif). Rosner and Simon (1971) developed the Auditory Analysis Test which measures students'

abilities to repeat an item while omitting a specific sound or word part. Performance on this test has been shown to correlate with reading ability (Pratt & Brady, 1988; Rosner & Simon, 1971). This relationship exists even when IQ scores are partialled out (Rosner & Simon, 1971).

Phonological recoding (decoding) refers to the reader's transformation of a written word into a sound-based representation so that the word can be accessed from memory (Wagner & Torgesen, 1987). To test phonological recoding, one utilizes tasks such as asking the subject to decide whether a stimulus is a real word or a nonsense word, and asking subjects to read pseudowords.

2.3 Orthographic Processes

Research has focused extensively on phonological processes and their connection to reading, but orthographic processes have received minimal attention (Bowers & Wolf, 1993; Willson & Rupley, 1993). This is unfortunate, since according to Stanovich and West (1989), "whereas virtually no child with deficient phonological processing skills develops reading ability with ease, some children with adequate phonological sensitivity lag behind in the development of word recognition efficiency" (p. 404). These individuals may manifest deficits in orthographic strategies. Thus, phonological processing may be a necessary but insufficient skill for word recognition. Stanovich and West (1989) found that orthographic knowledge

accounted for some of the variance in children's word recognition. When Siegel, Share and Geva (in press) compared dyslexic and normal readers who read at the same grade level, the dyslexics performed poorer than the normals on phonological tasks, but in some cases performed better on the orthographic tasks. This finding suggests that a thorough understanding of reading differences requires exploration of both phonological and orthographic components.

Orthographic processes involve memory for particular visual and spelling patterns that comprise specific words or word parts (Barker, Torgesen & Wagner, 1992; Stage & Wagner, 1992). Orthographic awareness refers to the "knowledge of the legitimate letter sequences or spelling patterns in a written language" (Morris & Perney, 1984, p. 453). The learning of patterns of vowels and consonants is a major task for beginning readers. Massaro and Taylor (1980) note that vowels are rarely found at the beginning or ending of English words. Therefore, readers learn to expect to see consonants in the initial and final positions, and vowels in the middle positions (with the exception of the final "e" which is not pronounced). Beginning readers need to learn that some consonant blends exist both at the start of words (street) and at the end (lastst), while others only exist at the beginning (brain) or only at the end (behind) (Morris & Perney, 1984). Research indicates that ease of word

recognition is influenced by knowledge of these patterns. For example, Treiman, Goswami, and Bruck (1990) investigated nonword reading abilities of students in the first grade, third grade, and college, and found that all the students read more accurately items which included common vowel-consonant patterns.

Orthographic patterns can only be utilized by readers with sufficient prior experience with words so that they can recognize common letter patterns. Orthographic processing is related to print exposure (Stanovich & West, 1989). Utilizing the orthographic strategy, one can read patterns such as "ing" and "ment" without having to decode the individual letters. Children begin to acquire orthographic knowledge during the second grade and they can begin to detect legal letter patterns from illegal ones.

Orthographic knowledge has been found to be related to word recognition ability (for example, Allington, 1978; Bruck, 1990; Cunningham & Stanovich, 1990; Leslie & Shannon, 1981; Leslie & Thimke, 1986; Massaro & Hestand, 1983; Stanovich & West, 1989). Ehri and Saltmarsh (in press), examined advanced and novice first graders' ability to detect spelling changes in words that they had recently learned to read and found that the advanced readers were able to detect more changes in the spellings. The researchers attributed this to the advanced readers' superior orthographic, phonemic, and phonological recoding

skills. Since, the novice readers seemed to store only some of the letters in memory, particularly the letters in the first and last position, they could only detect spelling changes in these positions, not those in the middle positions.

Stage and Wagner (1992) utilized spelling inventories (lists of dictated words) to test orthographic knowledge. They found that accuracy of spelling nonsense words increased from kindergarten through third grade, but that it varied in terms of letter position. Spellings were most accurate for the initial position in a syllable, followed by the final position and most errors were found in the middle letters (especially vowels). The position effect decreased as grade increased.

According to Berninger (1990) orthographic knowledge includes both sequential redundancy (knowing which letter sequences are permissible and which occur most frequently) and spatial redundancy (such as knowing that some letters occur more often in some positions). In Siegel et al.'s (in press) task, which measures sequential redundancy, subjects are presented with pairs of pronounceable pseudowords. One member of the pair includes an orthographically illegal bigram (the sequence of two letters in a word), while the other member includes a legal bigram (for example: filv filk). Subjects indicate which item in the pair could be a real word (they are told that none of the items are real).

Katz (1977) administered a task measuring spatial redundancy to adults, as well as good and poor fifth grade readers. He presented his subjects with 26 pairs of items which included four blank underscores and one underscore with a letter written above it (for example: _ t _ _ _ and _ _ _ t _). Each pair included an item with the letter in its most frequent position, and in its least frequent position in English. Subjects were required to circle the item which represented the letter in the most characteristic position. Results indicated that for both children and adults there was a positive correlation between performance and reading ability.

The degree of a subject's orthographic awareness is related to performance on phonological awareness tasks (Ehri, 1989), since spellings provide a concrete image which allows people to conceptualize words in smaller units. This view is supported by findings that subjects who lack orthographic awareness perform poorly on phonemic awareness tasks, compared to people who are orthographically knowledgeable (e.g. Morais, Bertelson, Cary, & Alegria, 1986). If students do not possess adequate phonological awareness and complete letter-sound knowledge, they "will be left to their own resources to discover how the system works" (Ehri, 1989, p. 361).

2.4 Amalgamation Theory

As noted in the previous sections, both orthographic and phonological skills are important for reading. Levinthal, Kostogiannis, and Richman (1992) investigated reliance on orthography and phonology by presenting students with word pairs that rhyme (phonological clue) and/or look alike (orthographic clue). Four types of pairs were used: items which both rhyme and look alike (barge/large); items which do not rhyme and do not look alike (girl/jump); items which rhyme but do not look like (fuel/mule); items which look alike but do not rhyme (have/gave). Subjects were required to circle the rhyming pairs. Levinthal et al. (1992) found that fourth and fifth graders' performance on this task significantly correlated with reading ability.

Ehri (1992) proposes that sight word recognition relies on direct visual-phonological associations between the spellings of printed words and their pronunciations in memory. When an individual is presented with a word, its spelling is used to gain entry into the mental lexicon where pronunciations are accessed to help read the word. During initial exposure to an unfamiliar word, individuals may use phonological recoding or analogy strategies to help create the access route in memory. However, once the route is established, the reader can gain direct access to the word without intervening rules. As a reader is continuously exposed to words, he or she forms an amalgamation of

phonological and orthographic images in memory (Stanovich & West 1989). This amalgamation helps the reader retrieve words rapidly from his or her lexicon. Since there is a specific connection between spellings and pronunciation, phonological and orthographic processes are two crucial components of amalgamation theory. They work together to help the individual recognize words in an interactive fashion.

Ehri's (1992) amalgamation theory stresses a visual-phonological pathway. The development of sight word reading through this pathway is gradual. Ehri (1992) states that beginning readers ("logographic" or "visual cue" readers) do not possess letter-sound knowledge and therefore recognize words by visual cues. Once they acquire some letter-sound knowledge ("phonetic cue" readers), they can begin to establish partial connections between spellings and pronunciations. More advanced readers ("cipher" readers) can use their phonological skills to create a visual-phonological pathway for words. As readers become exposed to more words, new orthographic patterns are added to lexical knowledge which creates more visual-phonological pathways. As a result, immediate recognition of familiar words increases.

Ehri (1989) hypothesizes that it is easier to acquire lexical knowledge once students learn how the orthography corresponds to the phonology. Drake and Ehri (1984) exposed

students to correctly spelled words. Half the children were taught to pronounce them with the help of standard dictionary pronunciation keys, while the other half were exposed to pronunciations which stressed a close match between the sounds and the letters. Results indicated that children remembered the spellings more accurately in post-tests when exposed to pronunciations which closely matched the letters and sounds.

In order for amalgamation processes to be complete, individuals must possess phonological recoding skills and a knowledge of orthographic patterns. Ehri and Wilce (1987) selected kindergartners who knew letter-sound relationships but could not read nonsense words. One group of children learned to decode nonsense words (group 1), while a second group only practiced letter-sound relationships (group 2). In a series of post-tests, the children in group 1 learned to read a set of similarly spelled real words almost perfectly, whereas children in group 2 learned less than half of the words. According to Ehri, by learning how to read nonsense words, children were able to form more complete visual-phonological connections in memory so that they were able to read similarly spelled real words. Children in group 2 were unable to read the words successfully since their acquisition of skills necessary for amalgamation to occur was incomplete.

"During the course of learning to read and spell,

orthography penetrates and commingles with readers' phonological knowledge to determine how phonemes in words are conceptualized" (Ehri, 1989, p. 360). This is exemplified by a study conducted by Ehri and Wilce (1980) in which fourth graders were required to spell words and to segment them phonemically. Orthographic knowledge was inferred from spelling accuracy. Results showed that their orthographic knowledge influenced their conception of phonemes in the words. For example, their performances indicated that they thought that words such as "pitch" had one more phoneme than words such as "rich".

In a series of experiments, children in second through fourth grades detected silent letters in words faster than pronounced letters, and exhibited better recall of words when silent letters were utilized as prompts (Ehri & Wilce, 1982). According to amalgamation theory, orthographic images of letters are established in memory when they are integrated as symbols for sounds in the pronunciations of words. Since silent letters do not have this grapheme-phoneme relationship, they become stored as exceptions and therefore are highly salient in the representation.

2.5 Summary and Discussion

Word recognition ability is effective for discriminating between good and poor readers (Adams & Huggins, 1985). Methods utilized by readers to recognize words include sight word reading, phonological recoding and

orthographic cues (Ehri, 1991). Amalgamation theory stresses a direct visual-phonological association between printed words and their pronunciations in memory (Ehri, 1992). As a child is repeatedly exposed to words, he or she forms amalgams of phonological and orthographic images in memory which help the child retrieve words rapidly from his or her lexicon (Stanovich & West, 1989).

Phonological and orthographic processes are key components of amalgamation theory which account for variance in reading ability (Berninger, 1990). Whereas phonological processes include phonological awareness and phonological recoding in lexical access (Wagner & Torgesen, 1987), orthographic processes concern memory of particular visual and spelling patterns that identify specific words or word parts (Barker et al., 1992; Stage & Wagner, 1992). The Auditory Analysis Test (Rosner & Simon, 1971) and segmentation tasks are examples of methods utilized to analyze phonological abilities. Orthographic processes have been investigated using spelling inventories, tasks which manipulate positions of letters, and tasks which manipulate legal and illegal letter patterns. Amalgamation processes may be studied by analyzing whether phonemic awareness is influenced by orthographic knowledge of specific words, as well as by rhyming tasks which manipulate phonological and orthographic cues.

Section III
Literature Review-Part II:Development of Reading Skills

3.1 Development of Reading in Children

This study explored the similarities and differences in underlying word reading processes for AL students and children. Therefore, now that a general overview of word recognition, orthographic, phonological and amalgamation processes has been presented, it is important to understand how these processes develop. Since theories of word reading are based on empirical evidence from children, this section will address these processes in terms of childhood development. Chall's (1983) theory of reading acquisition will serve as a framework.

Drawing on Piagetian theory, Chall (1983) conceptualizes six levels (referred to as levels 0 - 5) of development of reading skills. Each stage is qualitatively different from the previous one, and an individual progresses through them in a hierarchical fashion. According to Chall, "the fact of successive stages means that readers do 'different' things in relation to printed matter at each successive stage, although the term 'reading' is commonly used for all the stages" (p. 12).

Since the current study explored word recognition abilities of adults and children whose reading levels lie between the third and fifth grades, the first and two final stages will not be reviewed in detail. Briefly, stage 0 is conceptualized as a level of prereading which generally

lasts from birth to approximately age 6. Rudimentary phonological awareness (such as appreciation of simple rhymes), and orthographic knowledge (such as distinguishing letters from squiggles) are developed. Chall's two final stages involve reading levels of ninth grade and above and address reading comprehension issues.

Stage 1

Stage 1 occurs in grades 1-2, ages 6-7. Since Chall (1983) hypothesizes that AL students at stage 3 often lack the basic skills acquired by children at earlier stages, it is possible that some of the AL subjects in this study, who read between the third and fifth grades, exhibited task performances typical of stage 1.

Stage 1 is the initial reading or decoding stage. Children learn letter-sound correspondences, develop a sight word vocabulary, and they are able to read very simple texts consisting of high frequency and phonetically regular words. They develop their decoding skills as they realize that words contain a finite number of sounds. The importance of this growth in phonological awareness is highlighted by findings which indicate a relationship between phonological awareness in the beginning of the first grade and reading and spelling at the end of the school year (Wimmer, Landerl, Linortner & Hummer, 1991). Furthermore, research indicates that children who do not acquire phonemic awareness skills in the first grade continue to read poorly in the fourth

grade (Juel, 1988). This problem may continue to adulthood.

The relationship between phonological awareness and reading development is reciprocal. In a longitudinal study, Perfetti, Beck, Bell, & Hughes (1987) asked first graders to engage in a phoneme deletion task (for example, saying cat without the /t/). It was found that improvement in reading facilitated improvement in the deletion task, which further facilitated improvement in reading.

Stage 1 readers become phonetic cue readers and use partial alphabetic cues to read words by sight (Ehri & Wilce, 1985; Ehri, 1991). At first, they can only use some letters to help them read the word. The beginning reader often identifies words by their first letters (Rayner & Pollatsek, 1989). These letters provide access to specific words in memory that have been read previously (Ehri, 1987). Words that share the same letters, such as mother and matter, may be incorrectly identified (Ehri, 1989). Due to their incomplete knowledge of letter-sound correspondence rules, novice readers exhibit difficulty in reading nonsense words. However, due to their reliance on letters, they often show an enhanced ability to recognize real words with uncommon spelling patterns (Juel & Roper/Schneider, 1985).

As children progress and learn grapheme-phoneme correspondence rules, they slowly and overtly begin to sound out each word. With practice, this becomes more of a covert process. At first, these rules may be rigidly applied and

overgeneralized causing errors. Decoding may be very sequential until students attain more proficiency and become hierarchical decoders able to take into account conditional and letter combination rules. By the end of this stage, sight words become stored in memory by means of the phonological rules that the child has learned.

During the first grade students develop the ability to read both real words and pseudowords (Tunmer et al., 1988). As Stanovich, Cunningham, and Freeman (1984) explain, reading a real word is a "complex measure of decoding skill. It presumably reflects a combination of the skills that subjects use to decode on both a phonological and a whole-word or visual-orthographic basis. [On the other hand,] a pseudoword is a nonword that conforms to the orthographic and phonological structure of English" (Stanovich et al., 1984, p. 284). Since one cannot apply a visual or "whole-word" strategy to pseudowords, the ability to read such items reflects how well one can apply grapheme-phoneme rules, or analogies.

In the first, second, and third grades, the relationship between spelling knowledge and word recognition is strong (Juel, Griffith & Gough, 1986; Massaro & Hestand, 1983). For example, first grade performance on a spelling test in September is a fairly good predictor of word recognition ability at the end of the school year (Morris & Perney, 1984).

Stage 2

Stage 2 is the confirmation, fluency, and "ungluing from print" stage. This level describes second and third graders who are between the ages of 7 and 8. Children integrate previous skills and they become confident readers, often preferring silent to oral reading. As decoding becomes mastered, attention can focus on comprehension.

According to Chall, it is crucial that second and third graders practice reading familiar stories so that they can learn to use their decoding abilities, their knowledge of oral language, the redundancies of familiar stories, and contextual cues to help them gain fluency (less word-by-word reading), automaticity (recognizing words without attention or effort) and speed. Simultaneously, it is also crucial that their exposure to print increases. According to Juel et al. (1986) exposure to print influences a student's lexical knowledge - an important factor in an ability to read irregular words such as "sword" and "island". The ability to read irregular words increases with grade level, and it is correlated with overall reading ability (Adams & Huggins, 1985).

Pratt and Brady (1988) analyzed the extent to which reading ability is related to third graders' phonological awareness. Good and poor third grade readers were compared on a series of phoneme manipulation tasks (for example, the Auditory Analysis Test). Results indicated that

phonological awareness task performance accounted for much of the variance between good and poor readers. These results confirm findings reported by Calfee, Lindamood and Lindamood (1973) who tested students from kindergarten through twelfth grade on the Lindamood Auditory Conceptualization Test (LACT). Using multi-colored blocks, this test taps ability to represent sounds in word-like units. At all grade levels there was a relationship between performance on the Wide Range Achievement Test (WRAT) spelling and reading subtests, and performance on the LACT.

While children's phonological skills are growing, their orthographic knowledge is also increasing. At this level, both phonological and orthographic processes are important as children become more flexible in using word recognition strategies. They begin to recognize patterns, and store similar words together in their lexicon. In the second grade, with increased exposure to words, children start to develop a sensitivity to orthographic structure (Ehri, 1991; Rayner & Pollatsek, 1989). Second graders are better able to detect character strings which resemble English words (Leslie & Shannon, 1981) and their accuracy of performance on such tasks continues to increase through the third grade (Massaro & Hestand, 1983). Whereas orthographic knowledge explains 3% of the variance in word reading abilities among first graders, it explains 20% among second graders (Juel et al., 1986). With third graders, orthographic knowledge

contributes significantly to nonword reading, timed and untimed word recognition, and silent and oral passage reading (Barker et al., 1992).

Children at this stage become "cipher" readers: "upon seeing a word, cipher readers can apply their general knowledge of how orthography maps speech to generate a pronunciation of the word that takes account all of its letters" (Ehri, 1987). Cipher readers, by amalgamating their phonological and orthographic knowledge, differ from phonetic cue readers (characteristic of children at stage 1) who can only make incomplete connections between printed spellings and pronunciations (Ehri, 1992).

Between the second and fifth grades, orthographic sensitivity speeds the recognition of words. The reading pattern of normal children begins to resemble Ehri's (1991) description of the orthographic level. Children at this level utilize their orthographic knowledge to help them recognize words. They are able to recognize words by analogy to similar words that they have stored in their mental lexicons.

Midway through the second grade, children begin the process of becoming morphemic spellers. This involves a shift from using letters to represent every sound, to the use of spelling patterns for prefixes, suffixes, root words, the "silent-e rule", and analogies (Ehri, 1985). Students spell more words correctly, and are more skilled at

remembering the correct spellings of words. Henderson (1985) describes this stage as the "within word pattern" level. Students attach meaning to spellings and can utilize endings such as "ing", "ed" and "s".

Stage 3

Chall (1983) states that "each stage of reading development has its own tasks and crises, but the fourth grade seems to present a major hurdle" (p. 7). She suggests that her six reading levels can be crudely separated into two main stages: pre fourth grade and post fourth grade. Until now, the major reading task was to learn the association between print and speech. Once the phonological and orthographic systems are efficient, the focus changes as children learn to associate print with meaning. She calls this new level which is apparent in fourth through eighth graders, the "learning the new" stage. It is during this period that students learn to read for information.

By the fifth grade, all the fundamental reading processes have become more or less automatic which allows reading comprehension to become the chief focus (Rayner & Pollatsek, 1989). For example, Backman, Bruck, Herbert, and Seidenberg (1984) investigated readers in the second, third, fourth, and twelfth grades. They found that second graders were the slowest at recognizing words, followed by the third graders. The fourth graders, however, read the words as quickly as the twelfth graders. While the second and third

graders made more word recognition errors, the fourth and twelfth graders' responses were almost error free. Other researchers have found that fifth graders who have not attained automatic decoding ability exhibit problems with reading comprehension (Perfetti & Hogaboam, 1975).

In third and fourth grade students, both phonological and orthographic abilities continue to be important in explaining variance in word recognition abilities (Cunningham & Stanovich, 1990). Orthographic knowledge at this stage appears to influence phonemic awareness. Ehri and Wilce (1980), engaged fourth graders in a phonemic segmentation task of real and nonwords. They found that children could spell most of the real words correctly, and their orthographic knowledge influenced their conception of phonemes in words. For example, they included an extra poker chip to symbolize the extra "t" sound in the word "pitch" but they did not do this for the word "rich" which lacks a T. Similar results were found for nonwords (simpty/simty) which were taught to the students.

Students at this stage become aware of syllable juncture (Henderson, 1985); that some consonants need to be doubled when spelling words such as pet-petted but not in words such as game-gaming. At this level, students learn how to spell polysyllabic words.

Derivational principles, the final spelling stage (Henderson, 1985), is reached by some children at the age of

10, while others only reach it in adulthood (some never reach it). At this level, they continue to extend their knowledge of polysyllabic spellings, and they also use their expanded vocabulary to help spell words. For example, if they learn the biological term for wing "ptera", the spelling of pterodactyl makes sense.

3.2 Summary and Discussion

Children at or below the fifth grade level need to acquire the fundamental processes important for word recognition so that they can focus on reading comprehension (Rayner & Pollatsek, 1989). During elementary school years there is a significant increase in the ability to utilize spelling-sound correspondence rules and analogy strategies to decode unfamiliar words (Stanovich et al., 1984). Elementary school students also develop sight word reading skills as their ability to read irregular words grows (Adams & Huggins, 1985). Throughout this period, reading ability is strongly related to phonological awareness skills (Pratt & Brady, 1988; Wimmer et al., 1991). In the second grade, children begin to develop a sensitivity to orthographic structure (Ehri, 1991) and the contribution of orthographic knowledge to word reading ability increases as the children get older (Juel et al., 1986). During this time frame children become able to amalgamate their phonological and orthographic knowledge to help them read words accurately (Ehri, 1987).

3.3 The Reading Processes of AL Students

Although Chall's (1983) scheme is intended to apply to children, she believes that it is applicable to AL students as well. She collapses the six stages developed with children into three stages for AL students. The lowest AL reading stage includes first through fourth grade reading levels as measured on standardized tests and covers the stages of prereading, decoding, and fluency (stages 0-2). The next stage covers grades four through eight and corresponds to stage 3 for children, "reading to learn the new." The final AL stage corresponds to stage 4, "multiple viewpoints" and includes grades nine to twelve (Chall, 1990).

Chall (1983) hypothesizes that as children, AL students exhibited great difficulty with stages 1 and 2. As a result, they do not automatically make the connection between print and spoken words (Chall, 1983). However, due to their enhanced language and life experiences, once the tasks of stage 1 are mastered, as adults, they can acquire the skills of stage 2 much faster than children (if they can find enough interesting adult appropriate material). Assuming that the AL student has adequate background knowledge, stage 3 should not cause difficulties. However, AL students at stage 3 often continue to lack basic decoding and fluency skills. Further research is necessary to confirm Chall's hypotheses.

The field of adult literacy suffers from a paucity of thorough and methodologically sound studies (Balmuth, 1985; Kitz, 1988). For example, researchers often do not describe or link their subjects' degree of reading weaknesses to reading outcomes. As a result, Kavale and Lindsey's statement in 1977 is still relevant today: "[Researchers] must devise strategies to ... develop a significant body of knowledge about the characteristics of illiterate adults and the nature of their reading processes" (p.370). As will become apparent from the literature review, there has been some research on AL students' phonological abilities, and on their abilities to decode unfamiliar words and irregular words. Amalgamation skills have hardly been addressed and with the exception of spelling inventories, orthographic processing has been ignored. In the discussion below, a review of general adult learning theory will be followed by a review of research pertaining to the reading skills of AL students.

Adult Learning Theory

The comparison between adults' and children's reading development is a controversial issue in the field of adult literacy. Many argue that adult literacy acquisition may be unique, given the adults' enhanced experiences of the world, and their more mature language skills. Theorists of adult development state that adult learners differ from children (Knox, 1980; O'Donnell, 1982). For example, whereas

children's learning is often teacher-directed, often adult learning is claimed to be self-directed (Knox, 1980, O'Donnell, 1982). Even if an adult does not direct his or her own learning, educators are encouraged to foster adult students' self-directed learning (Brookfield, 1986). Adult learners usually select specific goals which will enhance their family, career, recreation, or societal participation (Knox, 1980). Current responsibilities, attitudes, self-esteem, self-efficacy, commitment, and past educational history will influence their motivation to learn (Knox, 1980). However, the very factors that distinguish adult learners from children may be obstacles for AL students. They are often unsure of their ability to learn, have little and/or negative educational experiences, and do not have their family's support (Beder, 1991; D'Amico-Samuels, 1991; Forester, 1988; Fowler & Scarborough, 1993; Kavale & Lindsey, 1977; Norman & Malicky, 1986; Thistlethwaite, 1983). These characteristics adversely influence efforts to diagnose their reading difficulties since they are often resistant and anxious under test conditions (Balmuth, 1985; D'Amico-Samuels, 1991). These characteristics make it difficult to conduct studies on this population, since they often hesitate to volunteer, and/or do not want to return for follow-up testing (Darkenwald, Gordon, & Valentine, 1985).

Phonological Processes

It appears that like young children, AL students show deficits in the area of phonological processing (Kitz, 1988; Lindamood, Bell, & Lindamood, 1992; Marcel, 1980). This finding is evident in both foreign unschooled illiterate adult samples, as well as in American AL student samples. For example, Read, Yun-Fei, Hong-Yin, and Bao-Qing (1986) found that adults who were literate only in Chinese logographic script were unable to add or delete phonemes in spoken Chinese. However, a similar group of Chinese subjects knowledgeable in both logographic and alphabetic spelling of Chinese were able to succeed in phonological analysis tasks. Similarly, adult "ex-illiterates" who attended basic instruction classes in Portugal performed better than non-reading adults who had never received any reading instruction, on tasks of deleting and adding initial phonemes in verbal utterances, showing phonemic awareness of syllables, and detecting which pictures rhyme (Morais et al., 1986). These findings suggest that phonological deficits are a consequence of the failure to learn to read. This conclusion is similar to the findings of Wimmer et al. (1991) who found that six and seven year old nonreaders performed poorer than their reading peers on phonemic awareness tasks.

To investigate whether AL students can be taught phonological analytic skills, Morais, Content, Bertelson,

Cary and Kolinsky (1988), studied twelve Portuguese non-readers who had never attended school. When first tested, they were unable to delete the initial consonants of articulated pseudowords. Upon receiving training in the deletion task, 9 of 12 subjects learned to perform this task quite successfully. The authors conclude that there is no age-based critical period for learning to analyze phonemes.

Pratt and Brady (1988) looked at AL beginner and intermediate readers and compared them to more advanced AL students who were studying for their high school equivalency diplomas. They found that akin to their comparison between good and poor third grade readers, the advanced AL students outperformed the less advanced readers on the Auditory Analysis Test and the Lindamood Auditory Conceptualization Test (these include phoneme deletion and phoneme segmentation tasks). Similar results were found on tasks which focused on judgments about the length of words and nonwords (e.g., is _____ short like bike or long like bicycle). In addition, the two groups performed similarly on a nonspeech control task, where subjects utilized blocks to represent changes in presentations of tones.

Based on a graded word test, Byrne and Ledz (1983) studied AL subjects at mean reading ages of 6.6 years (group I) and 9.9 years (group P). Group P outperformed group I on non-word reading, phoneme reversal, recall of words, and recognition memory for words and nonwords (i.e., recognizing

whether a target item had been heard previously). Although the authors attribute problems with phoneme reversal to memory difficulties, it is also possible that the adults did not fully understand the task. Error analysis indicated that most of the mistakes were either nonresponses (45% of group I's errors and 40% of group P's) or responses that rhymed with the stimulus (45% of group I's and 40% of group P's).

Read and Ruyter (1985) administered various phonological tasks to adult prison inmates who scored at third and fourth grade levels on the reading comprehension subtest of the Stanford Achievement Test. In general, the subjects were able to assess the similarities of vowels and consonants in words, judge one syllable rhymes, repeat initial consonants, and to state whether a specific phoneme had occurred somewhere in a spoken one syllable item (phoneme monitoring). However, they exhibited poor segmentation skills in tasks that required the location of a phoneme in a given word, counting phonemes, and adding an initial consonant. In addition, a significant minority performed like kindergartners and first graders in making phonetic judgments. For example, some asserted that pictures of cheese and train started with the same sound. Both stimuli start with the same phoneme, however, as children become more experienced with written words, they lose this phonemic awareness. Thus, the phonological

performance of the prisoners often resembled younger normal children who are emergent readers, a phenomena which is masked by their higher reading comprehension grade equivalency test scores.

The subjects in Read and Ruyter's (1985) study were also presented with the Block Design, Picture Completion, and Digit Span subtests of the WAIS-R. They performed near average on the Block Design and Picture Completion tasks, but they performed well below average on the Digit Span test. This test involves listening to and then orally recalling a series of numerals. Poor performance suggests a weakness in short-term phonological memory. Adults' performance on the digit span task was significantly correlated with their performances on decoding and phonological tasks. The authors speculate that the AL subjects "cannot ... create and maintain an accurate phonological representation of a word in memory, analyze it into phonemes, and relate those phonemes to spellings ... to be able to decode unfamiliar words or to learn sound-spelling correspondences" (p. 50).

Orthographic Processing

It appears that AL students and children follow a similar progression in their spelling development. Bear, Truex, and Barone (1989) administered a spelling inventory to AL students who recognized words at the fourth grade level. They found that on average, the adults scored at

the "within-word pattern" stage of spelling, a level which Henderson (1985) claims normally developing children reach between the ages 6-12. In addition, when the authors looked at each subject's individual results, they noted that the students' errors corresponded to the stages of spelling proposed by Henderson (1985).

To obtain a reading grade level equivalent, Bear et al. (1989) gave their subjects an informal test of word recognition. As with studies conducted with children, they found a significant correlation between word recognition and spelling. In general, both reading and spelling performances of subjects were characteristic of the "within-word pattern" stage of spelling. In both tasks AL students showed mastery of short vowels, single-syllable words, and common long vowel patterns.

Amalgamation Processes

This investigator could not locate any studies on AL students and amalgamation processes. Perin's (1983) study of adolescents with reading problems may be suggestive of AL students' performances. She found that orthographic awareness influenced phonemic awareness. Subjects had to indicate the number of phonemes heard in items which were presented orally. Three types of items were utilized: real words that included more letters than phonemes, and both nonsense and real words that were comprised of a "one-to one letter" phoneme match. Subjects were told not to think

about the words' spellings. However, results indicated that they had fewer correct responses to the first group of stimuli as compared to the two other groups of items. Thus, the subjects were using orthographic knowledge to influence their segmentation responses.

Sight Word Reading and Decoding Skills

Read and Ruyter (1985) administered decoding and word recognition tasks to their AL subjects. The subjects performed poorer when reading nonsense words than they did when reading real words that had identical spelling patterns. They also administered word recognition tasks to differentiate performances on regularly spelled words, exception (irregularly spelled) words, and nonsense words. The highest scores were shown on the exceptional words. When Read and Ruyter (1985) compared AL subjects' performances to previously reported results on the same tasks given to children, they found that a grade equivalent reading score hid important differences between the two groups. Specifically, in a comparison of adults and children who scored at third to fourth grade reading comprehension levels, the adults had greater difficulty reading nonsense words, a task that taps phonological recoding skill. However, as compared to the children, the adults had less difficulty reading exception words, a skill that requires exposure to words through reading experience and taps sight word reading skills.

There are alternative explanations for Read and Ruyter's (1985) findings. AL students' greater life experiences may contribute to their word reading ability. Perhaps matching on levels of reading comprehension may not be appropriate when one is comparing phonemic abilities which relate to the single-word recognition level of reading. The results question the value of assigning grade equivalent scores to adults. Finally, the findings may be compared to results found by Juel and Roper/Schneider (1985). They compared first graders who resembled phonetic cue readers (they possessed only partial letter-sound knowledge) with first graders who possessed greater letter-sound knowledge. Tasks included reading nonsense words and distinctive/unusual words (for example the double "e" in the word "tree" occurs in very few different four letter words). Results indicated that the phonetic cue readers had greater difficulty reading nonwords, but found the distinctive/unusual words easier to read. It is possible that the adults in Read and Ruyter's (1985) study are similar to these phonetic cue readers.

3.4 Summary and Discussion

Research in adult literacy suffers from a paucity of thorough and methodologically sound research (Balmuth, 1985; Kitz, 1988). Often researchers fail to describe their subjects' degree of reading weakness. Other researchers utilize grade equivalents to describe their AL students, but

they do not directly administer their tasks to children. It is thus very difficult to ascertain whether AL students are similar or dissimilar in key processes from children who read at the same level.

Despite the weaknesses of adult literacy research, some clear trends emerge. As with children, AL students' phonological processing skills are related to their reading ability. Both Pratt and Brady (1988) and Byrne and Ledz (1983) found that more advanced AL students performed more accurately on phonological processing tasks than their less advanced peers. AL students appear to follow a progression in their spelling development which resembles normally developing child spellers (Bear et al., 1989), and there is a significant correlation between their word recognition and spelling performances (Bear et al., 1989). Finally, this investigator could not locate any studies on AL students and amalgamation processes. However, Perin's (1983) study of adolescents with reading problems may be suggestive of AL students' ability in this area. She found that indicative of amalgamation activity, their orthographic awareness appears to influence their phonemic awareness.

Read and Ruyter (1985) found that as compared to children, AL subjects had less difficulty reading exception words than they had reading the nonsense words. It is possible that their difficulty in decoding nonsense words may be related to their poor phonological skills. Although

subjects had attained reading comprehension grade equivalency scores at the third-fourth grade level, a significant minority performed like kindergartners and first graders in the phonetic judgement task. It can also be argued that reading exception words requires exposure to words through reading experience (Read & Ruyter, 1985). Therefore this finding may indicate that AL students' greater life experiences may contribute to their word reading ability. Finally, these results are reminiscent of Juel and Roper/Schneider's (1985) partial cue readers who had difficulty reading nonsense words, but had less difficulty reading visually distinctive words with unusual spelling patterns. Read and Ruyter (1985) did not administer specific orthographic measures. Thus, it is unclear why their students found the exception words easier to read than the nonsense words.

Read and Ruyter's (1985) study depicts the confusing conclusions that may be reached if AL educators rely on reading comprehension grade equivalency scores when trying to understand the reading of isolated words out of context. Their finding that a significant minority of subjects performed like kindergarten and first grade children on a phonemic awareness task, is masked by their third and fourth grade equivalency scores attained on a reading comprehension test. This finding questions the usefulness of grade equivalency scores for AL students and/or indicates that

matching on levels of reading comprehension may not be appropriate when comparing phonemic abilities.

3.5 Language Skills

Many AL educators assert that AL students should be able to accomplish in months of part-time education what children accomplish in years of full-time schooling (Balmuth, 1985). In support of this belief, some researchers claim that adults possess greater experience with language, such as a larger vocabulary (e.g. Hoffman, 1978).

According to Chall (1983), oral language abilities are important because beginning readers must utilize their knowledge of oral language when learning to read. By the end of second grade, children can usually understand up to 4000 spoken words, but they can only read about 600. Therefore, their listening comprehension is much higher than their text and word reading ability (Chall, 1983). Although the relationship between listening comprehension and reading exists at all ages, it increases in importance as the child approaches the fifth grade (Stanovich et al., 1984). In addition, knowledge of vocabulary slowly makes a qualitative shift. After the fourth grade, children begin to develop abstract vocabulary. For example, instead of answering that an orange is something to eat, children will now respond that it is a fruit (Chall, 1983).

A few studies have been conducted on the language

skills of AL students. Gold and Johnson's (1982) study directly contradicts the theory that AL students have enhanced linguistic abilities. They administered a battery of tests to AL students, including the reading subtest of the WRAT, an informal listening comprehension test, and a verbal opposites task (students had to verbalize antonyms in response to words supplied by the examiner). The subjects attained a mean reading grade equivalent of fourth grade on the WRAT and on the listening comprehension test, and a sixth grade equivalent on the verbal language task.. These results do not indicate that AL students have mature language skills!

Sticht (1982) has conducted various studies on listening comprehension. Utilizing a narrative prose passage of fifth grade level readability, he devised listening comprehension tasks which included tracking specific words and answering retention questions. Fifth grade children often performed better on tracking tasks, and similarly on retention tasks when compared to AL students reading at the eighth grade level.

In another study, Sticht (1982) utilized the listening comprehension section of the Durrell-Listening-Reading Series. Using the norms provided by the Durrell, he confirmed his previous findings. Specifically, adults who read at the fourth or fifth grade levels did not display language skills that were more mature than those of fourth

or fifth grade children. Thus, Sticht concludes that one cannot assume that AL students have enhanced language skills, at least as measured by his listening comprehension tasks.

Liberman, Rubin, Duques, and Carlisle (1985) collected writing samples from AL subjects, and administered a test of morphological knowledge of inflectional and derivational rules. The writing samples contained many linguistic and grammatical errors. Subjects had difficulty with basic grammatical skills such as plurals and past tenses. Similarly, Rubin, Patterson, and Kantor (1991) found that AL students exhibited difficulties on tasks testing the use of morphological rules. When they compared AL performance to that of normal second grade children, they found that the two groups did not differ significantly from one another. Finally, Scholes and Willis (1987) found that AL students did not differ from poor third grade readers in performance on tests of syntax and morphology. Further, the good third grade readers outperformed the AL students.

Cantwell and Rubin (1992) compared object naming ability of AL students and literate adults. Subjects were shown pictures of objects which they had to name. In another task, subjects were shown four pictures, and had to point to the picture of the object which was named by the experimenter. The AL students had more difficulty than the other adults in both naming and recognizing the objects.

Whyte (1981) compared language skills of AL students who exhibited word recognition reading ages of 8.0 or less to normal adult readers who had reading ages of 12 or above. Although both groups showed similar abilities in interpreting metaphors, the AL students utilized more concrete examples whereas the normals employed more abstractions. While both groups recalled a similar number of ideas after listening to a tape-recorded passage, the AL students had more difficulty ascribing a title to the passage. Finally, the AL students had more difficulty classifying items and ideas. Since all subjects had normal intelligence, Whyte (1981) suggested that linguistic difficulties account for the AL students' poor reading skills.

In summary, it appears that, contrary to popular opinion, AL students possess serious linguistic deficits. They have weaknesses in the ability to supply antonyms (Gold & Johnson, 1982), to classify items (Whyte, 1981), to name objects (Cantwell & Rubin, 1992) and to utilize abstract examples (Whyte, 1981). They also show deficits in morphological knowledge (Rubin et al., 1991) and in the area of listening comprehension (Sticht, 1982).

AL students' linguistic deficits are not surprising. Nagy and his colleagues (1987) examined third, fifth, and seventh graders' incidental learning of vocabulary gained from reading of books. They suggest that approximately a

third of a child's annual vocabulary growth is accounted for by learning gained from reading. It is possible that in spite of AL students' extensive oral language experience, their vocabulary may be more closely connected to reading. If they cannot decode accurately and fluently, they are not exposed to the increased vocabulary that more advanced books offer (Stanovich, 1986).

Section IV
Study - Part I: Purpose and Rationale

4.1 Summary of Literature Review

The development of word recognition ability is a crucial task for students acquiring literacy skills. Methods utilized by readers to recognize words include sight word reading, phonological recoding and orthographic cues (Ehri, 1991). Amalgamation theory explains that in memory, visual and phonological information merge, or are amalgamated, in the storage of information about word spelling. Pathways comprising both phonological and visual information enable individuals to access familiar words quickly and directly (Ehri, 1992). These amalgamated pathways are formed once orthographic and phonological knowledge bases have developed.

Phonological processes rely on the use of sounds in a language to help comprehend and produce speech and print (Wagner et al., 1994). Phonological processes include phonological awareness and phonological recoding (Wagner & Torgesen, 1987). For both children and AL students, phonological processing skills have been found to be closely related to reading ability (Byrne & Ledz, 1983; Pratt & Brady, 1988). In normal childhood development, rudimentary phonological processes develop during the preschool years, when children learn simple rhymes. The processes continue to mature through the elementary school years as children develop knowledge of grapheme-phoneme correspondence rules.

AL students' deficits in phonological skills are evident in poor performance on phonetic judgement and nonsense word tasks (Read & Ruyter, 1985). Orthographic processes concern memory for particular visual and spelling patterns that identify specific words or word parts (Barker et al., 1992; Stage & Wagner, 1992). According to Berninger (1990), children develop orthographic knowledge which includes both spatial redundancy (such as knowing that some letters occur more often in some positions), and sequential redundancy (knowing which letter sequences are permissible and which occur most frequently). Orthographic processes have been studied by using tasks which manipulate the positions of letters (Katz, 1977), and tasks which manipulate legal and illegal letter patterns (Siegel et al., in press). Unfortunately, with the exception of spelling inventories, orthographic tasks have not been administered to AL students. Thus, very little is known about their orthographic knowledge.

Children's spelling knowledge grows in stages (Ehri, 1985). Words can be constructed and administered to different age groups to demonstrate this progression. AL students also follow this progression, and like children, their spelling knowledge is related to their word recognition ability (Bear et al., 1989).

Amalgamation processes may be studied by analyzing whether subjects' phonemic awareness is influenced by their

orthographic knowledge of specific words (Ehri & Wilce, 1980), and by tasks which manipulate phonological and orthographic cues in rhyming tasks (Levinthal et al., 1992). Amalgamation processes have not been studied with the AL population. One study, conducted by Perin (1983) suggests that similar to children, adolescent poor spellers' orthographic awareness influences their phonemic segmentation skills.

According to Chall (1983), beginning readers must utilize their knowledge of oral language when learning to read. This literature review indicates that contrary to the opinion of many practitioners, AL students show serious linguistic deficits, including: weaknesses in the ability to supply antonyms (Gold & Johnson, 1982), to name objects (Cantwell & Rubin, 1992) and to engage in listening comprehension activities (Sticht, 1982).

4.2 Purpose of Study

The primary purpose of this study was to investigate factors which predict word recognition ability. Adults and children whose reading abilities ranged between third and fifth grade levels served as the subjects. Sight word reading and nonword decoding strategies were studied. This study investigated whether AL students and children exhibited similar sight word reading, nonword decoding, phonological, orthographic, amalgamation and receptive vocabulary knowledge. In addition, analyses were conducted

to explore which reading process variables predicted word recognition, nonword decoding and sight word reading performances in these two populations. Finally, analyses were conducted to examine what proportion of the variance was accounted for by the significant process variables in the performance of the children and in the performance of the AL students.

4.3 Rationale

Although the goal of reading is to comprehend, comprehension is dependent upon word recognition. Word recognition is a building block for reading comprehension; one cannot comprehend without being able to recognize individual words. The correlation between word recognition and reading comprehension scores is very high in third and fifth grade children (Perfetti & Hogaboam, 1975). In addition, while tests of word recognition yield relatively pure measures of reading ability, tests of reading comprehension tap reading ability, as well as general ability to comprehend spoken language (Fowler & Scarborough, 1993; Shankweiler et al., 1992). The focus of the current study was on the processes that are central to word recognition.

A methodological flaw in the study conducted by Read and Ruyter (1985) concerns the possible disparity between the reading measure utilized to match child and adult reading groups and the reading processes under study.

Specifically, they used reading comprehension scores to match adults and children, but then studied processes involving single words. It would have been more informative to relate reading and spelling processes to grade equivalents determined by word recognition tests. Stanovich et al. (1988) state that researchers who match subjects on reading comprehension scores are looking at "the relative contribution of the subskills determining comprehension ability..." (p. 82). However, researchers who match subjects "purely on the basis of decoding ability are asking ... whether the two groups perform at the same level on word-recognition tests for the same or different reasons" (p. 82).

The reading level of third through fifth grade was selected because it is believed that by the fifth grade, all of the fundamental reading processes have been mastered (Rayner & Pollatsek, 1989). This is consistent with Chall's (1983) theory of reading development and corresponds to her stages 2 and 3 of children's reading. This level also corresponds to Chall's (1990) two lowest reading stages for AL students. It was expected that differences in phonological, orthographic and amalgamation processes would be found, because she states that AL students who reach the equivalent of a stage 3 reading level often lack basic skills which children at this stage have mastered. Supporting evidence was provided by Read and Ruyter (1985)

who found that a significant minority of AL students who exhibited reading comprehension scores at the third-fourth grade levels showed phonetic judgments similar to kindergartners.

As indicated in the literature review, there are various methods readers may utilize when faced with a word out of context (Ehri, 1991). This study measured the abilities of AL students and children on an irregular word reading task, and on a nonword decoding task. An irregular word reading task was used because irregular words do not follow basic spelling-sound correspondence rules, and therefore, it can be considered as a measure of sight word reading (Adams & Huggins, 1985; Ehri, 1991). The nonword decoding task measured how well individuals can read unfamiliar words. Nonsense words were utilized to increase the probability of unfamiliarity. Since one cannot apply a visual or "whole-word" strategy to nonsense words, the ability to read such items reflects how well individuals can utilize phonological recoding or analogy strategies (Stanovich et al., 1984). Differences in children's and AL students' performances on nonword decoding and sight word reading tasks were expected. Read and Ruyter (1985) found that AL students were deficient in the ability to utilize phonological information, but exhibited less difficulty at reading exception words than children.

The available literature strongly suggests that AL

students possess poor phonological skills. However, researchers have not made direct comparisons between AL subjects and children reading at the same level. For instance, Pratt and Brady (1988) report that their AL students showed deficient skills on the Auditory Analysis Test, but do not compare their subjects' performance to that of children reading at the same level.

Orthographic processing has been ignored in studies of AL reading, with the exception of spelling inventories. This is unfortunate because it appears that AL students might favor a visual approach to reading. This is suggested by Read and Ruyter's (1985) findings that AL subjects read exception words more accurately than nonsense words. The present study attempted to isolate the gaps in AL readers' knowledge. For example if Ehri's (1980) amalgamation theory is correct, how is it possible that a significant minority of Read and Ruyter's (1985) subjects read at a third to fourth grade level of comprehension and yet performed like kindergartners and first graders on phonetic judgement tasks? Were they able to compensate for their lack of phonological awareness by an increased emphasis on orthography? This study attempted to add to our understanding of AL students' reading processes by administering tasks which tap phonological, orthographic and amalgamation processes.

Finally, it appears that AL students possess serious

linguistic deficits (Cantwell & Rubin, 1992; Gold & Johnson, 1982; Rubin et al., 1991; Sticht, 1982; Whyte, 1981). Research indicates that language skills are predictive of reading skills (Chall, 1983; Levy & Carr, 1990). For example, there is a high correlation between vocabulary knowledge and reading ability (Cunningham & Stanovich, 1990). Pratt and Brady (1988) found that on the Peabody Picture Vocabulary Test-Revised (PPVT-R) (Dunn & Dunn, 1981) scores of advanced and poor AL students were considerably different. Therefore, in this study, receptive vocabulary knowledge was one of the factors studied.

In summary, it was anticipated that results of this study would indicate whether adults and children at the same word recognition grade level are similar in their receptive vocabulary, sight word reading, nonword decoding, phonological, orthographic, and amalgamation skills. It was also hoped that findings from this study would shed light on the ongoing debate whether adults and children reading at similar grade levels, perform underlying processes similarly. It was expected that the results would also help evaluate the usefulness of the reading grade level concept as it applies to both children and adults. Finally, it was anticipated that information gleaned from this study would provide educational clues regarding the instruction of adult readers.

4.4 Hypotheses

Hypothesis #1 Children will read nonsense words more accurately than the AL students, indicating superior decoding skill.

Rationale #1 This hypothesis is based on findings which indicate that AL students are deficient in phonological skills, which are vital for decoding nonsense words (e.g. Pratt & Brady, 1988; Read & Ruyter, 1985).

Hypothesis #2 AL students will read irregular words more accurately than the children, indicating superior sight word reading skill.

Rationale #2 This hypothesis is based on Read and Ruyter's (1985) finding that when compared to children, AL students read exception words better than nonsense words.

Hypothesis #3 Compared to children, AL students will exhibit higher scores on the orthographic tasks.

Rationale #3 This is based on Read and Ruyter's (1985) finding that a significant minority of AL students who read at third-fourth grade levels exhibited phonetic judgements similar to kindergartners. It is hypothesized that since AL students possess poor phonological skills, they compensate for their deficit by having better orthographic skills.

Hypothesis #4 Compared to children, AL students will perform less well on the tasks measuring phonological processes.

Rationale #4 This is based on numerous studies indicating that AL students are deficient in phonological skills (such

as Pratt & Brady, 1988; Read & Ruyter, 1985).

Hypothesis #5 Compared to the children, AL students will perform less well on the tasks measuring amalgamation processes.

Rationale #5 Since AL students are deficient in phonological skills, it is hypothesized that their amalgamation skills suffer as well.

Hypothesis #6 AL students and children will not significantly differ from one another on the receptive vocabulary task.

Rationale #6 Contrary to many practitioner's beliefs, AL students do not have mature oral language skills (e.g. Gold & Johnson, 1982; Sticht, 1982). It is predicted that vocabulary growth is connected to reading ability. For example, Stanovich (1986) states that if students cannot decode accurately and fluently, they will not be exposed to the increased vocabulary that more advanced books offer.

The abovementioned hypotheses were tested by analysis of variance. In addition, regression analyses were conducted to explore which reading process variables predicted word recognition, nonword decoding and sight word reading performances in the AL and child populations. Regression analyses were also conducted to examine what proportion of the variance was accounted for by significant process variables in the performance of the children and in the performance of the AL students. There were no

hypotheses associated with these regression analyses, as they were considered more exploratory in nature.

Section V
The Study - Part II: Method

5.1 Subjects

The subjects were 72 native English speaking AL students and 72 native English speaking children who scored between the third and fifth grade levels on a word recognition measure. None of the subjects had any apparent hearing or speech difficulties. There were 24 subjects at each reading grade level (3rd, 4th, 5th) in both subject groups.

AL students were selected from 16 community adult basic education classes geared for grade levels 3-6 in the Minneapolis/St. Paul metropolitan area. Seven of the sixteen teachers claimed that some class time was devoted to phonics instruction. The investigator described the study to the AL teachers and asked them whether they were interested in having their students participate. If an interest was expressed, they were asked to select native English speakers whom they believed would score between the third and fifth grade levels on a word identification test. The investigator approached these potential students privately and explained the nature of the study. It was stressed that participation was voluntary and that they could discontinue at any time (see informed consent procedure, Appendix A). Only those subjects who agreed and signed the permission form participated. The Word Identification subtests of the Woodcock Reading Mastery Tests-Revised (Woodcock, 1987) were

administered. Subjects who scored between the third and fifth grade levels were chosen for the study.

Children were selected from five public elementary schools in the same neighborhoods as the adult literacy centers. Three of the five public schools housed three of the adult literacy programs that were utilized. Children selected were similar to the AL students in terms of residential neighborhoods, gender and race. The children were enrolled in elementary schools where phonics was taught in the first and second grades while whole language methods were used in the third grade. The same teacher contact procedure (see above) was followed with the elementary teachers except that teachers were also asked to select only children who had not repeated a grade and who read within six months of their expected grade level. Only those children who returned permission slips (see Appendix B) were asked to participate. Children were told that their participation was voluntary and that they could discontinue at any time. Similar to the AL students, the Woodcock Word Identification subtests (Woodcock, 1987) were administered and only those children who scored between the third and fifth grade levels were selected for the study.

Toward the end of the data collection process, an attempt was made to attain racial and gender balance across reading grade levels and subject groups. Specifically, more males (regardless of race) were needed in the AL fifth grade

reading level, while more Black male children were needed at all reading grade levels. Therefore, in the last few weeks of data collection, teachers were asked to select students whom they believed would meet the reading and native language criteria as well as the racial and gender specifications necessary to achieve a balance in both sample groups.

Age, racial and gender characteristics of the two groups are given in Table 1. The AL subjects were 36 females and 36 males; the children were 40 females and 32 males; the AL subjects were 38 African-Americans and 34 Whites; the children were 35 African-Americans and 37 Whites. The children ranged in age from 8 years, 5 months to 11 years, 9 months. The adults ranged from 16 to 70 years of age.

Table 1

Demographic Characteristics for the Three Grade Levels
and Two Subject Groups

Characteristics	Reading Grade Levels		
	Third Grade	Fourth Grade	Fifth Grade
Age-Mean			
Children	9.1	10.3	11.0
Adults ^a	34.5	34.5	31.2
Age-Range			
Children	8.5-9.11	8.5-10.9	9.8-11.9
Adults	16-60	16-70	16-70
Gender (Female/Male)			
Children	13F/11M	13F/11M	14F/10M
Adults	12F/12M	13F/11M	13F/11M
Race (Black/White)			
Children	11B/13W	12B/12W	12B/12W
Adults	12B/12W	13B/11W	13B/11W

^aOnly age ranges were obtained in the interview with adults. Means were calculated by multiplying the midpoints of each age range by the number of people who reported that range at each reading grade level, adding these values, and dividing by 24 (total number of subjects at each reading grade level).

5.2 Materials

Informed Consent: Permission forms were signed by AL student participants (see Appendix A) and by parents of the child participants (see Appendix B).

Interview: Demographic and educational information was obtained in an interview with AL students (see Appendix C for questions). The information solicited from subjects included their race, gender, age, educational history, and English proficiency.

Eleven literacy tasks were administered:

1. Word Recognition Task: Word recognition scores were obtained by administering the Word Identification subtest of the Woodcock Reading Mastery Tests-Revised (Woodcock, 1987). This subtest has been normed on both children and adults. In order to increase the validity of the score, two forms, G and H, of the subtest were given to subjects. This test required subjects to read presented words within approximately five seconds per word. Each form includes 106 words, and all subjects began with the first word on each form. The ceiling of the test was established when the subject incorrectly read six consecutive words, ending at the bottom of the page. For purposes of data analysis, raw scores were utilized. According to the tester's manual, third through fifth grade equivalency levels correspond to raw scores of 105-154 (see Appendix D).

2. Nonword Decoding Task: To assess decoding ability, the Word Attack subtest of the Woodcock Reading Mastery Tests-Revised-Form G (Woodcock, 1987) was utilized. This subtest has been normed on both children and adults. It contains 45 items and requires subjects to read nonsense words. The test began with two sample items. Subjects were told that the items on this test were nonsense words, that is, words which are not real and therefore do not have any meanings. They were instructed to read the nonsense words as if they were real words. None of the subjects read the sample words incorrectly. Next, all students were presented with the first item. The ceiling for this subtest was established in the same way as described for the Word Identification subtest. All responses were recorded and correct responses were tabulated. For the purposes of data analysis, raw scores (range 0-45) were utilized (see Appendix E).

3. Receptive Vocabulary Task: The Peabody Picture Vocabulary Test-Revised (Dunn & Dunn, 1981) was utilized. This test has been normed on both children and adults and was employed as a measure of receptive vocabulary. All subjects began at the eight year old level. The tester said a word and the subject selected from a template of pictures the picture that represented the word. The basal level was established by correct responses to eight consecutive words. The ceiling was established when the subject incorrectly

identified six items from eight consecutive words. For the purposes of data analysis, raw scores (range 0-175) were utilized (see Appendix F).

4. Sight Word Reading Task: To test subjects' sight word reading of irregular words, a list of 50 words was presented. This task was taken from Adams and Huggins (1985) who created a list of words which do not follow basic spelling-sound rules and which are graduated in terms of difficulty. Subjects were required to read each word out loud. Testing continued until ten consecutive words were read incorrectly. For purposes of data analysis, only words which were read correctly within one second (indicating sight word reading) were tabulated. Raw scores (range 0-50) were utilized in the data analysis (see Appendix G).

5. Deletion Task (Phonological Task #1): Rosner and Simon's (1971) Auditory Analysis Test was utilized. This test assessed subjects' ability to delete phonemes. The examiner said a word and the subject was required to repeat the word twice, initially in its entirety, and then without a specific sound. There were 40 words and scores were based on number correct. Testing continued until the subject made four consecutive errors. Subjects were given two practice trials. The tester stated "Say cowboy." After the subject responded, the tester said "Now say it again but without the boy." "Toothbrush" was the next practice item, and after repeating it correctly, the subject had to say it without

the "tooth." None of the subjects had difficulty with the practice items and they all proceeded to the first test item. Raw scores (range 0-40) were utilized for purposes of data analysis (see Appendix H).

6. Segmentation Task (Phonological Test #2): Ehri and Wilce's (1980) segmentation procedure was utilized. Since this task was also used to measure amalgamation processes, it is described in the section below on amalgamation tasks. There were ten words. Subjects were required to segment words into phonemes by positioning a chip as each sound was pronounced. Scores were based on number of words correctly segmented (range 0-10).

7. Letter Pattern Task (Orthographic Test #1): Siegel et al.'s (in press) orthographic test of sequential redundancy was utilized. In this task, subjects were presented with 16 pairs of pronounceable nonsense words and they were asked to circle which of the pair looked most like a real word. Each pair included an item with a bigram that never occurs in a specific position in English, and an item which has a bigram that does occur in English, for example, filv vs. filk. Siegel et al.'s (in press) procedure was followed. Raw scores, representing correct responses, could range from 0-16 (see Appendix I).

8. Letter Position Task (Orthographic Task #2): Katz' (1977) measure of spatial redundancy was utilized. Subjects were presented with 26 pairs of items. Each pair included a

letter of the alphabet placed in its most frequently occurring position in English words and in its least frequently occurring position. Subjects were asked to select the most characteristic position for each letter. For example, they chose between alternatives _ _ _ t _ and _ _ _ _ t. Two practice items were included. Raw scores, representing correct responses, could range from 0-26 (see Appendix J).

9. Spelling Inventory (Orthographic Task #3): Bear et al.'s (1989) spelling inventory was utilized. This inventory was designed to measure developmental orthographic knowledge following Henderson's (1985) stages of spelling development. Twenty words were presented verbally one at a time and subjects were asked to spell each word. The experimenter read a word, provided a sentence with the word in it, repeated the word and then asked the subject to spell it by writing the word on a piece of paper. The raw score (range 0-20), representing correctly spelled words, was recorded (see Appendix K).

10. Rhyme Word Reading Task (Amalgamation Task #1): Levinthal et al.'s (1992) rhyming task was utilized. Subjects were presented with 212 pairs of words and they were required to circle those pairs which rhymed. The word pairs were manipulated in terms of their phonological and orthographic resemblances. The pairs of words included items which both rhymed and looked alike (barge/large);

items which did not rhyme and did not look alike (girl/jump); items which rhymed but did not look alike (fuel/mule); and items which looked alike but did not rhyme (have/gave). In order to generate a score which reflected sensitivity to the relationship between orthography and phonology, two of the four types of word pairs were scored for this study: word pairs which were orthographically similar but phonologically different (OSPD), and word pairs which were orthographically different but phonologically the same (ODPS). To be correct, subjects had to circle the items which rhymed (ODPS word pairs such as ache/bake) and to withhold circling the items which did not rhyme (OSPD word pairs such as have/cave). For purposes of data analysis, raw scores (range 0-106) were utilized. Performance on this task is thought to indicate whether phonological and orthographic processes are amalgamated when words are learned (see Appendix L).

11. Extra Letter Segmentation Task (Amalgamation Task #2): Ehri and Wilce's (1980) procedure was utilized. The items to be segmented consisted of 10 words containing ambiguous sounds and 10 words in which these sounds were unambiguous but embedded in a similar phoneme context, for example, catch and boats, respectively (target sounds underlined). The words were not presented as pairs. The experimenter read each word aloud, read a clarifying sentence and then repeated the word. The subject repeated

the word and then was asked to repeat the word very slowly while placing a chip on the table for each sound that he or she heard while pronouncing the word (for example, setting out a chip as each of the following sounds was spoken: /s/ - /t/ - /o/ - /p/). The experimenter modeled the procedure for the words "see", "fun", and "stop." After each practice word, the subject was asked to imitate the model. Upon completion, the subject repeated the practice items without the experimenter modeling the procedure. If the subject made a mistake on the practice word, the experimenter provided the correct response and the subject repeated the practice trials until he or she accurately segmented all three words. While none of the children needed extra practice, 33 of the AL students required extra practice trials (range = 1-4 practice trials).

After the practice trials, twenty test items were presented, 10 words with unambiguous sounds, followed by 10 items containing ambiguous sounds. The first 10 items formed the segmentation task (phonological task #2). The latter words comprised the extra letter segmentation task (amalgamation task #2). These words included ambiguous sounds that are only detected in pronunciations because they are symbolized in spellings (for example, pitch). Including a chip for these sounds indicates that the reader has amalgamated the phonological and orthographic forms of the words. Spelling knowledge of the words was assessed after

all the words had been presented by having subjects write each word.

Two scores were derived from the performances. Segmentation scores reflected the number of non - ambiguous words segmented correctly, while amalgamation scores reflected the number of words where ambiguous sounds were detected as separate segments and correctly segmented (see Appendix M). Raw scores (range 0-10) were utilized for data analysis of the segmentation task but proportions were utilized for the extra letter segmentation task. The purpose of the extra letter segmentation measure was to indicate whether subjects' conceptualization of the sound structure of words was influenced by their knowledge of the words' spellings, specifically whether they conceptualized extra sounds suggested by letters. As explained in the results section, many of the subjects (86% of the AL students and 58% of the children) could not spell all of the words to be segmented. Therefore, for purposes of data analysis, scores consisted of proportions. The number of correctly spelled extra-letter words served as the denominator. The numerator was the number of these correctly spelled words which were segmented correctly to include a separate segment corresponding to the extra letter.

5.3 Procedure

Testing was conducted between November, 1993 and June, 1994. AL subjects were tested before the children were recruited. First, the word recognition task was administered. Only subjects who scored between the third and fifth grade levels completed the other tasks, which were administered in the following order: the sight word reading task, receptive vocabulary task, nonword decoding task, the segmentation and extra letter segmentation task, and the deletion task. Upon completion, AL students were interviewed. Whereas the previously mentioned tasks were administered individually, the following tasks were administered to pairs of subjects: the letter pattern task, the letter position task, the spelling inventory, and finally the rhyme judgment task. The procedure was identical for the children, except that the interview was omitted.

For the AL students, administration of the tasks lasted 60-90 minutes, depending on the length of the interview. Fifty-four of the AL students preferred to complete the tasks during one session. The remainder preferred two sessions (7 reading at the 3rd grade level, 5 reading at the 4th grade level, and 6 reading at the 5th grade level). All children completed the tasks in two sessions, each lasting approximately 20-30 minutes. When two sessions were utilized, the following tasks occurred on the first day: the

word recognition task, the sight word reading task, the receptive vocabulary test, the nonword decoding task, the segmentation and extra letter segmentation task, the deletion task and the interview (administered only to the AL students). Included in the second session were the letter pattern task, the letter position task, the spelling inventory, and the rhyme judgment task. All subjects completed all tasks and appeared to enjoy the sessions.

5.4 Description of Design

To investigate whether AL students and children performed similarly on tasks measuring various reading capabilities, a series of analysis of variance (ANOVA) tests were conducted. The independent variables in these analyses were subject group (adult vs. child), and reading grade level (3rd. vs. 4th. vs. 5th) based on the Woodcock Word Identification subtests. The dependent variables consisted of scores on the following tasks: nonword decoding, sight word reading, letter pattern, letter position, spelling, deletion, segmentation, rhyme word reading, extra letter segmentation, and receptive vocabulary.

The initial plan was to create composite scores measuring three reading process variables: a phonological composite score constructed from the deletion and segmentation tasks; an orthographic composite score drawn from the spelling, letter position and letter pattern tasks; and an amalgamation composite score constructed from the

extra letter segmentation and the rhyme word reading tasks. With these composite scores, exploratory regression analyses were to be conducted to determine which reading process variables were predictive of word recognition, sight word reading, and nonword decoding scores, and whether subjects' status as child or AL student interacted with the predictor variables. However, as indicated in section 6.3, the composites were not feasible because the AL students and children showed different patterns of intercorrelations among the composite variables. Therefore the reading process measures were entered separately in the regression analyses.

The following questions were addressed with the regression analyses:

1. Are phonological, orthographic, and amalgamation processes predictive of word recognition ability? Is the nature of the predictive relationship different for children and AL students (i.e. is there an interaction between the status of the subject as adult or child and the processes which explain word reading variance)?

The dependent variable in this analysis was the word recognition score, as measured by the Woodcock Word Identification subtests (Woodcock, 1987). The independent variables were: the status of the subject as an adult or child, and the phonological, orthographic, and amalgamation scores.

2. Are phonological, orthographic, and amalgamation processes predictive of nonword decoding ability? Is the nature of the predictive relationship different for children and AL students (i.e. is there an interaction between the status of the subject as an adult or child and the processes which explain nonword decoding variance)?

The dependent variable in this analysis was the decoding score, as measured by the Woodcock Word Attack subtest (Woodcock, 1987). The independent variables were: the status of the subject as an adult or child, and the phonological, orthographic, and amalgamation scores.

3. Are phonological, orthographic, and amalgamation processes predictive of sight word reading ability? Is the nature of this predictive relationship different for children and AL students (i.e. is there an interaction between the status of the subject as an adult or child and the processes which explain sight word reading variance)?

The dependent variable in this analysis was the sight word reading score as measured by the Adams and Huggins' task (1985). The independent variables were: the subject's status as an adult or child, and the phonological, orthographic, and amalgamation scores.

A second round of regression analyses was conducted on AL students' scores separately from children's scores. The central question was how much variance was accounted for by those variables identified as statistically significant in

the first round of regression analyses. Regressions were conducted separately for children and adults. Dependent variables in these analyses were word recognition, sight word reading and nonword decoding. The independent variables included only those reading variables that accounted for significant variance in the previous regression analyses.

Section VI Results

6.1 Who Were the AL Students?

Information about demographic characteristics and educational history was obtained from the AL interview (see Appendix C). This background information was gathered to provide a description of this sample and to explore why these adults were deficient in reading. This information is summarized in Table 2.

Sixty-nine percent of the AL subjects were 21-40 years old. Fifty-three percent were females and 53% were Black. Many subjects were new to adult education: 43% of the subjects reported attending adult basic education classes for three months or less.

In an attempt to identify major reasons why the subjects had difficulty with reading, information about their educational history was solicited. As children, 33% of the AL subjects had repeated at least one grade, with the majority repeating the early grades. In spite of the fact that their word recognition scores did not exceed a fifth grade level, 87% of the AL subjects had completed at least one grade in high school (defined as 9th grade and above). Subjects reported various work-related reasons for non-completion of their education, including parental pressure to stay at home to care for siblings, to help with farm work, or to help with housework. Other reasons included pregnancy and family reasons such as parental death, or

sickness of a grandparent. The most frequently reported reason for dropping out (29%) was difficulty of school work.

Twenty-eight percent of the students stated that at least once while enrolled in school, they were absent for a long duration. Reasons for absences included babysitting for siblings, pregnancy, help with housework and/or farm work, illness, parental death, and moving to different locations.

Forty-three percent of the subjects reported that it had been suggested to them that they might have a learning disability, and 40% were actually tested for possible learning disabilities. Twenty-nine percent of the subjects received diagnostic testing before high school, 10% during the high school years, and 18% as adults.

Twenty-nine percent of the subjects claimed that they had received some form of special education classes. Of this group, 70% stated that they had gone to a resource room for reading, while 30% stated that they had gone to all-day special education classes. Seventy-one percent of these subjects stated that they had received these special education services in elementary school while 10% claimed that they received them in high school.

Twenty-nine percent of the subjects reported that other family members (siblings, parents or children) had experienced difficulty with reading. Thirty-one percent of the subjects reported that their mothers had graduated from

high school, while 26% of the subjects reported that their fathers were high school graduates. One percent of subjects reported that their mothers had received some post-secondary education and 4% reported that their fathers had continued past high school.

In summary, the majority of the AL students reported that neither they nor their parents had graduated from high school. However, in spite of their grammar school word recognition levels, most of the AL students had completed at least one grade in high school. Difficulty with school work was the most frequent reason the AL students provided for leaving school. Characteristics which one might expect of AL students were found in approximately a third of the AL subjects: familial histories of reading difficulties, prolonged school absences, repetition of school grades, and/or learning disability diagnoses. Finally, the majority of the AL students had been in adult education classes for less than one year.

Table 2

Characteristics of Adult Literacy Students

AGE:

16-20	8%
21-30	41%
31-40	28%
41-50	10%
51-60	10%
61-70	3%

ATTENDANCE AT BASIC EDUCATION CLASSES:

$\leq$ 3 months	43%
4-11 months	24%
$\geq$ 1 year	33%

REPEATED GRADES:

1	2	3	4	5	6	7	8	9	None	Unknown	Many Grades
8%	11%	6%	1%	3%	1%	1%	1%	1%	57%	10%	6%

HIGHEST GRADE COMPLETED:

3rd	6th	7th	8th	9th	10th	11th	12th
1%	1%	1%	10%	17%	25%	21%	24%

Table 2 (continued)

Characteristics of Adult Literacy Students

REASONS FOR NONCOMPLETION OF EDUCATION:

Work	20%
Family	20%
Academic	29%
Pregnancy	16%
Unknown	15%

SUGGESTED PROBLEMS:

Learning Disability	43%
Educational Problem	14%
Visual Disability	3%
Hearing Disability	7%
Speech Disability	8%
Physical Disability	1%
None	24%

DIAGNOSTIC TESTING:

Learning Disability	40%
Educational Problem	7%
Visual Disability	3%
Hearing Disability	3%
Speech Disability	3%
Physical Disability	3%
None	41%

Table 2 (continued)

Characteristics of Adult Literacy Students

PARENTAL EDUCATIONAL ATTAINMENT LEVELS:

	<u>Maternal</u>	<u>Paternal</u>
≤ 6th	5%	5%
7th-8th	8%	10%
9th-11th	14%	7%
H.S. Graduate	31%	26%
Some College	1%	4%
Unknown	41%	48%

6.2 Comparison of Children and AL Students

A major purpose of this study was to explore whether AL students and children who are reading at equivalent grade levels perform similarly in various reading tasks. Woodcock Word Identification (1987) scores were utilized to determine subjects' reading grade levels. An analysis of variance (ANOVA) was conducted to verify that the AL students and the children obtained similar Woodcock Word Identification scores at each reading grade level. The independent variables were subject group (adult vs. child), and reading grade level (3rd vs. 4th vs. 5th). As indicated in Table 3, results of this analysis confirmed that there was a significant main effect for reading grade level, but no significant main effect or interaction involving subject group. These results indicate that the two groups read similar number of words at each reading grade level. Mean performances of the groups are reported in Table 4.

To investigate whether the AL students and children performed similarly on other reading measures, several ANOVA tests were conducted. The independent variables in these analyses were subject group (adult vs. child), and reading grade level (3rd vs. 4th vs. 5th). The dependent variables consisted of the number of correct responses on the tasks listed below. Raw scores were utilized in the analyses unless otherwise specified:

1. Nonword Decoding (Word Attack subtest of the Woodcock

- Reading Mastery Tests-Revised-Form G, Woodcock, 1987).
2. Sight Word Reading (Adams & Huggins, 1985).
 3. Letter Pattern Task (Siegel, et al., in press).
 4. Letter Position Task (Katz, 1977).
 5. Spelling Inventory (Bear et al., 1989).
 6. Deletion (Rosner & Simon, 1971).
 7. Segmentation (Ehri & Wilce, 1980).
 8. Rhyme Word Reading (Levinthal et al., 1992).
 9. Extra Letter Segmentation (Ehri & Wilce, 1980).
 10. Receptive Vocabulary (Peabody Picture Vocabulary Test-Revised, Dunn & Dunn, 1981).

Descriptive statistics for the children and AL students, including maximum scores, means, and standard deviations, are presented in Table 4. All subjects completed all tasks and there were 72 AL students and 72 children. There were 24 subjects at each reading grade level (3rd, 4th, 5th) in both subject groups. Adults and children were expected to differ on most of these reading measures, based on results of previous studies. Specific hypotheses capturing these expectations are spelled out below followed by results of the relevant ANOVAs. The test statistics in these analyses are reported in Table 3.

Table 3

Test Statistics in the ANOVAs of Reading Variables

<u>Main Effects and Interaction</u>			
<u>Dependent Measure</u>	<u>Subject Group</u>	<u>Reading Level</u>	<u>Interaction</u>
Word Recognition	2.70 (ns)	631.12 ^{***}	2.00 (ns)
NonWord Decoding	85.94 ^{***}	42.35 ^{***}	1.80 (ns)
Sight Word Reading	15.86 ^{***}	103.09 ^{***}	1.00 (ns)
Letter Pattern	0.05 (ns)	3.40 [†]	2.73 [†]
Letter Position	1.60 (ns)	2.22 (ns)	0.45 (ns)
Spelling	10.15 ^{***}	60.80 ^{***}	1.00 (ns)
Deletion	113.22 ^{***}	28.39 ^{***}	1.12 (ns)
Segmentation	65.34 ^{***}	1.71 (ns)	0.30 (ns)
Rhyme Word Reading	9.69 ^{††}	13.03 ^{***}	2.30 (ns)
Extra Letter			
Segmentation	29.60 ^{***}	1.30 (ns)	0.32 (ns)
Receptive Vocabulary	29.03 ^{***}	3.65 [†]	5.04 ^{††}

Note. The test statistics were F-values with the following degrees of freedom: for subject group F (1, 138); for reading level, F (2, 138); for interaction F (2, 143).

[†]p < .05; ^{††}p < .01; ^{***}p < .001; ns = not significant

Table 4

Means and Standard Deviations for all Measures
As a Function of Reading Level and Subject Group

Measure (Maximum Score)	Reading Levels					
	Third Grade		Fourth Grade		Fifth Grade	
	<u>M</u>	<u>(SD)</u>	<u>M</u>	<u>(SD)</u>	<u>M</u>	<u>(SD)</u>
<u>Woodcock</u> <u>Word</u> <u>Recognition</u> (154)						
Children	113.8	(5.4)	130.8	(5.0)	148.5	(5.5)
Adults	113.5	(6.1)	134.3	(4.8)	149.3	(3.9)
<u>Nonword</u> <u>Decoding</u> (40)						
Children	23.1	(7.4)	26.7	(5.1)	32.0	(3.3)
Adults	11.5	(5.5)	18.0	(7.1)	24.8	(6.3)
<u>Sight Word</u> (50)						
Children	16.9	(5.0)	23.8	(4.5)	33.5	(3.7)
Adults	19.9	(5.5)	29.3	(8.2)	36.1	(5.8)
<u>Letter Pattern</u> (16)						
Children	12.2	(2.2)	12.5	(1.9)	14.0	(1.3)
Adults	12.9	(1.9)	13.0	(1.8)	13.0	(1.8)

Table 4 (continued)

Means and Standard Deviations for all Measures
As a Function of Reading Level and Subject Group

Measure (Maximum Score)	Reading Levels					
	Third Grade		Fourth Grade		Fifth Grade	
	<u>M</u>	<u>(SD)</u>	<u>M</u>	<u>(SD)</u>	<u>M</u>	<u>(SD)</u>
<u>Letter</u>						
<u>Position</u>						
(26)						
Children	18.2	(3.5)	18.6	(2.6)	20.0	(2.7)
Adults	19.3	(3.1)	19.3	(3.0)	20.0	(3.0)
<u>Spelling</u>						
(20)						
Children	7.4	(1.9)	10.5	(2.6)	14.8	(2.2)
Adults	6.4	(3.7)	9.4	(4.4)	12.3	(3.3)
<u>Deletion</u>						
(40)						
Children	19.1	(6.3)	23.1	(6.2)	30.0	(6.5)
Adults	10.0	(4.9)	10.4	(6.2)	17.9	(7.8)
<u>Segmentation</u>						
(10)						
Children	5.7	(2.6)	6.3	(2.9)	6.9	(2.9)
Adults	2.0	(2.0)	3.0	(2.7)	2.8	(3.2)

Table 4 (continued)

Means and Standard Deviations for all MeasuresAs a Function of Reading Level and Subject Group

Measure (Maximum Score)	Reading Levels					
	Third Grade		Fourth Grade		Fifth Grade	
	<u>M</u>	<u>(SD)</u>	<u>M</u>	<u>(SD)</u>	<u>M</u>	<u>(SD)</u>
<u>Rhyme Word</u> <u>Reading</u> (106)						
Children	59.4	(12.2)	60.9	(18.2)	73.5	(14.6)
Adults	45.8	(3.2)	60.3	(16.8)	63.7	(13.9)
<u>Extra Letter</u> <u>Segmentation</u> (1.00)						
Children	.64	(.48)	.46	(.35)	.57	(.41)
Adults	.24	(.38)	.18	(.24)	.24	(.32)
<u>Receptive</u> <u>Vocabulary</u> (175)						
Children	94.2	(9.9)	98.0	(11.2)	109.7	(10.0)
Adults	112.0	(17.5)	115.6	(16.3)	111.8	(16.3)

1. NonWord Decoding:

Hypothesis #1: Children will read nonsense words more accurately than the AL students indicating superior decoding skill.

Results: The hypothesis was supported. As evident in Table 3, the main effect of subject group was significant as well as the main effect of reading level, with no interaction between the two variables. As indicated by mean performances in Table 4, children decoded nonsense words more accurately than AL students across all reading levels. Also, nonwords were decoded more accurately at higher reading levels by both groups.

As Stanovich et al. (1984) point out, the ability to read nonsense words reflects how well individuals can utilize spelling-sound correspondence rules or analogy strategies. It is interesting that five AL students appeared to utilize an analogy strategy when reading at least some of these nonsense words. For example, when presented with the nonsense word "dee," a subject said "oh - that looks like bee, so it must be dee." Another subject exclaimed that "fay" reminded him of "may" and therefore he could read the nonsense word. None of the children expressed utilization of this strategy. Rather, children as well as the other AL students either silently sounded out the words before reading them, or decoded them out loud as evident by overt sounding out and blending strategies.

Another difference noted between the groups was that the majority of the children regarded the task with enthusiasm. This was indicated by remarks such as "Oh, you want me to read Martian words" or, "These words look like a different and secret language" or, "This will be fun" or, "This is cool." In contrast, the adults, often approached the task with trepidation, unsure that they would even read the sample words correctly. Common remarks included: "Oh, I don't think that I will be able to do this," "This is much too hard" and, "I can't wait until this part is over."

2. Sight Word:

Hypothesis #2: AL students will read irregular words more accurately than the children, indicating superior sight word reading skill.

Results: The hypothesis was supported. As evident in Table 3, the main effect of subject group was significant as well as the main effect of reading level, with no interaction between the two variables. As indicated by mean performances in Table 4, AL students read sight words more accurately than children across all reading levels. Also, sight words were read more accurately at higher reading levels by both groups.

3. Orthographic Tasks:

Hypothesis #3: Compared to the children, AL students will exhibit higher scores on the orthographic tasks.

Results: The hypothesis was not supported.

a. Letter Pattern: As evident in Table 3, a main effect for subject group was not found. From means in Table 4, it is apparent that subjects succeeded on 12-14 out of 16 items, a level above chance and close to ceiling. This indicates that the children and adults were equally skilled in determining which letter sequences were more characteristic of English word spellings.

A main effect for reading grade level was found, as well as an interaction between subject group and reading grade level. From means in Table 4, it is apparent that performances were superior at higher reading levels but only for the children, not for the adults. In other words, reading grade level was associated with superior letter pattern knowledge (sequential redundancy knowledge) among children but not among AL students.

b. Letter Position: As is evident in Table 3, neither the main effects nor the interaction were significant. From means in Table 4, it is apparent that subjects succeeded on 18-20 out of 26 items, a level above chance. This task is thought to measure knowledge of spatial redundancy. Results indicated that children and AL students were equally skilled at determining which of two letter positions most commonly occurs in English words.

c. Spelling: As evident in Table 3, the main effect of subject group was significant as well as the main effect of reading level, with no interaction between the two

variables. As indicated by mean performances in Table 4, children spelled words more accurately than AL students across all reading levels. Also, words were spelled more accurately for both the children and the AL students at higher reading levels.

To summarize findings across the three orthographic measures, in no case was there evidence for the hypothesis that AL students possess superior orthographic knowledge compared to children. On two of the tasks, those measuring letter pattern and letter position knowledge, performances of adults and children were very similar. On the spelling measure, children spelled more words correctly than AL students, providing support for an alternative hypothesis, that children possess orthographic knowledge that is superior to AL students.

4. Phonological Processes:

Hypothesis #4: Compared to children, AL students will perform less well on the tasks measuring phonological processes.

Results: The hypothesis was supported.

a. Deletion: As evident in Table 3, the main effect of subject group was significant as well as the main effect of reading level, with no interaction between the two variables. As indicated by mean performances in Table 4, children deleted sounds of words more accurately than AL students across all reading levels. Also, sounds were

deleted more accurately at higher reading levels by both groups. The extent of AL students' difficulty in this task is highlighted by the fact that 22/72 AL students deleted sounds accurately on fewer than ten words correctly, compared to only 1/72 children. In addition, as revealed in Table 4, AL students at the 5th grade level performed worse on average than children at the 3rd grade level.

b. Segmentation: As evident in Table 3, the main effect of subject group was significant. Neither a main effect of reading level nor an interaction between the two variables was found. This indicates that children segmented sounds of words more accurately than AL students across all reading levels, but readers at higher levels did not outperform less advanced readers.

The difficulty AL students experienced with this task is highlighted by the amount of practice they required before beginning the test. To prepare subjects for the task, the experimenter modeled the procedure and asked subjects to imitate the models. If subjects made mistakes on the practice words, the experimenter provided the correct responses and subjects repeated the practice trials until the words were accurately segmented. While none of the children needed extra practice, 16 of the AL students at the third grade level required extra practice trials (range = 1-3 practice trials), 10 of the AL students at the fourth grade reading level required extra practice trials (range =

1-4 practice trials), and 7 of the AL students at the fifth grade reading level required extra practice (range = 1-3 practice trials). In spite of the added practice trials, 22/72 AL students did not segment any of the test words correctly, compared to only 1/72 children. In addition, as revealed by mean scores in Table 4, the fifth grade level AL students performed far worse than the third grade level children. Finally, many of the adults expressed great frustration with this task.

To summarize findings across the two phonological tasks, the hypothesis that AL students would perform worse than children was clearly supported. In fact, AL students exhibited serious deficiencies in their phonological analytic ability, with several subjects failing to respond to most if not all the items.

5. Amalgamation Processes:

Hypothesis #5: Compared to the children, AL students will perform less well on the tasks measuring amalgamation processes.

Results: The hypothesis was supported.

a. Rhyme Word Reading: The dependent measure in this task was the number of word pairs with dissimilar spellings that readers recognized as rhyming (e.g., shoe-blue) plus the number of word pairs with similar spellings that readers recognized did not rhyme (e.g., comb-tomb). As evident in Table 3, the main effect of subject group was

significant as well as the main effect of reading level, with no interaction between the two variables. As indicated by mean performances in Table 4, children processed rhyme relations among words more accurately than AL students across all reading levels. Also, rhyming pairs were detected more accurately at higher reading levels in both groups.

b. Extra Letter Segmentation: The dependent measure involved the detection of ambiguous sounds in correctly spelled words. The words included ambiguous sounds that are only detected in pronunciations because they are symbolized in spellings (for example, pitch). Initial analysis of performances in this task revealed that many of the subjects (86% of the AL students and 58% of the children) could not spell all of the words to be segmented. In fact, four AL students could not spell any of the words (compared to zero children). This was important because scores on this task were intended to reflect the influence of subject's spelling knowledge on their conception of ambiguous sound segments in words. Therefore, raw scores were not used. Instead, each score consisted of a proportion. The number of correctly spelled extra-letter words served as the denominator. The numerator was the number of these correctly spelled words which were segmented correctly to include a separate segment corresponding to the extra letter. Before being subjected to an ANOVA, the

proportion scores were transformed by the arc sine function.

As evident in Table 3, the main effect of subject group was significant. Neither a main effect of reading level nor an interaction between the two variables was detected. This indicates that children detected ambiguous sounds of words more accurately than AL students across all reading levels, but subjects did not detect more sounds at higher reading levels. The difficulty AL students experienced with this task is highlighted by the fact that 32/72 AL students did not detect any ambiguous sounds in correctly spelled words, compared to only 9/72 children. In addition, many of the adults expressed great frustration with this task.

To summarize findings across the two amalgamation tasks, the hypothesis that, compared to children, adults would have spellings more weakly amalgamated to pronunciations of words in memory was supported. Adults were less accurate in distinguishing between rhyming and nonrhyming written words when the spellings were misleading, and they were less likely to conceptualize ambiguous letters in the spellings of words as symbolizing a separate phoneme in the pronunciations of words.

6. Receptive Vocabulary:

Hypothesis #6: AL students and children will not differ significantly on the receptive vocabulary task.

Results: The hypothesis was not supported. As evident in Table 3, the main effect of subject group was significant

as well as the interaction between subject group and reading level. However, there was no main effect of reading level. From means in Table 4, it is apparent that the adults knew more vocabulary words than children. In addition, the differences in means between the children and adults were greater at the 3rd and 4th reading grade levels than at the 5th grade level. Post hoc t -tests performed at each reading grade level revealed that adults outperformed children at the 3rd grade level, $t(1, 36) = 4.33, p < .001$, and at the 4th grade level, $t(1, 41) = 4.36, p < .001$. The difference between adults and children fell short of significance at the 5th grade reading level, $t(1, 38) = .53, p > .05$. This indicates that adults' vocabulary was superior to that of children mainly at the two lower reading grade levels.

From means in Table 4, it is apparent that vocabulary performance increased with reading level among the children but not among adults. To verify this, one-way ANOVAS were conducted on the two groups separately, with reading grade as the independent variable. A main effect was detected in the child ANOVA, $F(2, 69) = 14.53, p < .001$, but not in the adult ANOVA, $F(2, 69) = 0.40, (ns)$. This verifies that receptive vocabulary skills increased across grade levels for the children, but was similar for the adults across grade levels.

Further analyses were conducted to try to understand the nature of the AL students' higher receptive vocabulary

knowledge. Performances of AL students in this study were compared to performance norms for adults given in the PPVT-R test manual. Since only age ranges were obtained during the AL interview, the midpoint of each subject's range was selected, and a corresponding standard score was obtained from the test manual. Since the PPVT-R only reports data for subjects younger than 41 years of age, norms for 40 year olds were applied to subjects over 40. This was necessary for 14 subjects. For each reading grade level, the mean standard scores were determined. The percentile rank corresponding to each mean was obtained from the test manual. Mean percentile ranks were obtained for the children as well. Values reported in Table 5 reveal that the AL students performed very poorly, at the first percentile or lower. In contrast, the children performed at the 30-39th percentile. Thus, although their receptive vocabulary scores were higher than the children's at most grade levels, the adults' receptive vocabulary knowledge was extremely deficient when compared to that of normal adults. Unfortunately, the PPVT-R test manual does not provide the educational levels of the adult norming sample. However, since 23% are listed as professionals and administrators, and only 8% as laborers, the norming sample is probably more educated than the present study's sample. A comparison of occupational representation is not possible, because the present study's AL interview did not include occupational

questions.

Table 5
Mean PPVT-R Standardized Scores (SS)
And Corresponding Percentile Ranks
For Children and AL Students

Subjects	Reading Levels					
	Third Grade		Fourth Grade		Fifth Grade	
	<u>SS</u>	<u>% Rank</u>	<u>SS</u>	<u>% Rank</u>	<u>SS</u>	<u>% Rank</u>
Children	92	30	92	30	96	39
AL Students	61	<1	63	1	61	<1

Note. The number of subjects in each cell was 24.

To summarize, the ANOVA results indicate that the children were stronger than the AL students in the following skills: nonword decoding, phonological knowledge (both deletion and segmentation skills), amalgamation ability (both extra letter segmentation and rhyme word reading tasks), and spelling skills. The AL students were stronger than the children in their sight word reading and receptive vocabulary. The two groups were similar in their orthographic knowledge involving letter positions and letter patterns. Superior performances at higher reading grade levels were apparent on several reading process measures for both children and AL students: nonword decoding, sight word reading, spelling, deletion, and rhyme word reading. No differences across reading grade level were detected for three process measures: letter position knowledge, segmentation and extra letter segmentation skills. On the measures of letter pattern and receptive vocabulary knowledge, children's performances improved at higher reading grade levels, while AL students' performances did not. Finally, on the vocabulary measure, adults outperformed children at the third and fourth reading grade levels, but not at the fifth grade reading level.

6.3 Intercorrelations of All Variables

When this study was initially conceptualized, it included a series of regression analyses to examine the predictive value of three reading process variables on the following dependent measures: word recognition (Woodcock Word Identification subtests, 1987), sight word reading (Adams & Huggins, 1985), and nonword decoding (Woodcock Word Attack subtest, 1987). The independent variables included the status of the subject (whether the subject was an AL student or child) and the following composite scores:

1. A phonological composite score constructed from the deletion and segmentation tasks.
2. An orthographic composite score constructed from the spelling, letter position, and letter pattern tasks.
3. An amalgamation composite score constructed from the extra letter segmentation and the rhyme word reading tasks.

To verify that the measures comprising each composite variable were strongly intercorrelated for the children as well as adults, the correlations among the variables were analyzed before the regression analyses were conducted. The intercorrelation matrices are presented in Table 6 for the children, and in Table 7 for the AL students (see Appendix N for the intercorrelation matrix for the combined sample of children and AL students). To summarize, 4 of the 5 correlations were significantly higher than zero for

children, but only 1 of the correlations was significantly higher than zero for adults. Those correlations higher than zero, however, were not strong, ranging from $r = .27$ to $r = .36$.

1. Phonological Composite:

Among the children, the segmentation and deletion tasks were significantly correlated, $r = .29$, $p < .05$. However, for the AL students these tasks were not correlated, $r = .06$, $p > .05$.

2. Orthographic Composite:

Among the children, all three orthographic tasks (letter position, letter pattern, and spelling tasks) were significantly correlated with each other:

a. letter position and letter pattern: $r = .28$,
 $p < .05$.

b. letter position and spelling: $r = .27$, $p < .05$.

c. letter pattern and spelling: $r = .36$, $p < .01$.

However, among the AL students, the letter position and the letter pattern tasks were not correlated, $r = .13$, $p > .05$. Neither were the letter position and spelling tasks correlated significantly, $r = .15$, $p > .05$. Only the spelling and letter pattern tasks were significantly correlated, $r = .30$, $p < .05$.

3. Amalgamation Composite:

The extra letter segmentation task and rhyme word reading task were not significantly correlated in either group,

$\underline{r} = .11$, $p > .05$. for children, and $\underline{r} = .02$, $p > .05$ for adults.

Because intercorrelations among tasks contributing to composite variables were not sufficiently high in both subject groups, the plan to use composites in the regression analyses was replaced with an alternative plan, to enter the task variables separately into the regression analyses.

Some other notable relationships surfaced in the correlation matrices. Previous studies have indicated that vocabulary knowledge and reading ability are correlated (Cunningham & Stanovich, 1990). This relationship was evident in the present study among the children, for whom receptive vocabulary scores were significantly correlated with word recognition ($\underline{r} = .49$, $p < .01$), sight word reading ($\underline{r} = .48$, $p < .01$), deletion ($\underline{r} = .29$, $p < .05$), spelling ($\underline{r} = .31$, $p < .01$) and rhyme word reading ability ($\underline{r} = .40$, $p < .01$). However, the relationship was not apparent among AL students, for whom receptive vocabulary was not significantly associated with any of the tasks (see Tables 6 and 7).

Among the children, rhyme word reading was correlated with seven tasks beyond the .01 level of significance: word recognition ($\underline{r} = .41$); sight word reading ($\underline{r} = .40$); receptive vocabulary ($\underline{r} = .40$); deletion ($\underline{r} = .38$); letter pattern ($\underline{r} = .37$); letter position ($\underline{r} = .36$); and spelling ($\underline{r} = .34$). However, for the adults, rhyme word reading was

only correlated beyond the .01 level of significance with word recognition ($r = .42$). This suggests that rhyme word reading shared processes with the other tasks to a greater extent among children than among adults, for whom it operated independently.

Among the children, 25 out of the 55 correlations in Table 6 were significant beyond the .01 level of significance. This is in contrast to the AL students where only 13 correlations were significant at $p < .01$ (see Table 7). Moreover, comparison of correlations cell by cell revealed that in 80 percent of the cases, the correlation for children was larger than the correlation for adults, whereas in only 14 percent of the cases was the reverse true. The median correlation in the child data was .28 whereas the median correlation in the adult data was .07 indicating that the difference between the size of the correlations was large. Therefore, despite the fact that the two groups had achieved the same level of maturity in word recognition, the various subskills comprising literacy were more thoroughly integrated and interrelated among normally developing readers than among the adult literacy students who were delayed in their reading acquisition.

Although fewer correlations among the reading variables showed strength among AL students, it was not the case that variables were totally unrelated. Some of the same relationships were apparent among both adults and children.

Nonword decoding was highly correlated beyond the .01 level of significance with word recognition, sight word reading, deletion, and spelling in both groups (see Tables 6 and 7). Another similarity between the two groups involved the extra letter segmentation task. As indicated in Tables 6 and 7, for both children and AL students, the only task correlated with the extra letter segmentation task was the segmentation task. Furthermore, the deletion task was moderately to strongly correlated with spelling performance in both groups (both $ps < .01$). Thus, there were similarities as well as differences in the relationships among variables observed for children and adults.

Table 6

Intercorrelation Matrix of the Measures for the Children

Task	1	2	3	4	5	6	7	8	9	10	11
1.WR	--	.63 ^{**}	.90 ^{**}	.49 ^{**}	.19	.63 ^{**}	.42 ^{**}	.27 [†]	.86 ^{**}	.41 ^{**}	-.10
2.DEC		--	.52 ^{**}	.10	.14	.53 ^{**}	.16	.13	.62 ^{**}	.19	-.20
3.SIGHT			--	.48 ^{**}	.15	.54 ^{**}	.42 ^{**}	.11	.82 ^{**}	.43 ^{**}	-.03
4.RV				--	.13	.29 [†]	.16	.07	.31 ^{**}	.40 ^{**}	.13
5.SEG					--	.29 [†]	-.03	.24 [†]	.22	.06	.59 ^{**}
6.DEL						--	.27 [†]	.41 ^{**}	.62 ^{**}	.38 ^{**}	.03
7.SIEG							--	.28 [†]	.36 ^{**}	.37 ^{**}	-.04
8.KATZ								--	.27 [†]	.36 ^{**}	.05
9.SPELL									--	.34 ^{**}	-.01
10.RJ										--	.11
11.EX											--

Note. WR = word identification derived from subtests of the Woodcock Reading Mastery Test; DEC = nonword decoding derived from Word Analysis Subtest of the Woodcock Reading Mastery Test; SIGHT = sight word reading derived from Adams and Huggin's irregular word reading task; RV = receptive vocabulary derived from the PPVT-R; SEG = segmentation derived from Ehri and Wilce's task; DEL = deletion derived from Rosner and Simon's Auditory Analysis Test; SIEG = letter pattern derived from Siegel et al.'s task; KATZ = letter position derived from Katz' task; SPELL = spelling derived from Bear et al.'s spelling inventory; RJ = rhyme judgement derived from Levinthal's task; EX = extra letter segmentation derived from Ehri and Wilce's task.

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

Table 7

Intercorrelation Matrix of the Measures for the AL Students

Task	1	2	3	4	5	6	7	8	9	10	11
1.WR	--	.68 ^{**}	.74 ^{**}	.03	.11	.44 ^{**}	.06	-.01	.57 ^{**}	.42 ^{**}	.04
2.DEC		--	.44 ^{**}	.09	.03	.42 ^{**}	.06	.08	.41 ^{**}	.26 [†]	.02
3.SIGHT			--	-.07	.07	.40 ^{**}	.37 ^{**}	.02	.64 ^{**}	.27 [†]	.01
4.RV				--	.07	.05	-.16	-.02	-.22	.09	.07
5.SEG					--	.06	-.04	.02	.09	.05	.74 ^{**}
6.DEL						--	.08	.18	.38 ^{**}	.24 [†]	.08
7.SIEG							--	.13	.30 [†]	-.11	.01
8.KATZ								--	.15	.00	-.06
9.SPELL									--	-.02	.02
10.RJ										--	.02
11.EX											--

Note. WR = word identification derived from subtests of the Woodcock Reading Mastery Test; DEC = nonword decoding derived from Word Analysis Subtest of the Woodcock Reading Mastery Test; SIGHT = sight word reading derived from Adams and Huggin's irregular word reading task; RV = receptive vocabulary derived from the PPVT-R; SEG = segmentation derived from Ehri and Wilce's task; DEL = deletion derived from Rosner and Simon's Auditory Analysis Test; SIEG = letter pattern derived from Siegel et al.'s task; KATZ = letter position derived from Katz' task; SPELL = spelling derived from Bear et al.'s spelling inventory; RJ = rhyme judgement derived from Levinthal's task; EX = extra letter segmentation derived from Ehri and Wilce's task.

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

6.4 Regression Analyses

Regression analyses were conducted to explore which of several reading process variables accounted for significant variance in word recognition, nonword decoding and sight word reading scores for the children and AL students. As discussed in the previous section, composite scores were not utilized because intercorrelations among the variables making up the composites were not sufficiently strong in both subject groups.

Regression analyses were conducted on the following dependent measures: word recognition, nonword decoding, and sight word reading. The independent variables entered as predictors in the analyses were performances in the following tasks: deletion, segmentation, spelling, letter position, letter pattern, and rhyme word reading. The extra letter segmentation task was not included primarily because scores correlated highly with the segmentation task, indicating that the two tasks were measuring the same process and hence provided redundant information about subjects' segmentation ability. The child and adult data were combined in the regression analyses, and the status of subjects (child vs. AL student) was entered as an additional independent variable in order to assess whether predictor variables operated differently in the two subject groups. Such a difference was indicated by the presence of a significant interaction between the predictor variable and

subject status.

A backwards, step-wise procedure was utilized to uncover the significant predictors. Results are reported in Tables 8, 9, and 10, where it is evident that very similar results were found for the children and adults.

1. For children, word recognition scores were predicted by spelling and deletion, whereas for the AL students, the word recognition scores were predicted by spelling, deletion, and rhyme word reading scores. This can be understood by looking at the terms of the regression analysis in Table 8. There were three types of terms in the regression analysis: the reading process variables (deletion, segmentation, spelling, letter position, letter pattern, and rhyme word reading), the status of the subject (child vs. AL student), and the cross product between the reading process variable and status of subject. In the analysis, since AL subjects were coded as one, and children coded as zero, if a reading variable was significant in the cross product (such as rhyme word reading in this analysis), it was only significant for the AL students and not for the children. This procedure was followed for the remaining two regression analyses.

2. For children, nonword decoding scores were predicted by deletion and spelling, whereas for the AL students, nonword decoding scores were predicted by deletion, spelling and rhyme word reading scores.

3. For both children and AL students, sight word reading scores were predicted by spelling, letter pattern, rhyme word reading, and letter position scores.

In summary, very similar reading process variables accounted for variance in word recognition, nonword decoding, and sight word reading for children and AL students. However, an additional variable proved important for adults but not children, that involving rhyme word reading, interpreted in this study as an indication of amalgamation. This variable accounted for additional significant variance in AL students' word recognition and nonword decoding scores.

To assess the importance of the key predictor variables for each of the two subject groups, another set of regression analyses was conducted separately on the performances of the AL students and children. The dependent variables were word recognition, sight word reading and nonword decoding. The independent variables included only those reading process variables that accounted for significant variance in the previous regression analyses where AL and child scores were combined. Squared multiple correlations were computed for the AL students and children to examine what proportion of the variance was accounted for by the reading process variables found to be significant in the earlier, combined analyses. Of interest was whether the variables were equally predictive for adults and for

children.

A. Word Recognition: For children, the independent variables were spelling and deletion. For AL students, the independent variables were spelling, deletion, and rhyme word reading. From Table 11, it is evident that much more variance in word recognition scores was accounted for in the case of children than in the case of AL students, 74% vs. 54%. Spelling was the major variable accounting for the most variance in both subject groups (74% for children, 33% for adults), and deletion was least important (2% in each case). However, it should be noted that spelling and deletion were strongly correlated in both groups, so the two variables are not completely independent contributors. Finally, whereas rhyme word reading explained 19% of the variance in adults' performance, it was not a significant predictor in children's performance. This suggests that amalgamation was important for distinguishing the better from poorer readers among adults. Its lack of showing among children may have arisen because it was more strongly correlated with several other variables, including spelling and deletion.

B. Sight Word Reading: For both children and AL students, the important independent variables included spelling, rhyme word reading, letter pattern and letter position scores. From Table 11 it is apparent that spelling accounted for much more variance than the other variables in

both subject groups. The amount of variance accounted for by each of the variables was similar in both groups with the exception of spelling which accounted for 68% of the variance in children's sight word reading but only 40% of the variance in adults' sight word reading.

Comparison of results in the word recognition analysis to results in the sight word reading analysis in Table 11 reveals some similarities and differences. About the same amount of variance was explained by the process variables for both word recognition and sight word reading in each subject group: for AL students, 54% vs. 54%; for children, 76% vs. 75%. Also spelling was the most important process variable for both subject groups in both analyses, and rhyme word reading was the second most important process variable in both analyses for adults. However, the other process variables accounting for minor proportions of variance differed for the word recognition and sight word reading analyses, indicating that somewhat different processes were involved in the sight word reading and word recognition tasks.

Letter pattern and letter position process variables were important for sight word reading among both AL students and children, indicating the importance of orthographic knowledge for remembering how to read words that do not conform to spelling-sound correspondence rules. Rhyme word reading was also important for both children and adults.

This may indicate the importance of amalgamation. Alternatively, the relationship between the rhyme judgment task and the sight word reading task may have arisen because both require the recognition and pronunciation of irregularly spelled words.

C. Nonword Decoding: For children, the important independent variables were spelling and deletion. For the AL students, the important independent variables were spelling, deletion, and rhyme word reading. As evident in Table 11, spelling accounted for more variance than the other variables among children whereas deletion accounted for more variance than the other variables among adults. As in the other analyses, more total variance was accounted for by the process variables in the case of children than in the case of AL students, 42% vs. 29%. Comparison of the three analyses reveals that reading process variables accounted for less total variance when nonword decoding was the dependent variable than when word recognition and sight word reading scores served as the dependent variables. This indicates that the process variables examined in the present study were more heavily involved in word reading processes than in nonword reading processes.

In summary, with the exception of the added importance of rhyme word reading for the AL students, the same process variables accounted for the bulk of the variance in word recognition, nonword decoding, and sight word reading for

both groups. However, less overall variance was accounted for in the performances of AL students. One interpretation is that there are other factors yet to be discovered that account for variance in AL students' word reading performance. Another interpretation is that less variance was accounted for because reading development occurred less systematically in AL students than in children. Whereas adults acquired their skill over a longer period of time in more variable ways with more varied experiences, children's literacy acquisition was controlled by teachers delivering consistent instruction in elementary schools over a 3-5 year span.

Table 8

Multiple Regression, After Step-Wise Removal of Non-Significant Predictors of Word Recognition

<u>Variable</u>	<u>B</u>	<u>S.E. B.</u>	<u>Beta</u>	<u>F</u>	<u>Sig F</u>
InterRR	.366	.065	.295	31.33	<.01
Spelling	.332	.333	.813	84.03	<.01
AL/Child	7.701	2.233	.253	11.91	<.01
InterSpel	-1.121	.399	-.245	7.90	.01
Deletion	.304	.125	.187	5.96	.02

Note. AL/Child = whether subject was an AL student or child; InterRR = interaction of AL/Child and rhyme reading task; InterSpel = interaction of AL/Child and spelling.

With AL subjects coded as one, and children coded as zero, the following regression equation was produced:

word recognition =

.3spelling+.3deletion+ AL/Child(8+.4rhyme word reading-1spelling)

For children the equation was:

word recognition = .3spelling + .3deletion

For adults the equation was:

word recognition = -.7spelling +.3deletion +.4rhyme word reading

Table 9
Multiple Regression, After Step-Wise Removal of Non-
Significant
Predictors of Sight Word Reading

<u>Variable</u>	<u>B</u>	<u>S.E. B.</u>	<u>Beta</u>	<u>F</u>	<u>Sig F</u>
Spelling	1.326	.137	.605	94.19	<.01
AL/Child	8.521	1.193	.479	51.00	<.01
Siegel	.853	.260	.179	10.75	<.01
Katz	-.524	.163	-.176	10.35	<.01
Rhyme	.118	.029	.227	16.66	<.01

Note. AL/Child = whether subject was an AL student or child; Siegel = letter pattern task; Katz = letter position task; Rhyme = rhyme word reading task.

For both AL subjects and children the following regression equation was produced:

sight word reading =

1spelling+.9 letter pattern+.1rhyme-.5letter position

Table 10

Multiple Regression, After Step-Wise Removal of Non-Significant Predictors of Nonword Decoding

<u>Variable</u>	<u>B</u>	<u>S.E. B.</u>	<u>Beta</u>	<u>F</u>	<u>Sig F</u>
InterRR	.104	.043	.146	5.76	.02
Spelling	.700	.150	.325	21.82	<.01
AL/Child	-4.833	1.308	-.276	13.65	<.01
Deletion	.250	.081	.268	9.55	<.01

Note. AL/Child = whether subject was an AL student or child; InterRR = interaction of AL/Child and rhyme reading task.

With AL subjects coded as one, and children coded as zero, the following regression equation was produced:

nonword decoding =

.3deletion+ .7spelling+ AL/Child(-5 + .1rhyme word reading)

For children the equation was:

nonword decoding = .3deletion + .7spelling

For adults the equation was:

nonword decoding =

.3deletion + .7spelling + .1rhyme word reading

Table 11

Proportion of the Variance Accounted for by Reading Process
Measures for Adults and Children

<u>Dependent Measure</u>	<u>Adults</u>	<u>Children</u>
Word Recognition	Spelling (33%) Rhyme Word (19%) Deletion (2%) Total = 54%	Spelling (74%) Deletion (2%) Total = 76%
Sight Word Reading	Spelling (40%) Rhyme Word (8%) Letter Pattern (5%) Letter Position (1%) Total = 54%	Spelling (68%) Rhyme Word (3%) Letter Position (3%) Letter Pattern (1%) Total = 75%
Nonword Decoding	Deletion (18%) Spelling (7%) Rhyme Word Reading (4%) Total = 29%	Spelling (39%) Deletion (3%) Total = 42%

Section VII DISCUSSION

7.1 Summary of the Results

Despite similar reading grade levels, children and AL students differed significantly on most of the reading variables. Children outperformed adults in decoding, phonological processing, and amalgamation skills. AL students outperformed children in the areas of sight word reading and receptive vocabulary. On the tasks measuring orthographic processing, results were mixed. The children performed significantly better than the adults on the spelling inventory, but both groups showed similar levels of letter pattern and letter position knowledge.

Higher reading grade levels were associated for both children and AL students with superior performance on several reading measures: decoding, sight word reading, spelling, deletion, and rhyme word reading. No differences across reading grade level were detected for three process measures: letter position knowledge, segmentation and extra letter segmentation skills. On the measures of letter pattern and receptive vocabulary knowledge, the children's performances improved at higher reading grade levels, while AL students' performances did not. Finally, adults knew more vocabulary words than children at the third and fourth reading grade levels, but they were equivalent at the fifth grade reading level.

The constellations of reading process variables that

proved important in accounting for variance in the analyses of the three dependent measures, word recognition, sight word reading, and nonword decoding, were similar in some but not all respects. Variance in word recognition and nonword decoding was explained by the same process variables: spelling and deletion in the child analyses, and spelling, deletion, and rhyme word reading in the AL student analyses. Variance in sight word reading was explained by spelling also, but the other contributing variables were different: rhyme word reading, letter position and letter pattern in the analyses of both adults and children. As this summary makes evident, most of the process variables proved important for both children and AL students. The main exception was rhyme word reading which surfaced as important for AL students' word recognition and decoding, but was not important for the children.

Regarding the amount of variance accounted for by the process variables, results indicated that less overall variance was explained in the performances of adults than in the performances of children. For sight word reading and word recognition measures, spelling accounted for much more variance than the other variables among both children and adults. For nonword decoding, spelling accounted for the most variance among the children, whereas deletion explained the most variance among the adults.

Both AL students and children exhibited similar

patterns of intercorrelations on the measure of nonword decoding. However, two major differences in the intercorrelation matrices were apparent. First, correlations were much stronger generally in the child data than in the adult data, and many more were statistically greater than zero among children than among adults. Second, consistent with previous research, children's receptive vocabulary scores were significantly related to several reading measures, whereas, AL student's receptive vocabulary knowledge was not significantly associated with any of the reading tasks.

7.2 Explanation of Empirical Findings

Comparison of Reading Proficiencies

Findings from this study shed light on the debate regarding whether adults and children who read words at the same grade levels are equally proficient in the processes thought to underlie word and nonword reading. Results indicated that they are not. Compared to children, AL students showed weaknesses in nonword decoding, phonological, and amalgamation skills, and they showed strengths in the areas of receptive vocabulary and sight word reading. Although adults were similar to children in their orthographic knowledge involving sequential and spatial redundancy, they were weaker in their spelling knowledge. These results reveal that although children and adults might be reading at the same grade levels as measured

by the Woodcock Word Identification subtests (Woodcock, 1987), they are not equally proficient in performing other types of word reading, specifically, sight word reading and nonword reading. Moreover, they are not equally proficient in performing subprocesses thought to underlie word reading, specifically, phonological analysis, amalgamation of print to speech, and knowledge of word spellings.

Results of this study confirm and expand what is known about the strengths and weaknesses of AL students. Results confirm Read and Ruyter's (1985) findings that AL students are deficient in their ability to decode nonwords, and that AL students are relatively strong in their ability to read sight words. This study also confirms the claim that AL students are deficient in phonological processing skills (Kitz, 1988; Lindamood et al., 1992; Read & Ruyter, 1985).

This was the first study to investigate the amalgamation abilities of AL students. Findings showed that AL students performed worse on amalgamation tasks than children, providing support for amalgamation theory. Since amalgamation processes require both phonological and orthographic abilities (Berninger, 1990), given that adults were deficient in phonological abilities, they would be expected to be deficient also in tasks measuring amalgamation.

It was somewhat surprising to find that adults outperformed children on the receptive vocabulary knowledge

task. Previous research has indicated that AL students do not have mature oral language skills (e.g. Cantwell & Rubin, 1992). Further examination of the data revealed that adults outperformed children only at the third and fourth reading grade levels. Adults did not differ from children at the fifth grade level. Moreover, compared to the general population of adults, the vocabulary knowledge of AL students was quite deficient. Thus, findings were not as discrepant with previous claims as was thought at first glance of the data (this will be discussed in more detail subsequently).

This was the first study which administered letter position and letter knowledge tasks to AL students. It was also the first study to directly compare children and AL students on their knowledge of word spellings. It was hypothesized that compared to the children, the AL students would exhibit higher scores on these orthographic tasks. Because the literature review indicated that AL students possess poor phonological skills (Read & Ruyter, 1985), it was hypothesized that they might compensate for their deficit by having superior orthographic skills (Siegel et al, in press). Results showed that children and AL students had similar sequential and spatial redundancy knowledge. The fact that AL students' orthographic knowledge was equivalent to that of children despite the fact that their phonological knowledge was severely deficient compared to

that of children can be interpreted as support for a compensation hypothesis. In other words, whereas children's phonological skills and orthographic knowledge were comparable, adults' orthographic knowledge was superior to their phonological knowledge. This combined with the superior performance of adults over children in reading sight words provides evidence that compensation was operating in the reading skills of adults.

It is unclear why children outperformed the adults on the spelling task, another measure of orthographic knowledge. A possible answer can be found in the intercorrelation matrices. For both children and adults, spelling was strongly correlated with deletion, a measure of phonological processing ability. Deletion was less strongly correlated with measures involving knowledge of letter position and letter sequence, particularly in adults. The fact that phonological processing skill is more central to spelling than to the other orthographic measures combined with the fact that children exhibited superior phonological processing ability provides the explanation: adults were found to be weaker than children in spelling ability because of their phonological processing skill (this issue will be addressed in more detail subsequently).

Why were the adults deficient in decoding and stronger in sight word reading? There are two possible explanations. One is that the adults were more successful reading the

irregularly spelled sight words because this skill requires exposure to words through reading experience (Read & Ruyter, 1985). Exposure to print influences a student's ability to read irregular words automatically and fluently (Juel et al., 1986). Because adults have lived longer than children and presumably have been exposed to many more words, this may have facilitated the development of a larger sight vocabulary. However, exposure to words comes primarily through text reading. Because reading is difficult for AL students, it is questionable how much reading of text they do outside of class. In addition, orthographic processing should be promoted by exposure to print (Stanovich & West, 1989). However, AL students' did not outperform children on measures of orthographic processing. This weakens the argument that their stronger sight word skills were associated with increased print exposure. Future research is needed to understand the connection between exposure to print and sight word reading in AL students.

An alternative explanation for AL students' strong performance on the sight word task is favored. AL students may resemble Ehri's (1987, 1989, 1991) description of phonetic cue readers. Consistent with the findings of this study, phonetic cue readers have difficulty decoding nonwords and often show an enhanced ability to recognize real words with irregular spelling patterns (Juel & Roper/Schneider, 1985). In addition, phonetic cue readers

use partial alphabetic cues to help them read words rather than a phonological recoding strategy. Based on evidence in this study, it is likely that the AL students could not successfully employ letter-sound correspondence rules to help them read words. The AL students had great difficulty with the phonological tasks. Specifically, they were unable to successfully delete and segment sounds, indicating that they were not analyzing parts of words in speech. According to researchers, these phonological skills are crucial to normal reading development, since individuals need to understand that words consist of phonemes in order to realize the importance of letter-sound correspondences (Fowler & Scarborough, 1993).

AL students' performances on the orthographic tasks also support a phonetic cue argument. In spite of superior sight word reading skills, the AL students did not exhibit superior orthographic skills. This is discrepant with the expectation that sight word reading and orthographic knowledge should develop hand in hand (Barker et al., 1992; Ehri, 1992). When sight word reading does not contribute to the development of orthographic knowledge as much as it might, the reason may be that full alphabetic information about the sight words is not being retained in memory. Rather, sight words are represented incompletely with partial alphabetic information. As a result, orthographic patterns recurring across different words are not detected

as easily, hence limiting the development of orthographic knowledge. This would happen if phonetic cue reading underlay the learning of sight words. More research is needed to investigate the hypothesis that AL students at third to fifth grade reading levels resemble phonetic cue readers.

Present results are consistent with previous findings of a developmental relationship between reading grade level and several other reading skills: nonword decoding ability, deletion skills, and spelling ability for both children and AL students (Bear et al., 1989; Byrne & Ledz, 1983; Juel et al., 1986; Pratt & Brady, 1988; Stanovich et al., 1985; Wimmer et al., 1991). The finding that sight word reading and rhyme word reading performances increased as reading grade level increased was consistent with previous research conducted with children (Adams & Huggins, 1985; Levinthal et al., 1992). Present findings are the first to document this growth for AL students. It is unclear why tasks assessing letter position knowledge and segmentation did not show developmental changes. Other researchers have found a relationship between these tasks and reading ability (e.g. Calfee et al., 1973; Katz, 1977). Consistent with previous research, (Siegel et al., in press), letter pattern knowledge for children, was associated with reading growth. This was not true for the adults. Since this is the first time letter pattern knowledge has been tested with AL

students, more research needs to be conducted. Finally, children showed a relationship between reading grade level and receptive vocabulary knowledge, the AL students did not (the issue of vocabulary development and reading ability is addressed in a later section).

Analysis of Processes Underlying

Word and Nonword Reading

Similar processes were found to account for the bulk of the variance in word and nonword reading for both subject groups. For children and AL students, spelling and deletion skills were important predictors of word recognition and nonword decoding performances. For both subject groups, spelling, letter pattern, rhyme word reading, and letter position knowledge were important predictors of sight word reading. This suggests that there are fundamental processes that underlie the acquisition of word reading skills. However, it is important to note that less overall variance was accounted for by these processes among AL students than among children, indicating that these core processes underlie children's reading to a greater extent than adults' reading. It may be that there are other factors important for adults' reading which have yet to be discovered. Alternatively, perhaps the individual differences among AL students are just greater than among children as a result of their very different histories of literacy acquisition. AL students, throughout their lives acquired their reading

skill in variable ways, whereas children have acquired literacy in more controlled ways by teachers over a 3-5 year span in elementary schools.

One variable that proved important in explaining variance in the reading performances of adults but not children was rhyme word reading. One possible explanation for this group difference can be called from the patterns of intercorrelations. For the children, rhyme word reading was correlated with seven tasks beyond the .01 level of significance, whereas for adults it was correlated with only one other task. Therefore for children, rhyme word reading processes overlapped with the other processes required in the other tasks, whereas for the adults it operated more independently. For this reason, rhyme word reading might have carried added importance in the regression analyses of the AL students.

Another difference in the regression analyses distinguishing the two groups lay with nonword decoding. Performance on the deletion task accounted for the most variance in AL students' nonword decoding scores, whereas spelling performance was the most important predictor for children. This suggests that the processes underlying nonword decoding were somewhat different for children and AL students. Whereas orthographic processes dominated for children, phonological processes dominated for adults.

Strengths of Interrelationships

Among Reading Processes

AL students showed weaker interrelationships among the reading measures, indicating a lack of integration of the subskills. The intercorrelation matrices indicated 25 significant correlations (beyond the .01 level of significance) for the children, and only 13 significant correlations (beyond the .01 level of significance) for the AL students. This is reminiscent of Guthrie's (1973) findings. He found that in contrast to reading disabled children, normal children displayed a pattern of significantly correlated reading subskills. He explains that these results indicate a lack of integration among the subskills for the poor readers, and hypothesizes that this integration benefits the normal readers.

Present findings reveal that not only do AL students have deficits in some of the reading subskills but also their reading subskills are less integrated than those of children. This may indicate that there is less interfacilitation among the reading subskills of adults. In other words, each type of reading process may operate independently and may not be activated to support other processes when they operate. For example, when sight words are read, phonological recoding may not be activated as well to confirm that the word read by sight was read accurately. This may be due to less systematic reading instruction for

the AL students, who have acquired their reading skills through more capricious instruction, over longer periods of time, and may have taught themselves some of the skills.

Although fewer correlations among the reading variables showed strength, it was not the case that variables were totally unrelated among AL students. Relationships involving the nonword decoding task showed strong intercorrelation patterns that were similar for children and AL students. Performance on this task was highly correlated beyond the .01 level of significance with word recognition, sight word reading, deletion, and spelling scores in both groups. These results reveal that phonological recoding ability is central to word reading and spelling for both children and AL students.

Data collected from the intercorrelation matrices may illuminate why adults had difficulty with the extra letter segmentation task. For both children and adults, the extra letter segmentation task was highly correlated with the segmentation task (beyond the .01 level of significance). Since both tasks involved the ability to segment sounds, a possible reason for the AL students' poor extra letter segmentation performance may have been their inability to segment sounds. This is confirmed by mean performances of children and adults on the segmentation task. Whereas on average the adults correctly segmented only two to three words, the children on average correctly segmented between

five and six words. According to Ehri's (1986) theory and research, AL students' lack of segmentation ability with regular as well as ambiguous sounds indicates that they are weak in the ability to interpret spellings as symbols for the phonemic structure of words. This weakness would explain their difficulty in remembering the spellings of words which was evident in their spelling performance in the present study.

In the present study, measures were identified to assess amalgamation processes, a concept proposed by Ehri (1980, 1987, 1992) to capture the idea that learning to read involves recognizing and remembering how graphemes in the spellings of words symbolize phonemes in the pronunciation of words. Amalgamation involves the ability to form strong bonds between spellings and pronunciations of words by linking graphemes to phonemes. Two different tasks were employed to assess this in readers, the extra letter segmentation task and the rhyme word reading task. The fact that the two tasks were unrelated to each other in both subject groups, with correlations below $r = .12$, indicates that they were not measuring the same process. Whether it is legitimate to conceptualize amalgamation as a single process that can be measured in some pure way may be problematic. Perhaps amalgamation is better conceptualized as an aspect of reading and spelling that is mixed up with other processes in a way that makes it inextricable. For

example, it is not clear why processes required to perform the rhyme word reading task are any purer a measure of amalgamation than processes required to remember the spellings of words or to remember how to read words. All of these require accessing in memory lexical representations that consist of both graphemes and phonemes linked together.

General Issues Raised by Findings

In the present study, measures of both orthographic and phonological processes were included. Spelling proved to be the best orthographic predictor and deletion proved to be the best phonological predictor in the regression analyses. Both spelling and deletion processes were central for word recognition and for nonword decoding performances. Spelling processes were central for sight word reading. This confirmed previous research which indicated a strong relationship between phonological awareness skills and reading ability (Pratt & Brady, 1988; Wimmer et al., 1991), as well as between spelling knowledge and reading ability (Bear et al., 1989; Juel et al., 1986).

The importance of spelling supports Stanovich and West's (1989) assertion that orthographic processes should be addressed when trying to understand individual differences in reading ability. The importance of orthographic processes is further reinforced by the finding that letter pattern and letter position knowledge accounted for minor proportions of variance in sight word reading

among both adults and children. Unfortunately, research has focused extensively on phonological processes and their connection to reading, but orthographic processes have received minimal attention (Bowers & Wolf, 1993; Willson & Rupley, 1993). Therefore, not as much is known about orthographic processes and how they contribute to overall reading variance.

One question which remains unresolved is the relationship between orthographic and phonological processes. The findings that spelling and deletion performances were highly correlated in both subject groups, and that letter pattern and letter position knowledge were correlated with deletion in the children's group, showed that the two processes are far from being independent. Calfee et al. (1973) also found that subjects' segmentation scores were correlated with WRAT spelling scores. Perhaps orthographic and phonological processes are more similar than different. Further research is necessary.

This study extended and improved on the Read and Ruyter (1985) study. Read and Ruyter administered various phonological, sight word reading, and nonword decoding tasks to adult prison inmates who scored at third and fourth grade reading levels. In contrast to Read and Ruyter who selected their subjects based on reading comprehension scores, subjects in the present study were selected on the basis of their word recognition ability. Results of the

present study confirmed Read and Ruyter's findings. Together, these two studies show that regardless of whether reading comprehension or word recognition scores are utilized to select subjects, AL students reveal weaknesses in phonological and nonword decoding skills and strengths in sight word reading ability.

Read and Ruyter (1985) noted that a significant minority of their AL subjects performed in ways reminiscent of kindergartners and first graders when making phonetic judgements. Although children below the third grade level were not included in the present study, it is interesting that mean performances of the AL students in both the deletion and segmentation tasks were far below the means of the children. Even AL students reading at the highest reading grade level (5th) showed mean performances below that of children reading at the lowest reading grade level (3rd). Thus, similar to Read and Ruyter's (1985) findings, the phonological performance of AL students in the present study resembled that of younger normal children reading below the third grade level.

One important way that the present study improved on the design used by Read and Ruyter (1985) is that tasks were administered directly to children in the present study whereas data on children were extrapolated from other studies in the comparisons drawn by Read and Ruyter. In addition, several reading processes assessed in the present

study were not included in Read and Ruyter's study. Thus, results of the present study provide a more complete picture of similarities and differences between AL students and much younger normally developing readers.

Vocabulary Knowledge

Among adult educators, a commonly heard claim is that because AL students possess larger vocabularies, they can accomplish in months of part-time education what children accomplish in years of full-time schooling (Balmuth, 1985; Hoffman, 1978). To obtain evidence regarding this claim, receptive vocabulary knowledge was assessed in the present study. A competing hypothesis was entertained as well, that AL students and children might not differ significantly on a receptive vocabulary task. This was based on the claim that an important contributor to the growth of vocabulary is reading exposure and experience (Stanovich, 1986), plus empirical studies indicating that AL students do not possess mature oral language skills (e.g. Cantwell & Rubin, 1992; Whyte, 1981). Results of the present study failed to support the no-difference hypothesis. Results revealed that at the third and fourth grade reading levels, AL students possessed stronger receptive vocabularies than children. This bolsters the notion that adults' greater life experiences with language help to build larger vocabulary knowledge (e.g. Hoffman, 1978). Results also question whether AL students' vocabulary growth is connected to

reading ability. Lack of a connection is further supported by the finding that reading grade level was correlated with vocabulary scores for children ($r = .49$, $p < .01$) but not for adults ($r = .03$, $p > .05$). In addition, correlational results indicated that the children's receptive vocabulary scores were significantly related to several reading measures, whereas AL students' receptive vocabulary knowledge was not associated with any of the reading tasks! Thus, it is possible that the relationship between receptive vocabulary and reading is very different for children than for AL students. Perhaps, receptive vocabulary development is associated with life experiences for AL students, whereas it is related to reading exposure for children.

Although AL students' vocabulary scores surpassed those of the children, when compared to other adults, this group was extremely deficient in receptive vocabulary. This is consistent with a study in which Gold and Johnson (1982) found that AL students performed at a fourth grade word reading level, while they performed at a sixth grade verbal language level. As in the present study, AL students' verbal language skills were higher than their reading skills but still severely deficient when compared to other adults. This may help explain why in the present study AL students and children at the fifth grade reading level did not significantly differ in their receptive vocabulary knowledge. Perhaps the fifth grade reading level is a

turning point after which children begin to outperform the AL students in vocabulary knowledge. Future research should be conducted to test this hypothesis.

Reading Grade Level Concept

A common yardstick used by reading researchers as well as reading teachers to describe the level of reading development of students is the concept of reading grade level. In the present study, reading grade level was assessed with the Word Identification subtests of the Woodcock Reading Mastery Tests-Revised (Woodcock, 1987), a test of word reading ability. AL students and normally developing grade school children reading at grade levels 3-5 were selected. Findings of the present study can be interpreted to bear on the issue of whether selecting two very different populations of readers according to reading grade level yields readers with comparable reading abilities. In other words, is reading grade level an appropriate yardstick for assessing reading ability? Results of the present study both support and challenge this concept.

In support of reading grade level descriptions of readers, the regression analyses indicated that similar processes explained the bulk of the variance in word reading performances for both subject groups. However, despite equivalent word recognition scores, the ANOVAs revealed that the two subject groups differed on eight of the ten reading

measures (see Table 3). Also the two groups showed different patterns of intercorrelations among the variables. In addition, the reading process measures accounted for substantially less overall variance among AL students than among children.

Stanovich and Siegel (1994) state that "mismatched cognitive profiles in a reading-level study are an empirical indication that the developmental paths by which the two groups [come] to their similar reading levels must be different" (pg. 26). Results of the present study appear to instantiate this claim and underscore Perin's (1991) assertion that reading grade equivalency is a confusing concept when applied to adults. Although the reading grade level concept may provide a rough or gross way of equalizing reading levels among different groups, it is important to recognize that major differences among reading related processes may still exist.

D'Amico-Samuels (1991) argues that while administrators of adult literacy programs may need to make decisions based on quantitative measures such as grade-level test, instructors may gain more by administering tasks which are sensitive to specific reading process measures. Present findings provide a case in point. Although an AL student may exhibit good sight word reading skills, he/she may be extremely deficient in phonological recoding skill, and may therefore be unable to decode unfamiliar words. A

standardized reading grade level score would not provide the instructor with this valuable insight. What is needed is a reading battery which tests a variety of reading processes such as decoding, sight word reading, phonological skills, and orthographic skills. This would provide the teachers with specific information regarding the strengths and weaknesses of their students and this information could easily be translated into learning goals for the students.

Comparison of AL Students and Reading Disabled Children

The performance patterns exhibited by AL students can be seen to resemble performances of reading disabled children. For example, the AL students showed deficiencies in phonological processing and nonword decoding. These are the very same weaknesses observed in reading disabled children (Fletcher, Shaywitz, Shankweiler, Katz, Liberman, Stuebing, Francis, Fowler, & Shaywitz, 1994; Siegel, 1993; Van Ijzendoorn & Bus, 1994). Both AL students in the present study and reading disabled children studied by Guthrie (1973) displayed few significantly correlated reading subskills. Finally, the AL students in this study were similar to Siegel et al.'s (in press) learning disabled children who exhibited stronger letter pattern knowledge as compared to their phonological skills. Thus, AL students appear to resemble reading disabled children. Both groups have gaps in phonological knowledge, exhibit stronger letter

pattern knowledge, and have fewer integrated reading processes. More research is necessary to investigate the similarities and differences between AL students and reading disabled children.

Characteristics of the Adult Literacy Students

Information about demographic characteristics and educational history was obtained from an interview with AL students. This background information was gathered to provide a description of the sample and to explore possible explanations for these adults' deficiencies in reading.

There is a paucity of published information on the backgrounds of AL students. Therefore, it is difficult to ascertain whether the demographic characteristics of this study's AL sample is typical of other AL students reading between the third and fifth grade levels. Nevertheless, two reports were found: census data of Minneapolis public school adult literacy programs collected between May 1, 1993 and April 30, 1994 (State of Minnesota Adult Basic Education Report), and profiles of a national sample of AL students enrolled in federally supported adult education programs between April 1991 and April 1992 (Developmental Associates, 1993).

The Minneapolis census data provides age, gender, and racial descriptions of beginning Adult Basic Education (ABE) students attending literacy programs in Minneapolis public

schools. Beginning ABE students are defined as students who possess math, reading, and writing grade levels of 0-5.9. The report describes the following composition of students: 51% female; 61% Black; 87% of the students ranging in age between 16 and 44. This compares closely to the present sample's composition of 53% female, 53% Black, and 87% of the students ranging between the ages of 16 and 50. Therefore, this study's sample was not very different from the Minneapolis census sample.

The national sample of adult literacy students who attended federally supported adult education programs included the following profiles: 22% Black; 61% female; 58% between the ages of 22 and 45; 87% of the students reporting that they did not earn a high school diploma. In comparison, this sample's composition was 53% Black; 53% female; 69% of the students between the ages of 21 and 40; and 76% of the students reporting that they did not earn a high school diploma. The present sample therefore is slightly different from the national sample. However, the national sample included a much larger range of literacy levels. Whereas the present study's sample only included subjects who scored between third and fifth grade levels on the Woodcock word recognition subtests, the data for the national sample included students far below and students far above these levels, ranging in reading levels below first grade to high school. In addition, the present sample only

included native English speakers, while the national sample included 18% non - native English speakers.

A commonly asked question is why AL students failed to acquire adequate reading skills in their earlier years in school. Researchers have noted that in general they are often poorly educated, and that as children they endured negative educational experiences (Beder, 1991; Forester, 1988). Both trends were evident in the present sample. Seventy-six percent of the AL sample did not graduate from high school, 33% of the AL students reported that they repeated at least one grade, and 29% of the sample indicated that they "dropped out" of school because it was too difficult. Students were not asked whether they found school difficult while they attended it, but it can be assumed that given their limited reading ability, the majority must have found the non elementary grades excruciatingly difficult. It is astonishing that in spite of word recognition abilities between the third and fifth grade levels, 87% of the students completed at least one grade in high school.

Although not addressed in this interview, it is possible that their negative childhood educational experiences explains their reluctance to participate in adult literacy programs. As Knox (1980) indicates, past educational history for all adults influences their motivation to learn. Therefore, perhaps it is not

surprising that in spite of such low reading levels, only 33% of the sample had attended adult basic education classes for one year or more. This is consistent with other studies which indicate that adult literacy programs tend to suffer from high attrition rates and that after a few months of training, many drop out (Dirkx & Jha, 1994; Lytle et al., 1986; Perin & Greenberg, 1994).

Why did the AL students have difficulty learning to read in the elementary school years? Family reasons (genetic or environmental) may have played a crucial role: 29% of the subjects reported that other family members had difficulty with reading, and approximately a third of the subjects reported that their mothers or fathers failed to complete high school. Another possible reason may have involved poor school attendance: 28% of the AL students claimed that they missed school for long durations. It is possible that these students missed critical lessons in school and had difficulty "playing catch up" with the other students. Stanovich (1986) in his description of the Matthew Effect explains that weaknesses in specific skills can retard future gains in related areas and can therefore result in large gaps in abilities.

Chall's (1983) approach to reading acquisition may help to explain the nature of the AL students' reading difficulties. Present findings indicated that the AL students were very deficient in decoding skills. Chall

(1983) states that children who fail to acquire adequate decoding skills take much longer than normal readers to make the transition from Stage 1 to Stage 2. If readers have not mastered the basic skills, in Stage 2 they have difficulty becoming automatic and fluent in their reading. This is noteworthy because interview data in the present study indicated that 25% of the AL students claimed to have repeated either the first, second or third grades. Although it is not known why they had to repeat these grades, these are the grades when children normally master Stage 1 and Stage 2. This point is made stronger by research which indicates that children who do not acquire phonemic awareness in the first grade continue to read poorly even in the fourth grade (Juel & Roper/Schneider, 1985).

Forty percent of the subjects reported that they had been tested for a learning disability. Twenty-nine percent of the AL students claimed that as children, they attended some form of special education classes, and of this group 30% stated that they went to all-day special education classes. These reports are consistent with the estimations of adult literacy providers who claim that between 30% and 80% of their students have a reading disability (Fowler & Scarborough, 1993). These reports also support the current notion that although many children learn to compensate for their learning disabilities, the learning disability is never fully remediated and continues into adulthood

(Lieberman, 1987).

7.3 Strengths of the Present Study and

Educational Implications

This investigation represents a major contribution to adult literacy research, an area that suffers from a paucity of thorough and methodologically sound studies. It is the first attempt to compare directly AL students and normally reading children on various reading measures. In contrast to many other studies which focus on a single task to support reading theories (Carr et al., 1990), this study included numerous reading measures. Finally, standardized tests that were more closely related to the word reading processes under study were used to equate the reading levels of AL students and children. In previous studies, reading comprehension scores rather than word reading scores have been used. As a result of these methodological improvements, it was possible to be more precise about the developmental levels of the comparison groups of readers and hence to assess more accurately the strengths and weaknesses of AL students at these levels. This level of description is lacking in many AL research reports.

The present study expands our knowledge of the orthographic and amalgamation skills of AL students. With the exception of spelling inventories, researchers have ignored AL students' orthographic abilities. This study showed that orthographic abilities need to be studied,

because AL students' knowledge of sequential and spatial redundancy was much stronger than their phonological abilities. In addition, this was the first investigation to explore AL students' amalgamation processes. According to the regression analyses, amalgamation processes, as measured by rhyme word reading, are important contributors to word reading skill in AL students.

Assuming that the adult readers in this study are representative of AL students in general who read between the third and fifth grade levels, information gleaned from this study can provide instructional clues. This study confirmed that AL students possess poor phonological skills. Research has indicated that at least with children, phonological skills and reading ability may have a reciprocal relationship, with improvement in one leading to improvement in the other (for example, Perfetti et al., 1987). Therefore, AL instructors should devote time to phonological instruction. Research has indicated that there is no age-based critical period for learning phonological skills (Morais et al., 1988).

Teachers should not base instruction on reading grade scores, but rather on a battery of measures which assess underlying processes such as phonological and orthographic abilities. For example, instructors should not be fooled by the word recognition abilities of their students. As indicated by this study and others (for example, Read &

Ruyter, 1985), AL students can be skillful when reading sight words, but very deficient when decoding unfamiliar words. It is essential to teach decoding strategies, so that the AL students can become less teacher and/or context dependent when reading unfamiliar words.

7.4 Limitations and Implications for Future Research

Adult literacy research is still in its infancy. Information needs to be collected to understand the demographic and educational background of these students. The information gathered from the interview with AL students could not be compared to other published data, since demographic and educational history is usually not reported in studies. Therefore, it was impossible to determine whether this sample of AL students is typical of other AL students reading at the same grade level. In order to gain a better understanding of this population, future AL researchers should always include in their studies a set of demographic and educational questions.

Forty percent of the AL subjects reported that they had been tested for a learning disability. This is consistent with the estimations of adult literacy providers who claim that anywhere between 30% and 80% of their students have a reading disability (Fowler & Scarborough, 1993). This high percentage of reported learning disabilities warrants special attention. How do these AL students differ from AL students not labeled as learning disabled? Unfortunately,

very little research has been conducted on learning disabled adults (Malcolm, Polatajko, & Simons, 1990). Research in this area can take any number of directions: a comparison of non - learning disabled AL students to disabled AL students; a comparison of AL students with varying degrees of learning disabilities; a comparison of AL students (both learning and non - learning disabled) with learning disabled children.

Future researchers can replicate and improve on this study's tasks. For example, the Word Attack subtest of the Woodcock Reading Mastery Test (1987) was utilized to test decoding skills. Unless the subject verbally stated how he/she decoded the word, it was unclear whether spelling-sound correspondence rules or analogy strategies were employed. For example, for the item, "gat", one may be reminded of the word "fat" and therefore correctly read the item, or one may sound it out by saying /g/ /a/ /t/, gat. Five AL students appeared to utilize an analogy strategy on some of the items, but because subjects were not asked to think out loud, it was unclear whether any of the other AL students or children also engaged in analogy strategies. In a future study, either one could ask the subjects to think out loud as they performed the task, or one could manipulate the ease with which analogy approaches could be utilized to decode the nonsense words (Treiman et al., 1990). It would be interesting to compare children and AL students in their utilization of analogy strategies versus spelling-sound

correspondence rules. Based on the results of this study, it is hypothesized that when compared to children, AL students will favor an analogy approach over a phonological recoding approach because of their relative strength in orthographic knowledge and relative weakness in phonological processing skills.

Whether the amalgamation and phonological tasks were the most appropriate measures for the AL students is an issue needing attention. The rhyme word reading task proved to be a better measure of amalgamation skills for the AL group than the extra-letter segmentation task. Successful performance on the extra-letter segmentation task was thwarted by the adults' difficulty segmenting words. It is possible that the AL students detected the ambiguous sounds, but because they were such poor segmenters, they could not reveal their knowledge. In addition, one teacher who taught both third grade children and AL students expressed her belief that the AL students were at a distinct disadvantage on the phonological and amalgamation tasks. She had often heard children playing self-initiated word games utilizing rhymes, deletions, and rhythmic intonations, but she had never heard AL students engaging in these activities. If playing such games is the only factor that enhances children's skills on these tasks, then perhaps such tasks do put adults at a disadvantage and should not be used to compare adults and children. However, it may be that skill

and enjoyment in playing phonological games are a reflection rather than a cause of children's superior performance on segmentation and deletion tasks and their superior phonological processing skill. What lies behind the sizeable deficit exhibited by AL students on phonological tasks is in need of further study.

More in depth research is necessary to understand the nature of the AL students' phonological difficulties. Due to the poor performance of the AL subjects in the deletion and segmentation tasks, future studies should include children reading below the third grade level. Read and Ruyter (1985) noted that a significant minority of their AL subjects with reading comprehension levels at the third and fourth grade levels performed in ways reminiscent of kindergartners and first graders when making phonetic judgments. In addition, future studies should include phonological tasks of various degrees of difficulty. Segmentation and deletion are considered to be the most difficult measures of phonological ability (Yopp, 1988). It would be interesting to compare the performances of children and AL students on easier measures. For example, Read and Ruyter (1985) report that in general, their AL subjects were able to perform easier phonological tasks such as assessing similarities of vowels and consonants in words, and stating whether a specific phoneme had occurred somewhere in a spoken one-syllable item. Finally, a short - term

phonological memory task is also indicated. Read and Ruyter (1985) noted that their AL subjects performed well below average on the digit span test of the WAIS - R, while performing near average on the block design and picture completion tasks. They hypothesize that poor performance on the digit span test is indicative of a weakness in short-term phonological memory.

According to Stanovich & West (1989), " ... virtually no child with deficient phonological skills develops reading ability with ease ... " (p. 404). Since AL students are clearly deficient in phonological abilities, it would be interesting to conduct a study to see if this statement applies to the AL population. Only seven of the sixteen AL teachers stated that they devoted some time to phonics instruction. In future research, the effects of such instruction could be studied by carefully controlling the amount of phonics instruction administered to AL students reading at the same grade levels. Of interest would be whether the students with intensive phonics instruction acquire word recognition abilities at faster rates.

Exposure to print was entertained as an explanation for the AL students' superior sight word reading performance, and their relative strengths in sequential and spatial redundancy knowledge. Future researchers should study their exposure to print. Subjects' exposure to print can be analyzed by asking subjects to answer several questions

regarding their literacy habits (do they read outside of class, what do they read, do they have any books at home, etc). In addition, an exposure to print test could be constructed in which AL students have to differentiate between real and fake authors or between real and fake titles of books, similar to Stanovich & West's (1989) task.

Finally, researchers should include reading comprehension measures in their studies of AL students. The correlations between word recognition and reading comprehension scores are very high in third and fifth grade children (Perfetti & Hogaboam, 1975). It would be interesting to see whether this relationship is similar for AL students. Reading comprehension is thought to tap decoding ability as well as the general ability to comprehend spoken language (Hoover & Gough, 1990; Shankweiler et al., 1992). In light of this study's finding that at the third and fourth grade reading levels, AL students were stronger than children in their receptive vocabulary knowledge, relationships between reading comprehension and word reading processes may be different for children and the AL students. In addition, researchers have found that fifth grade children who have not attained automatic decoding ability exhibit problems with reading comprehension (Perfetti & Hogaboam, 1975). Since the adults in this study were very deficient in their decoding ability, it would be interesting to see if they also exhibit problems

with reading comprehension.

Appendix A

Permission Slip (AL Students)

I am doing a research project on how adults read. I am asking you to help me and I need your written permission.

I will meet with people up to three times. I will schedule my sessions to make sure that you do not miss any important class activities. Each session will last up to 30 minutes. Different people will do different things. There will be various reading and spelling activities. People usually enjoy these sessions and look forward to them. In addition, you should know that you may stop at any time and there will be no problem.

I will ask you questions on your educational background. All information is totally confidential, even your name. However, I can share the information on the reading tasks with your teacher, if you give me permission. I will not give any background information to your teacher. This is confidential.

If you agree to participate in this project, please complete, sign and return the attached permission form to me.

Sincerely,
Daphne Greenberg

Please complete, sign and return to Daphne Greenberg.

CONSENT TO PARTICIPATE IN THIS RESEARCH PROJECT

Date: _____

My name is _____

(print) and I agree to participate in the research project conducted by Daphne Greenberg. I have listened and read along as Daphne Greenberg read the description of the study. I understand that no background information will be shared with anyone else.

I _____ do _____ do not want you to tell my teacher the information on the reading tasks that I give you.

Signature: _____

Appendix B
Parental Permission Slip

Dear Parents,

I am conducting a research project to study the reading processes of students in grades 3-5 and I am seeking your help in this matter. The school's principal and teachers have approved of my project and are offering their cooperation. I invite your child to participate in my study and I need your written permission before I may ask him or her.

I will meet with students a maximum of three times in a room during school hours. The teacher will schedule the sessions to insure that no important activities are missed. Each session will last about 30 minutes. The tasks given to students will resemble activities that occur in classrooms as part of reading and spelling instruction. Students typically enjoy these sessions and look forward to them. However, any child who participates is free to discontinue participation in the project at any time for any reason without any consequences. Information about your child's reading and spelling skills that might prove useful to your child's teacher will be provided upon request by the teacher if you have no objection.

Results may be published in a scholarly journal. Participant's identities will remain anonymous. Please complete and return the permission form to your child's

teacher.

Sincerely,

Daphne Greenberg

Please complete, sign and return to your child's teacher.

CONSENT TO PARTICIPATE IN THIS RESEARCH PROJECT

Date: _____

I grant permission for my child _____
(print name of child)

to participate in the research project conducted by Daphne Greenberg. I have read the description of the study. I understand and am agreeable to all the terms and conditions.

I ____ do ____ do not want information shared with my child's teacher.

Signature of parent: _____

Birth date of child: _____

Is English your child's first language? ____ Yes No ____

The language you and your family speak most often at home:

Appendix C

Interview

Background

THIS INFORMATION IS CONFIDENTIAL AND WILL NOT BE SHARED WITH ANYONE. THE INFORMATION IS FOR THE EXCLUSIVE USE OF DAPHNE GREENBERG'S RESEARCH PROJECT.

Gender:

Race:

Age: __ 16-20 __ 21-30 __ 31-40 __ 41-50 __ 51-60 __ 61-70

1.

a. What was the highest grade that you completed in school by age 21?

b. Why did you leave school: had to work

family reasons

academic reasons (school was too hard)

illness

other

2. Did you ever repeat a grade in school? Which grades?

3. While you attended school, did you ever have to miss school for a long time, such as a few months? Why? Did this happen on other occasions? Why?

4. When you were growing up, what language or languages were usually spoken at home?

5. What language do you speak most often now?

6. Have you ever taken a course or class in ESL (English as a second language)?
7. Have you ever attended other adult basic education classes, including any current classes, where you practice reading and writing? Tell me about them.
8. How long ago did you attend these classes?
9. For how long have you been attending these classes?
- 10.

a. Has anyone ever suggested that you have:

- a learning disability
- an educational problem
- eye trouble (not corrected by glasses)
- hearing problems
- speech disability
- physical disability
- long-term illness (6 months or more)

b. Have you ever been tested for any of these problems - as a child, in high school, or as an adult:

- a learning disability
- an educational problem
- eye trouble (not corrected by glasses)
- hearing problems
- speech disability
- physical disability
- long-term illness (6 months or more)

Can you tell me about it? Remember, this is confidential.

11. While you attended school, did you attend any special education classes? During which grades? What type of special education classes did you go to (all day classes, resource room)?

12. Have any family members had problems in learning to read (such as your children, parents, brothers and sisters)?

13. What was the highest grade your mother completed in school?

14. What was the highest grade your father completed in school?

Appendix D

Directions for Word Recognition Task (Woodcock)

All subjects began with the first word. Subjects were presented with the list of words and they were told the following:

"I will show you a list of words. I would like you to read each one as quickly and correctly as you can. If you do not know the word, you may guess or say that you don't know it. Are you ready? Good. Remember to read them as quickly and correctly as you can. Go as quickly as you can but don't go so quickly that you make mistakes."

Data was collected on whether the word was read correctly. Testing was discontinued once the student failed to read 6 consecutive items that ended with the last item on an easel page. Both forms were administered.

Appendix E

Directions for Nonword Decoding Task (Woodcock Word Attack)

All subjects began with the first item. Testing was discontinued when the student failed to "read" six consecutive items correctly that ended with the last item on an easel page. Students were told:

"I will now show you nonsense words. These words are not real and therefore do not have meanings. I would like you to try to read them for me. Remember, these are not real words. But you should read them as if they are real. Are you ready? Good. Then let's begin."

As students responded, their answers were recorded.

Appendix F

Directions for Receptive Vocabulary Task (PPVT)

All subjects started with test items which corresponded to the age of 8 years old. Basal scores were obtained according to the instructions provided by the PPVT-R manual. Training plates D and E were utilized. The directions as stated in the PPVT-R manual were followed:

"I have some pictures to show you. See, there are four pictures on this page. Each of them is numbered. I will say a word; then I want you to tell me the number of, or point to the picture which best tells the meaning of the word. Let's try one. Tell me the number of, or point to, the picture which best tells the meaning of wheel. That's fine. Now what number is giant?"

If during practice, the student provided the wrong answer, the correct answer was supplied along with an explanation of why this was so.

"Fine, now I am going to show you some other pictures. Each time I say a word, you say the number of, or point to, the picture which best tells the meaning of the word. As we go through the book you may not be sure you know the meaning of some of the words, but look carefully at all of the pictures anyway and choose the one you think is right. What number is"

While the subject responded, their answers were

recorded. If the student took more than a minute, the following instructions were provided: "Guess. Point to the one you think is correct." If the student said "I don't know", then they were told "that is a difficult one. Let's try the next." This was be counted as an error. Testing continued until the student made 6 errors in 8 consecutive items.

Appendix G

Directions for Sight Word Reading Task (Adams & Huggins, 1985)

Subjects were told " I will now show you words that I would like you to read. Please read them as quickly and correctly as you can. If you do not know a word, then you may guess or say that you do not know it. Go as quickly as you can but don't go so quickly that you make mistakes. Are you ready? Good. Remember, read the words as quickly and correctly as you can."

Responses were recorded in terms of whether they read the word within one second (f for flash) or longer. Testing was discontinued after 10 consecutive errors.

ITEM	FLASH	NONFLASH	ERROR
ocean			
iron			
island			
break			
busy			
sugar			
touch			
none			
heights			
whom			
tongue			

ITEM	FLASH	NONFLASH	ERROR
lose			
prove			
rhythm			
truth			
stomach			
blind			
wounded			
calf			
sweat			
sword			
anchor			
echo			
guitar			
veins			
chorus			
scent			
deaf			
mechanic			
dough			
rely			
ninth			
react			
recipe			
pint			
deny			

ITEM	FLASH	NONFLASH	ERROR
vague			
tomb			
drought			
trough			
depot			
bough			
bouquet			
aisle			
ache			
yacht			
chauffeur			
ukelele			
suede			
fiance			

Appendix H

Directions for Deletion Task (Phonological Task #1) (Rosner & Simon, 1971)

Subjects were told: "For this task, you have to listen to me very carefully. I am going to say a word, and then I will ask you to repeat it once exactly the way I say it. I then want you to repeat it again but without a certain part. Let's practice, for example:

cowboy. Say cowboy. Now say it without boy. Good. The next practice word is toothbrush. Say toothbrush. Now say it without tooth. Good." Okay. We are now ready to start. _____ Say: _____. Now say it again but without _____."

If the student did not answer correctly on the practice items, I explained the correct response.

Testing was discontinued after 4 consecutive errors.

ITEM	RESPONSE
a.cow(boy)	
b.(tooth)brush	
1.birth(day)	
2.(car)pet	
3.bel(t)	
4.(m)an	
5.(b)lock	
6.to(ne)	
7.(s)our	
8.(p)ray	
9.stea(k)	
10.(l)end	
11.(s)mile	
12.plea(se)	
13.(g)ate	
14.(c)lip	
15.ti(me)	
16.(sc)old	
17.(b)reak	
18.ro(de)	
19.(w)ill	
20.(t)rail	
21.(sh)rug	
22.g(l)ow	
23.cr(e)ate	

ITEM	RESPONSE
24.(st)rain	
25.s(m)ell	
26.Es(ki)mo	
27.de(s)k	
28.Ger(ma)ny	
29.st(r)eam	
30.auto(mo)bile	
31.re(pro)duce	
32.s(m)ack	
33.phi(lo)sophy	
34.s(k)in	
35.lo(ca)tion	
36.cont(in)ent	
37.s(w)ing	
38.car(pen)ter	
39.c(l)utter	
40.off(er)ing	

Appendix I

Directions for Letter Pattern Task (Orthographic Task #1)
(Siegel et al., in press)

Subjects were told: "I am going to show you a list of letter strings that are not real words. One of them is more like a word than the other. I want you to circle the one that looks more like a word. When you see each item, think about which one has a spelling that is more like a word. For example, if I show you, f6 and fe, you would circle fe, because it looks more like a word. So here is the list, and next to each number you will see a pair of items. For each number circle the item which you think looks more like a real word. If you are not sure of the answer, guess and select the item which you think may be the correct answer."

- | | | | |
|---------|------|----------|------|
| 1. filv | filk | 9. jofy | fojy |
| 2. tolz | tolb | 10. cnif | crif |
| 3. powl | lowp | 11. bnad | blad |
| 4. fant | tanf | 12. hift | hifl |
| 5. miln | milg | 13. gwup | gnup |
| 6. togd | togn | 14. nitl | nilt |
| 7. wolg | wolt | 15. clid | cdil |
| 8. moke | moje | 16. vism | visn |

Appendix J

Directions for Letter Position Task (Orthographic Task #2)
(Katz, 1977)

Subjects were told:" In the English language, each letter of the alphabet can occur in different places in different words. For example, let's take the letter e. E sits at the beginning of the word egg, in the middle of the word bet, and at the end of the word she. The letter S sits at the beginning of the word stop; it is the third letter in the word fast, and the last letter in the word mops." (note, students were shown these words). "If you looked at lots of words, you would find that specific letters sit in some positions much more often than they sit in other positions within words. In this task, you will see letters sitting in two different positions of words. I want you to circle the choice that shows where the letter sits most often in words. For example, if I show you:

t

-- t t --

then show me which one shows me where you would find t in most words. Pretend that all the letters are covered up except for the one that you see.

Or what if I show you:

a

-- a -- a --

Subjects were shown these two practice items and then were presented with the actual task.

"Good. You did very well on those practice ones. On this piece of paper, I want you to circle the responses which you think show the most frequent position of each letter. Remember, for each letter you should circle your choice. If you are not sure of the answer, guess and circle the one which you think may be the correct answer."

— — g — —	g	— g — — —
— — — — i	i	— i — — —
n — — — —	n	— — n — —
c — — — —	c	— c — — —
— — — — l	l	— — — l —
j — — — —	j	— — j — —
— — v — —	v	— — — — v
— — — — u	u	— — u — —
— k — — —	k	— — k — —

p _ _ _ _

_ o _ _ _

_ _ _ _ b

_ _ _ e _

_ _ h _ _

_ _ w _ _

r _ _ _ _

_ _ s _ _

_ _ _ _ m

p

o

b

e

h

w

r

s

m

_ _ _ _ p

_ _ _ _ o

b _ _ _ _

e _ _ _ _

_ h _ _ _

w _ _ _ _

_ _ _ r _

_ _ _ _ s

_ _ m _ _

— — — z —

z

— z — — —

— — — — d

d

— d — — —

— — q — —

q

q — — — —

— — — — t

t

— — — t —

— a — — —

a

— — — — a

— — — — x

x

— — x — —

— — — — y

y

— y — — —

— — — f —

f

f — — — —

Appendix K

Directions for Spelling Inventory (Orthographic Task #3)
(Bear, et al., 1989)

Subjects were told: "I would like you to spell some words. I will say the word that I want you to spell, then I will say a sentence with the word in it and then repeat the word. Write your spellings of the words on this piece of paper. Write as clearly as you can, so that I can read your letters. If you want to change what you wrote, don't erase. Just draw a line through it and write the word again. If you are not sure of how to spell a word, just make your best guess. It doesn't matter if you make a mistake, as long as you've guessed as well as you can."

1.bed. On our bed we have sheets, blankets and pillows.
bed.

2.ship. The ship sails on the ocean. ship.

3.drive. We drive our cars to work. drive.

4.bump. There is a big bump on the road. bump.

5.when. When is your birthday? when.

6.train. The train goes very fast on the tracks. train.

7.closet. We hang coats in the closet. closet.

8.chase. Dogs like to chase cats. chase.

9.float. Some people like to float in the pool. float.

10.beaches. The beaches are busy on hot summer days.
beaches.

11.preparing. The teacher is preparing for the lesson.
teacher.

12.popping. As kernels become popcorn, they make popping
sounds. popping.

13.cattle. During the tornado the farmer kept the cattle
indoors. cattle.

14.caught. The player caught the ball. caught.

15.inspection. The hospital passed its yearly inspection.
inspection.

16.puncture. There was a puncture in the tire. puncture.

17.cellar. Some people like to keep their wine in the
cellar. cellar.

18.pleasure. The child gave the mother a present with great
pleasure. pleasure.

19.squirrel. The squirrel ran up the tree. squirrel.

20.fortunate. They are very fortunate to have a good movie
theater in their neighborhood. fortunate.

Appendix L

Directions for Rhyme Judgment Task (Amalgamation Task #1)
(Levinthal et al., 1992)

Subjects were told: This is a rhyming task. Do you know how words sound when they rhyme? I'll show you: cat, sat, fat, hat. All those words rhyme. Sit, fit, bit, knit are rhyming words. In this task, you will see two pages of several words, with two words printed next to each other. It will be your job to look at each pair of words, read the words, listen to see if they rhyme, and if so circle the two words. Be careful. Some words will look the same but they will not rhyme. Also, some words will look different but they will rhyme. Circle only those words that rhyme with each other. Do not circle them if they do not rhyme. Work as fast and correctly as you can. Finish each column of word pairs before starting the next column".

"If you realize that you have made a mistake, go on to the next word pair. Do not erase, because this will slow you down. If you make a mistake, don't worry - just keep going. Remember, you should circle the word pairs which rhyme. Do not circle them if they do not rhyme. Finish each column before starting the next column."

plea flea	mark dark	bone gone	park road
make ache	thou plow	mink pink	pair fair
lump thug	leaf soon	sick dull	clue slew
home some	born worn	nail pale	time roof
trim grim	mint pint	mean high	room fume
hurt post	rice nice	nose lose	have gave
none stun	loan bone	hope soap	turn form
have cave	doll toll	dime boat	boot foot
dune moon	soft loft	news lose	hand land
last past	foul soul	reel each	from gift
meat dirt	file tile	hill will	fate bait
wood tape	fern back	golf wolf	half talk
deal seal	fuel mule	much such	fear bear
bomb tomb	bank sure	rude feud	roam dome
tilt wilt	hush bush	food hood	damp lamp
bail sale	blue flew	rung sung	girl jump
dull pull	jazz fill	sour four	wear rare
fool dual	gait hate	made fade	harm farm
clot blot	door sing	what side	were here
ward card	numb dumb	hail male	load toad
test sock	crow brow	that hand	shoe crew
hair care	coil boil	both moth	wasp rasp
swim east	dial mile	comb foam	walk left
lost most	gasp wasp	cold told	pitch ditch
tool rule	book noun	how tow	give hive
stack brain	want pant	barge large	plane train

jewel spool	learn clear	drove prove	plus club
shelf fight	hour tour	vault fault	blare stair
wand hand	porch torch	frail scale	eight wharf
stool cruel	thing storm	beard heard	grove drove
round gripe	fruit shoot	grape skirt	taste caste
reign train	force brake	flown clown	park bark
clear group	rose lose	hinge binge	neat feet
point joint	great state	blame clock	dose hose
love move	cream dream	stain crane	batch latch
crank drank	tough stuff	chair start	blow plow
croak spoke	sheet three	clove glove	right sight
sear bear	blame flame	blown stone	study thief
might tight	catch watch	match batch	knee tea
word lord	leave twice	stare flair	farm clay
poise noise	rough dough	chain think	great wheat
glass drive	write light	sight light	fly guy
phone known	bribe tribe	freak break	said paid
store whole	trail whale	brush crush	pain lain
wear hear	plate stream	pain lane	too you
float quote	fence hence	couch touch	fear hear
brace trace	youth south	brown march	move dove
soon tune	bless shoes	horse worse	mint hint
shirt ditch	grown crown	gland bland	your sour
quilt built	moose juice	plant these	treat sweat
done hone	yield field	stole droll	door face
house mouse	waist baste	grant roast	fought taught

spoon prune stick teach couth mouth book hall

Appendix M

Directions for Segmentation and Extra Letter Segmentation Task (Phonological Task #2 and Amalgamation Task #2 - adapted from Ehri & Wilce, 1980)

Subjects were told: "This task involves a game with word sounds. I will say a word. Then I want you to repeat it. Then I want you to say the word very slowly, and to place a chip for each sound as you say it. For example if I say see, you would say see and then place a chip for each sound /s/ /e/" (This was shown to the students).

"Now it's your turn. The word is see. Good." This procedure was repeated for the words fun and stop. Then the words were presented again, without the experimenter modeling the correct response. If the subject made a mistake, he/she was corrected. Practice with these three words continued until the subject correctly segmented the words without help.

Upon completion of the practice trials, subjects were told: "Good. We are ready to begin. I will say the word, then I will say a sentence with the word in it and then repeat the word. I will then ask you to repeat the word. Then I want you to say the word very slowly and to place a chip for each sound as you say it."

<u>Word</u>	<u>Response After First Model</u>	<u>Response Without</u>
<u>Model</u>		
see		
fun		
stop		
Number of practice trials needed after initial model: _____		
<u>Words</u>	<u>Subject's Response</u>	
beds		
bicycle		
lasts		
now		
pets		
cow		
holds		
Andy		
rides		
boats		
judge		
family		
acts		
new		
pitch		
few		
hands		
ends		
badge		
catch		

Next, subjects were asked to spell the words. Subjects were told: "I would like you to spell these words for me. First I will say the word that I want you to spell, then I will say the word in a sentence. I will then say the word again. Please write your answers on this paper. If you're not sure, just guess as well as you can. It doesn't matter if you make a mistake."

Clarifying Sentences

Now. Do it right now.

Cow. The farmer has a brown cow.

Pets. Dogs make good pets.

Boats. On a beautiful day, one sees many boats on the lake.

Rides. The cowboy rides his horse.

Beds. People sleep on beds.

Andy. Andy is my cousin's name.

Holds. Mother holds the baby.

Bicycle. My daughter has a red bicycle.

Lasts. This movie lasts for two hours.

New. The shiny car is brand new.

Few. Adults have many teeth, but babies have only a few.

Pitch. Baseball players know how to pitch the ball.

Catch. The kitten tries to catch the mouse.

Badge. The sheriff wears his badge with pride.

Judge. The criminals listen to the judge.

Ends. The movie ends with a surprise.

Hands. I have two feet and two hands.

Family. There are 12 children in that family.

Acts. The comedian in the show acts like a clown.

Appendix N

Intercorrelation Matrix of the MeasuresCombining Performances of Adults and Children

Task	1	2	3	4	5	6	7	8	9	10	11
1.WR	--	.53 ^{**}	.80 ^{**}	.22 ^{**}	.10	.40 ^{**}	.24 ^{**}	.13	.68 ^{**}	.40 ^{**}	-.05
2.DEC		--	.29 ^{**}	-.13	.35 ^{**}	.63 ^{**}	.08	.03	.52 ^{**}	.31	.15
3.SIGHT			--	.21 ^{**}	-.03	.24 ^{**}	.39 ^{**}	.08	.65 ^{**}	.27 ^{**}	-.10
4.RV				--	-.15	-.13	-.01	.06	-.09	.10	-.09
5.SEG					--	.46 ^{**}	-.04	.05	.23 ^{**}	.17 ^{**}	.72 ^{**}
6.DEL						--	.13	.17 ^{**}	.51 ^{**}	.38 ^{**}	.29 ^{**}
7.SIEG							--	.21 [*]	.31 ^{**}	.12	-.02
8.KATZ								--	.18 [*]	.15	-.04
9.SPELL									--	.18 [*]	.08
10.RJ										--	.13
11.EX											--

Note. WR = word identification derived from subtests of the Woodcock Reading Mastery Test; DEC = nonword decoding derived from Word Analysis Subtest of the Woodcock Reading Mastery Test; SIGHT = sight word reading derived from Adams and Huggin's irregular word reading task; RV = receptive vocabulary derived from the PPVT-R; SEG = segmentation derived from Ehri and Wilce's task; DEL = deletion derived from Rosner and Simon's Auditory Analysis Test; SIEG = letter pattern derived from Siegel et al.'s task; KATZ = letter position derived from Katz' task; SPELL = spelling derived from Bear et al.'s spelling inventory; RJ = rhyme judgement derived from Levinthal's task; EX = extra letter segmentation derived from Ehri and Wilce's task.

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

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