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Word Naming Time, Memory Span, Reading and Listening Comprehension of Good and Poor Readers

by

Ngan-yuk, Ivy SIU

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF Master of Education

IN

Special Education

Department of Educational Psychology

EDMONTON, ALBERTA

Fall, 1986

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Supervisor

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Date June 12, 1986.

Abstract

The purpose of this study was to investigate the reading and listening comprehension of good and poor fifth-grade readers, together with their interrelationships with word recognition speed and memory span. In order to achieve this goal, the naming time of 1-syllable, 2-syllable and 3-syllable words, together with visual and auditory word span tasks were given to each student. In addition, they were asked to recall stories which they had read and heard. The recall protocols were analyzed to examine whether poor readers could understand and recall the same quantity and quality of information as good readers did under both reading and listening conditions.

Thirty-eight fifth-grade readers were selected as subjects according to their verbal I.Q. scores on the Canadian Cognitive Abilities Test and their performance on the Edmonton Public Schools Reading Test.

The findings of the two-way analysis of variance showed that there were significant differences between good and poor readers in the amount of information recalled under both listening and reading conditions. Overall good readers recalled more than poor readers did.

The three-way analysis of variance table using Mandler and Johnson's system of analysis showed that there was no significant difference between good and poor readers in the proportion of recall under each syntactic group, but there was a significant main effect for syntactic category. There was a higher probability of recall of the beginning event and the outcome of the story, while the reaction and the goal were very much ignored in the recall. More important in the finding were the significant differences in the proportion of sentences in the various syntactic categories as a function of the mode of presentation. After listening, the recall of the setting, the beginning event, the attempt, the outcome and the ending was significantly higher than the recall of the reaction and the goal; while only the recall of the beginning event and the outcome was significantly higher than the recall of the goal after reading.

So the general conclusion reached is that poor readers are able to recall stories in a similar way as good readers do, whether reading or listening. Yet the amount of information they

recall is significantly different. Good readers are able to recall more information, including the details, while poor readers are able to recall the most important parts of the story, with the elaborations being omitted.

In addition of the above results, it was found that there were significant differences between good and poor readers on word naming tasks and word span tasks. Good readers were better than poor readers on each task. Further support of the working memory model was provided by the significant negative relationships between word naming speed of 2-syllable, 3-syllable words and memory span performance; between word naming speed and comprehension scores, and by the significant positive relationship between word span performance and comprehension. Thus it is concluded that the slow speed of word identification is common to performance on both word span and comprehension tasks. The faster one processes incoming information, the more capacity one has for storing and maintaining that information in working memory. Because of the inefficient processes of the poor readers, they have less capacity to maintain and store the processed materials, so the chance of integrating information in a logical, coherent way is jeopardized and results in poor comprehension performance.

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1. Introduction

The language arts are said to consist of the expressive skills of speaking and writing and the receptive skills of listening and reading (Walker,1973). Although both of the receptive skills can be considered as members of a single class, there is a controversy on whether there is a single language comprehension process, or whether reading comprehension involves processes that are inherently different from listening comprehension. Hence a number of studies have been carried out to investigate the correlation between these two processes, the relative efficacy of reading and listening as a means of learning, and the subskills that are involved in each of them (e.g. McConaughy,1985; Johnson,1982; Fleet,1980; Elgart,1978; Kintsch,1977 etc.), yet results of these studies vary.

1.1 Views on Reading and Listening Comprehension

Many prominent researchers and theorists in the area of reading see comprehension as the prime goal of the reading process (Goodman,1972; Smith,1977). Goodman (1972) considers meaning to be the immediate as well as the ultimate goal in reading. Smith (1977) also advocates that "comprehension is the very heart of the reading act. There is no use in reading unless one understands the meanings." (p.38) Although reading has unique characteristics, it shares many features with the other language processes such as listening. One of the commonalities is the processing of symbols to obtain meaning regardless of the modality of input (Jackson,1970).

Similarly Massaro (1979) views reading and listening as independent but analogous processes, the goal of which is to derive the meaning of a message. He defines reading as the abstraction of meaning from printed text, and listening as the abstraction of meaning from speech.

Despite the commonalities between reading and listening, there are in fact some differences between them. Perhaps the most salient difference is that speech contains

prosodic features (stress, intonation, loudness and tempo) that are not systematically represented in written material. These prosodic features indicate the speaker's attitude and affect; focus attention on particular aspects of the message and mark the structural boundaries of sentence and intrasentence units (Coots & Snow,1984). The last function is directly related to the basic processes of comprehension. As prosodic features cue the boundaries of perceptually functional units (e.g. phrases) in spoken sentences, they assist the listener in the immediate segmentation of verbal information. Apparently, the listener depends on these temporal cues for the chunking of words into larger constituents. When they are distorted, comprehension falls precipitously (Huggins,1978). Written discourse provides no such cues. So reading demands more syntactic sophistication than does listening.

Yet written text does have some compensatory aspects. A partial analogue of mant prosodic features is punctuation. Thus segmentation of the message into words and sentences is correctly indicated in the written text, and is not a task that must be performed by the reader. In addition, certain devices such as the demarcation of paragraphs can help specify the larger structure of the message. Textual devices such as underlying and italicizing may be used to emphasize or contrast words and phrases (Rubin,1980).

Another characteristic of text that can be an asset in its comprehension is its permanence. Readers can look back over passages they have previously read, glance ahead at the next few sentences or skim chapter and section headings. They can also reread sentences that are not clear or that are misparsed the first time around. So listening may make considerable demands on short-term memory which reading does not.

As comprehension is the essence of both reading and listening, attempts have been made by educators, psychologists and researchers to delineate what comprehension is. Le Ny and Verstiggel (1975) have suggested several general categories of processes

that take place in comprehension. They include active grasping of perceptual information; identification of words or morphemes, and of surface relationships present in the passage; parsing sentences; retrieval of relevant meanings from long-term-memory; construction of the currently processed chunk's meanings; and integration of this local meaning to larger meaningful structures of texts or discourses.

Kintsch (1975) put forward the opinion that comprehension is not merely interpreting what is directly expressed by a sentence. It involves integrating information from different sentences, organizing and supplementing it through inferences from which one already knows. Thus comprehension is not a passive searching for meaning, but rather an active reconstruction of meaning.

In this reconstructive view of comprehension, information expressed in the sentence plus the prior pertinent information available in the compehender's cognitive structures are both used to construct representations of subjects and events (Weisberg,1979). This is similar to Fagan's (1978) view that the reader uses the informational cues contained in the text and interprets the cues in the light of his knowledge of language and his knowledge of the world. The result of construction can therefore contain more information than the individual sentence expressed. The abstraction of information and the generation of inferences are requisite factors in comprehension and seem to be dependent on one's prior knowledge of the specific content as well as on one's general knowledge of the world. Thus the words of the passage do not contain the meaning but merely serve as triggering devices to reconstruct the appropriate meanings within the receiver's cognitive structures. Yet the receiver is always constrained in his meaning reconstructions by the language cues used by the writer (Walker,1976).

As stories, essays and other types of written discourse consist of information that is related to other information in the text, comprehending and remembering a text therefore likely involves recognizing and understanding these relations that tie together

information in the text (Varnhagen,1985). Various theorists (e.g. Mandler & Johnson,1977; Kintsch & van Dijk,1977; Trabasso & Sperry,1985) have developed their model of text comprehension with regard to these issues of text relations.

Johnson and Mandler (1977) developed the concept of story schema, which they defined as idealized, internal representations of parts of a typical story and the relationships between these parts. By analyzing the text and recall protocols into story schemas, research indicates that readers use these schemas to process, to recall and to comprehend stories as they read or listen to them (Rumelhart,1977; Mandler & Johnson,1977; Thorndyke,1977). These story schemas appear to parallel the readers' schemas, which are composites of real-life experience and experience with prose.

Mandler and Johnson (1977) used the term "story schema" to refer to a set of expectations about the internal structure of stories that serves to facilitate both encoding and retrieval. The story grammar is designed to represent the structure of simple stories. It can be represented as a tree with nodes and connections between nodes. All terminal nodes represent a state or an event which typically correspond directly to some surface expression.

The first basic node in a story is a Setting, usually consisting of stative information about one or more characters, and often including information about the time and locale of the story. The Setting is followed by one or more episodes. The first basic node in the episode is a Beginning, which may be of any sort of event. Then comes the next node, the Development, which indicates a shift to a Reaction of a character. This shift is from an external to an internal event. Typically the Reaction node consists of two parts: the first one is a Simple Reaction, which specifies the emotional response or what the protagonist thinks about the Beginning Event; the second one is a Goal, in which the protagonist formulates a plan to deal with any problem the Beginning may have created. Then the Goal Path is brought to complete Development. A Goal Path consists of an Attempt to reach the Goal and the

Outcome of that Attempt. The Attempt node involves the protagonist in an effort to achieve the explicitly stated or implied goal and consists of a series of actions by the protagonist. The Outcome node is some statement about the Attempt's success or failure. Finally the Ending indicates the resolution to a series of events. It often refers back to one or more previous nodes in the episodes, and may also include a reaction on the part of another character. Thus the Ending of one episode may in fact bring about a new episode (Mandler & Johnson,1978). Concerning the connections between these nodes, Mandler and Johnson (1977) put forward three types of relationship: AND, THEN and CAUSE. The AND relation connects two nodes with the notion of simultaneous activity or temporally overlapping states. Two nodes which are temporally ordered are connected by THEN. If the first node provides a reason for the occurrence of the second, thay are connected by the CAUSE relation.

During encoding, the cognitive schema reflected by the grammar serves several functions: they provide a framework within which incoming information will be structured; they help the reader/listener to know which aspects of the material are apt to be important or relevant; they tell the reader/listener when some part of the story is complete and can be stored, or is incomplete and therefore must be held until more information has been encoded.

At the time of retrieval, the schema serves as a code which operates in three ways. First, it tells the subject what general sort of information is to be retrieved. Second, it provides a temporal sequence to find specific content. Finally, if the exact content of a category in the sequence cannot be retrieved, the schema allows the subject to generate an approximation based on the structure of the schema itself.

In Mandler and Johnson's (1977) study, subjects heard two stories and later were asked to tell them again as exactly as they could. It was found that the recall protocols from the immediate and delayed recall conditions were highly similar for all first-graders, fourth-graders and adults. Overall, the recall of first-graders formed two

clusters: settings, beginnings and outcomes were well recalled; and attempts, endings and reactions were poorly recalled. The fourth-graders showed a similar pattern of recall, while the adults recalled attempts almost as well as settings, beginnings and outcomes. Thus it was concluded that both children and adults were sensitive to the structure of stories, although some differences were found.

Despite the importance of their findings, no attempt was made to compare the performance of good and poor readers. The extent to which each group could make use of the story schema to aid their recall was still uncertain. Thus this study was carried out to investigate whether poor readers could comprehend stories the same as good readers did. Mandler and Johnson's (1977) system was used in the present study. The advantage of studying comprehension for stories is that they are a widely tested form of connected discourse for which structural characteristics are well specified. The results of this study would indicate whether poor readers' story schema would be similar to good readers', and whether they would use the story schema to facilitate the organization of materials during retrieval to the same extent as good readers did. The Mandler and Johnson grammar was chosen because it has been validated in a variety of settings: with adults and children (Mandler,1978) and cross-culturally (Madler, Scribner, Cole & DeForest,1980).

Many skills have been identified as enabling students to comprehend written/oral discourse. Smith and Burrett (1974) have developed a taxonomy which includes literal recognition or recall, inference, evaluation and appreciation as subskills in reading comprehension, whereas Glynn (1983) suggests that the component comprehension processes that readers must perform include recognizing words and retrieving meanings; parsing sentences; identifying and organizing important text ideas; and integrating those ideas with prior knowledge. Similarly listening is a complex multi-dimensional set of skills (Backlund,1983). Goss (1982) defines listening comprehension as the process of taking what one hears and organizing it into verbal units to which one can apply

meaning.

Pearson and Fielding (1983) hold the opinion that listening comprehension involves the simultaneous orchestration of skills in phonology, syntax, semantics and knowledge of text structure, and seems to be controlled by the same set of cognitive processes as reading comprehension.

Despite the importance of listening in the classroom, the ability to listen has been taken for granted and given little attention in language arts program (Friedman,1978). As mentioned above, the interrelationships between reading and listening have long been a topic of interest. While there has been considerable research that has attempted to delineate similarities and differences, the results have been uniformly equivocal (Simpson & Thomas,1984). One theoretical position maintains that the receptive processes of reading and listening are more alike than different (e.g.Kintsch,1977). The process of comprehending language whether by eye or by ear is the same. In contrast, some researchers (e.g.Mattingly,1972) maintain the position that the processes of comprehending oral language and written text are different from and/or unique from one another. Unfortunately, the issue of whether the comprehension processes involved in listening and reading are more alike than different has not yet been resolved (Danks,1980).

As Mandler and Johnson's (1977) study has indicated, the recall protocols of first-graders, fourth-graders and adults were highly similar after reading. Yet no consideration has been made to examine whether the same pattern of recall will be obtained if the subjects are asked to read stories instead of listening to them. So attempts were also made here to compare the recall of both good and poor readers under both conditions of listening and reading.

1.2 Recall as a Measure of Comprehension

Different measures have been used to assess reading and listening comprehension, such as multiple choice questions, cloze procedures, and asking the subjects to write summaries of what they have read/listened. In the present study, the concern was the comprehension processes of good and poor readers under both reading and listening conditions - to see whether poor readers are able to attend, select, understand and recall similar information under the different modalities of reading and listening as good readers do. The oral recall of the subject was taken as the measure of comprehension here. The rationale for using recall to assess comprehension is that recall reflects a person's representation of the text in memory that in turn is a result of a reader's particular understanding of the text (Kintsch & van Dijk,1978). Of the oral retelling of what the subject has read/listened, inferences can be made about how the subject processes and organizes written/spoken materials.

One of the earliest and best known pieces of research in the recall of narrative stories was carried out by Frederick Bartlett (1932), and this illustrated some of the distortions which occur in memory recall. He read to his subjects a North American Indian folk story, and then had them recall it at various later points in time. Bartlett noted first that recall was extremely inaccurate: often only the outline of a story was remembered, the details being forgotten. Second, various systematic distortions crept in: things that fitted the story, but were not actually present in it appeared in the protocols. Finally, when their memory of a story was so bad that only isolated fragments could be remembered, subjects sometimes invented plausible stories around these details. Furthermore, many of these errors showed an adherence to stereotyped situations with which the subjects were familiar.

Bartlett's observations illustrate some of the complexities of recall protocols and their interpretation. Since the accurate part of recall is not random, but relates to the gist of a story, comprehension processes are implicated in the way the story is stored

in memory.

Furthermore, although the systematic nature of the errors reinforces this view, some of the protocol errors clearly resulted from processes at the time of recall, rather than from operations at the time of listening to the story. Intrusion errors resulting from inferences seem to be more related to what was necessary for comprehension than to unnecessary elaborations.

The re-examination of Bartlett's work on memory initiated interest in prose passages as the unit of analysis and contributed to the theoretical orientation of memory and comprehension as a constructive process. One of the most noticeable features of many recall protocols is the way in which they are not simply random samples of the original discourse, but somehow seem to capture the gist of the passage.

Tierney, Bridge and Cera (1979) suggested that by analyzing a passage into units and comparing it to the oral recall of a subject, the mental processes that are involved in the reader's organizing procedures can be ascertained. According to their view, recall of text involves both abstractive and constructive processes. The abstractive process involves selecting relevant ideas from text to be handled by the memory system, whereas the constructive process involves relating the information from the text to information possessed by the reader in order to construct a meaningful interpretation.

Recall is therefore a product of what one knows and what is said in the text. When asked to recall a sentence or a passage, subjects frequently reconstruct the sentence or the passage on the basis of partial information that they have selected and interpreted. The subjects remember some main ideas and make up the rest of the sentence or passage to fit these ideas.

The reconstructive character of recall is especially pronounced when subjects are not given unrelated sentences to recall, but stories or pictures (Kintsch,1977).

Apparently what happens in recalling stories is that the subject remembers an overall theme and then reconstructs the rest. Details are easily forgotten, but the theme of a story is much less susceptible to forgetting.

By comparing the protocols of the oral recall of good and poor readers, inferences of how they differ in information processing can be made. These protocols can be analyzed into idea units to determine the quantity of information recalled. In addition, the idea units can be categorized into different syntactic groups. If the information recalled by good readers falls into the categories in different proportions than the recall information of poor readers, then processing differences may be inferred.

1.3 Word Naming Time, Memory and Comprehension

1.3.1 Working Memory and Comprehension

With regard to the comprehension process, there are several conceptualizations or theoretical views of reading (Rupley & Blair,1981), some of which are extrapolated to listening. Within the information processing model, the issue of whether or not differences in working memory capacity can account for differences in reading achievement has been intensely investigated (Daneman & Carpenter,1980). According to Baddeley and Hitch (1974), working memory has both processing and storage functions that compete for a limited capacity. Information is processed in the central executive where it is transformed into a speech-like code. It is then stored in a speech-like form in the buffer until recall. During recall, the central executive retrieves information from the phonetic buffer. If processing is executed rapidly, then more capacity is left for storage and maintenance of the products of processing. This trade-off between processing and storage activities has been used to explain differences in reading achievement. Poor readers devote more capacity to executing the reading processes and

consequently may have less capacity for storing and maintaining information in working memory. These inefficient processes of the poor reader will be functionally equivalent to a smaller storage capacity because they must allocate more of the available shared capacity to the processing functions (Carpenter,1980). A functionally smaller storage capacity could interfere with the quality of contextual integration because integrating new information with prior context presupposes that the individual has access to that prior information (Daneman & Green,1986). On the other hand, the good reader may spend less time than the poor reader in the various stages of reading such as decoding, lexical access, parsing, inferencing and integrating, and therefore more capacity is available for storing the intermediate and final products of reading. Thus the good reader may have more capacity left over for the integration of materials and perform better during recall on the comprehension task.

Very often memory span tasks are used to indicate this memory capacity. At least two processes are involved in this span: the identification of the items and the retention of ordered information (Das,1984). Many studies have been carried out to relate performance on memory span tasks to reading achievement as measured by psychometric tests (e.g. Saunders,1931; Torgesen,1979; Torgesen & Houck,1980). The general conclusion reached is that individual differences in working memory capacity account for individual differences in reading achievement. Given this model, the speed of processing information is hypothesized to be a determinant of span performance and reading achievement.

Compatible with the working memory model is the limited capacity model proposed by LaBerge and Samuels (1974). Within this model, comprehension is guided primarily by a series of recognition processes in which information about individual words is encoded in a sequence of stages, beginning with lower-level feature and phonological analyses and proceeding to the retrieval of appropriate semantic information. The semantic cues obtained through this process are then made available for

higher-level integrative operations. If the lower-level coding processes are not carried out automatically, the processing capacity needed for higher level operations will be limited.

1.3.2 Word Naming Time and Comprehension

With regard to the relation between word naming skill and reading ability, it is found that there is a relationship between word naming speed and reading ability, particularly in early grades. Children defined as skilled readers on the basis of comprehension measures are markedly superior to below-average comprehenders in their ability to name words rapidly and accurately (Stanovich,1982).

McCormick and Samuels (1979) found correlations of approximately -0.55 betwen word recognition latency and comprehension ability, and approximately 0.60 between word recognition accuracy and comprehension ability. Groff (1978) reported correlations averaging over 0.80 between word reading and several standardized measures of paragraph reading. Biemiller (1977-78) tested children in the second through the sixth grades and observed that on the average, 68% of the variance in text reading time was accounted for by letter and word naming time. Mason (1978) found that good readers named words 57 msec faster than poor readers.

Further evidence in support of the importance of rapid word recognition is provided by Perfetti and Hogaboam (1975), who found that less-skilled third- and fifth-grade readers named even high-frequency words approximately 150msec slower than skilled readers.

As Smith and Holmes (1971) have argued, "unless the reader reads fast enough, he is not going to comprehend what he is reading simply because his memory system will not be able to retain, organize and store the fragmentary information in any efficient way. This is the situation of any reader who does not read fast enough, who relies too much on visual information: he will have very little comprehension of

what he reads (p.412)."

In summary, the relationship between word recognition speed and reading ability is very well established. This relationship is very strong in the early grades, but declines somewhat as the reader develops fluency, probably because when a certain threshold of reading speed is passed, increases in fluency are more dependent on the development of more sophisticated comprehension strategies that operate relatively independent of speed (Jackson & McClelland,1979).

1.3.3 Word Naming Time and Memory Span

As mentioned above, word span performance involves the identification of items and the retention of order information. The first reflects speed of accessing from long-term memory the name for the word, whereas the second requires a successive processing of words (Das,1984). Thus it is expected that individuals who are slow in word naming (as measured by word identification time or naming latency) will process information so slowly that they will have less capacity left over for storing items that have been processed and thus will have a shorter memory span (Dempster,1981).

In fact, Nicolson (1979) has investigated the relationship between memory span and processing speed. The results of his study provide strong support for the hypothesis that both within subjects and between age groups, changes in memory span are directly attributable to changes in reading rate.

Many studies have been done on the relationship between word naming speed and memory span (Dempster,1981; Huttenlocher & Burke,1976); between memory span and reading achievement (Raymond,1952; Torgesen,1978); and between word naming time and reading achievement (Perfetti & Hogaboam, 1975; Wolf,1982; Katz & Shankweiler,1983). Yet there are only a few studies done on the interrelationships between word naming time, memory span and story comprehension (Mason et al.,1975). So in addition to examining the recall of good and poor readers after reading and

listening, the interrelationships between word naming time, memory span and story comprehension would be investigated in this study as well.

Recent interest in psychology of reading has spawned a number of studies that have attempted to determine the critical stimulus variables affecting word recognition. Various studies have identified three variables: number of syllables (Spoehr & Smith,1873); number of letters (Frederickson & Kroll,1976); and word frequency (Forster & Chamber,1973). Further study by Perfetti, Hogaboam and Finger (1978) indicated that differences between skilled and less skilled readers were absent for naming colors, digits and pictures. Yet vocalization latencies of skilled and less-skilled young readers were found for words and increased with the number of syllables. It is therefor hypothesized by Perfetti and Hogaboam (1975), Perfetti and Lesgold (1976) that differences in reading comprehension are in large part due to differences in the knowledge and use of verbal codes. Hence in this study, words were used as the stimuli for naming time tasks. The relationship between the naming time for 1-syllable, 2-syllable and 3-syllable words, visual and auditory word span, together with listening and reading comprehension performance of good and poor readers was investigated.

1.4 Purpose of the Study

The purpose of this study was twofolds. First of all, the reading comprehension and listening comprehension of good and poor readers, as indicated by their recall protocols, would be analyzed to see whether poor readers were able to make use of the story schema to understand and recall the same quantity and quality of information as good readers did, and whether the same amount and type of information would be recalled after reading, as compared to the listening condition. Related to this was the controversial question of the relative efficacy of the mode of presentation on the comprehension performance of both good and poor readers. The

second major purpose of this study was to investigate the interrelationships among word recognition speed, memory span, reading and listening comprehension of good and poor fifth-grade readers. In order to achieve this goal, the naming time of 1-syllable, 2-syllable and 3-syllable words, together with visual and auditory span tasks would be given to each student. As word recognition is a component of the reading process, it is therefore expected that the ability to recognize words rapidly is related to individual differences in reading fluency. In addition, there is also the possibility that poor readers fail to acquire orthographic knowledge - one that requires the detection or remembering of ordered information, as measured by the memory span task.

1.5 Definition of terms

Reading Comprehension: A complex of processes (together with the result generated) involved in bringing meaning to the printed page and interacting with that written message in order to communicate with the author (McLeod,1978).

Listening Comprehension: A complex multi-dimensional set of skills (together with the result generated) involved in taking what one hears and organizing it into verbal units to which one can apply meaning (Goss,1982).

Memory Span Forward: The recall of lists of words in the order in which they are presented.

Word Naming Time: The speed the subjects are able to orally name words.

Good Readers: Those subjects in Grade 5 who achieve at or above the 75th percentile on the comprehension section of the Edmonton Public Schools District Reading Test, administered at the end of the previous school term.

Poor Readers: Those subjects who achieve at or below the 30th percentile on the comprehension section of the Edmonton Public Schools District Reading Test, administered at the end of the previous school year.

1.6 Limitations of the study

Many ways have been used to assess reading/listening comprehension including teacher questions of various types (literal and inferential), multiple choice questions, cloze procedure and summary of the story. Some are required in written form while others are in oral form. In this study, the comprehension performance of the subjects is measured in the form of a free recalling of what they have read/listened. By analysing the transcript of this oral retelling, together with the word naming latencies and the scores on the memory span tasks, inferences can be made about the relationship between naming time, memory span and reading/listening comprehension. Yet the use of a free, oral recall has the following limitations:

1. When subjects are given oral recalls, verbal fluency may have affected the results of the study. Some subjects may have comprehended the passage when reading/listening but may have been unable to verbalize their understanding. Others may not have comprehended as well when reading/listening but, because of verbal fluency, make the best of the information they possess. So the subjects selected in this study have similar verbal I.Q. in order to avoid the above factor operating as a variable affecting their performance.
2. Subjects participating in the study may not have been familiar with the oral retelling of a story. Because of the lack of experience or training, they may be unsure of how much or what parts of the information they understand should be included in the oral retelling. In order to control this, one practice short passage was given to the subject in the written form and another in oral form to get the subject familiar with what he/she was supposed to do.
3. The subjects selected to participate in the study may have been in an unfamiliar, atypical reading/listening situation. The presence of a stranger as the investigator and the tape recorder may affect the performance of the subjects, especially the shy and nervous ones during the testing sessions. In order to

avoid this, an atmosphere of friendliness and cooperation needs to be established. A brief introduction of what the tasks are about and an assurance that their performance would not be considered as part of their examination marks are necessary. Yet they are strongly encouraged to try their best.

4. There is only one reading test - the Edmonton Public School District's reading test to identify good and poor readers. This may not be able to discriminate good readers from poor readers so well as other standardized reading tests. Moreover, the percentiles set to differentiate good and poor readers from the normal ones are arbitrary and highly subjective. There may not be marked differences between these two groups of subjects. In order to check this, the Schonell's Graded Word Reading Test was given to each subject. This test represents a scientifically selected sample of words of increasing difficulty that will give an accurate estimate of a pupil's power of word recognition, and from which Reading Age can be calculated. Finally the scores used are from the end of the previous school year. Some students' comprehension scores may have undergone marked changes during the next few months.

1.7 Significance of the study

The working memory model proposed by Baddeley and Hitch (1974) says that slow processing of information results in little time left for storage of products. Thus poor readers need to spend more time in the various stages of reading such as decoding, lexical access, parsing, inferencing and integrating, therefore less capacity is available to them for storing the intermediate and final products of reading. Thus this study is intended to verify the above assumption by finding out the correlation between memory span and reading comprehension. In addition, until now there have been only a few studies on the relationship between memory span and listening comprehension of good and poor readers, except the one done by Daneman and

Carpenter (1980), who correlated reading span, listening span with reading and listening comprehension performance. The subjects used in their study were college students. So it was worthwhile to conduct an experiment to see whether memory span also correlated with listening comprehension of good and poor readers in elementary schools. Furthermore, the study will indicate whether or not poor readers can understand and recall important information to the same extent under different conditions of presentation of materials. This will add to our theoretical knowledge about the comprehension process. This will also have implications for classroom teachers, resource teachers and reading clinicians, for it will help them to know more about how poor readers process and organize the received information, and decide which condition is more optimal for poor readers to learn the communicated message.

2. Literature Review

The main purpose of this study is to investigate the relationship between word naming time, memory span, reading comprehension and listening comprehension of good and poor readers. This chapter will provide a review of literature related to this purpose. This chapter is divided into eight sections. The first three sections deal with a review of literature on reading comprehension and the differences between good and poor readers. The fourth one discusses the relationship between memory span and reading achievement. The fifth section is mainly concerned with listening comprehension while the sixth one discusses the relationship between reading and listening comprehension. Finally the last two sections review those studies which have compared the differences in comprehension performance under different modes of presentation of good and poor readers.

2.1 Models of Reading

There are four general views of reading. The first one is the top-down view, which is based on the idea that the reader brings more information to the written text than the text brings to the reader (Strange,1980). Essentially, readers are involved in hypothesis testing as they proceed through a printed page. Prior knowledge of the world and language enables readers to make informed predictions about what they are reading. As readers continue reading, they either confirm or modify their predictions as they relate to their prior knowledge.

2.1.1 Top-down Model

Goodman's model was developed on the basis of the author's experience of oral reading in youngsters. It is assumed that the processing sequence starts with the eye movement and a fixation on new material. After this the reader selects "graphic cues" from the field of vision to help in the formation of a "perceptual image" of

part of the text. The selection of visual information is guided by the reader's background, cognitive style, strategies, and the context constraints. The resulting perceptual image is made up "partly of what the reader sees and partly what he expects to see". In the next stage, the reader searches his memory for related syntactic, semantic, and phonological cues to enrich the perceptual image. At this point the reader makes a guess or tentative choice consistent with the graphic cues. If he is successful, he holds the resulting choice in "Medium-term memory". If not, he tries again or looks back at the earlier text. Once this choice has been made, it is tested against the prior context for grammatical and syntactic acceptability. If it fits in with earlier materials, its meaning is "assimilated with prior meaning" and the results are stored in long-term memory. At this point predictions are made about the forthcoming text and the cycle is repeated.

This model has several shortcomings. The main problem is that it does not specify much about the reading process (Mitchell,1982). It does not indicate how the various non-visual sources of information are drawn upon to modulate the formation of the perceptual image. Nor does it say anything about the relative importance of the contributions from the different sources. In addition, it fails to acknowledge the importance of lower level processes such as word recognition which the text requires of the reader.

2.1.2 Bottom-up Model

Another view, the bottom-up , or text-driven conceptualization is based on the idea that the page brings more information to the reader, i.e. readers begin reading without much information about the content. Then word parts and words are processed sequentially, and meaning is got directly from them (Gough,1972). In the first stage of the reading process, visual information on the page is registered in iconic memory where it remains available until the reader makes another fixation. This

information is used as raw material for the purpose of identifying the sequence of letters in the display. This recognition process is assumed to operate serially from left to right. the device responsible for the identification process (the Scanner) is assumed to consult pattern recognition routines held in long-term memory. The string of letters read from the display is placed in a Character Register and immediately operated on by a mechanism (the Decoder) which maps the characters onto a string of "systematic phonemes". The Decoder is assumed to make use of a Code Book of graphemeto-phoneme correspondence rules. The end products are stored temporarily in a form analogous to a tape recording. The phonemic representation, supplemented by reference to the Lexicon, is used to identify the sequence of words in the sentence , and these words are held in Primary Memory until the sequence can be parsed and placed in another more stable storage named TPWSGWTAU (or the place where sentences go when they are understood). The comprehension device draws upon syntactic and semantic rules in the course of analyzing the sentence.

Thus under this model, processing in reading is considered as data-driven in that all decisions about visual inputs, such as words or letters, must be made before the data are transformed into the kind of meaning code necessary to allow instantiation into long-term semantic memory. The memorial structures never serve to direct the hypotheses about what a particular word or letter might be. When reading is analyzed in this way, the component levels of processing appear to be organized hierachically and the attainment of any given level presumes the execution of all subordinate levels.

Like top-down models, the fundamental problem with bottom-up models is their very one-sidedness (Adams,1982). These bottom-up or hierarchical skills models have failed to recognize the role of higher order knowledge that even young readers are able to bring to the text. They pay no particular attention to the process of integrating sentences and propositions, which obviously plays an important role in the

comprehension process. In addition, these models are vague about the way in which the reading process is influenced by prior context (Mitchell,1982). They also lack flexibility because they assume that readers have no choice of strategies to deploy in different reading tasks.

2.1.3 Interactive Model

The interactive view assumes that what readers bring to the page and what is written on the page are both important in getting meaning. Readers are therefore using both text and information about their world to get at the meaning of print. Many theorists believe that meaning is not inherent in the print.

The schema theory is an attempt to explain comprehension as an interactive process in which readers use their knowledge structures to arrive at a consistent understanding of text. The schema theory has been described by Rumelhart (1975) as a theory about how knowledge is represented and about how that representation facilitates the use of knowledge in particular ways. According to schema theory, all knowledge is packed into units. These units are schemata. Embedded in these packets of knowledge is, in addition to knowledge itself, information about how this knowledge is to be used.

In the first stage of the reading process, the information is packed up by the eye and registered in a Visual Information Store (VIS) or icon. Visual features are extracted from this store and made available to the pattern synthesizer. The device draws upon a wide variety of different sources of information to work out the most probable interpretation of the text. Sources of information that may be used include information about letter shapes and the orthographic structure of English, information in the mental lexicon, information about what is syntactically and semantically acceptable in the language and information about the contextual situation. Information from all the different sources is brought together in a store called the message centre.

Each knowledge source contributes a set of alternate hypotheses. The plausibility of each hypothesis is then evaluated by checking it against information in other parts of the system. After repeated checking carried out simultaneously at all levels, the selective strengthening of compatible hypotheses defines a set of hypotheses that are consistent both with one another and with the featural information. This set of hypotheses is accepted as the final interpretation of the text at each of the different levels of analysis.

The role of inference in the reading comprehension process is a major feature of the schema theory. Literal information serves to activate schema that lead the reader to hypothesize about story structure, words, language features, and meaning. Schema may be changed, elaborated upon, or discarded as one proceeds through the text. Changes in schema can be considered new learning that may result from modifying an existing schema or from creating a new one.

According to this theory, then, readers may fail to comprehend because of three reasons: the reader may not have the appropriate schemata; the reader may have the appropriate schemata, but the clues provided by the author may not be sufficient to suggest them; or the reader may find a consistent interpretation of the text, but may not find the one intended by the author (Rumelhart,1980).

Thus the interactive model describes reading as a constantly shifting interactive process depending on familiarity with the topic, the syntax, the lexicon and the purpose for reading. This model is particularly attractive to reading educators because it better explains collected data on reading performance. It is Rumelhart's type of interactive model which is now a dominant one shaping pedagogical practices and research in reading (Blachowicz,1984).

At the core of interactive approaches to reading is the constructivist assumption that perception consists in representing or organizing information in terms of one's own previously acquired knowledge. Through the interactions between top-down and

bottom-up processes, the flow of information will be considerably constrained. In view of this, interactive models have adopted the notion of a central, limited capacity processor from theories of information-processing. It is the allocation of attention to higher-order dimensions that determines whether or how the text will be understood.

2.1.4 Limited-capacity Model

The limited-capacity model of reading, put forward by LaBerge and Samuels (1974), suggests a relationship between attention and the subprocesses of reading. It views reading as a process of activating internal codes corresponding to features, letters, spelling patterns, visual and phonological representation of words, and is concerned primarily with the conditions under which successive codes can be activated, with or without the reader's attention.

If the reading task requires less attention than the reader has available, there is no problem since the energy cost is less than his capacity to perform the task. But, if the energy cost for a task exceeds attention capacity, he has to resort to a strategy to overcome this. One useful strategy is to divide the task into smaller units, where the energy demands are less than our capacity limitations. Although the unskilled person can now perform complex tasks by doing one subunit at a time, the procedure is slow and difficult. As the unskilled person continues to practise the subunits, the attention demands for the subunits decrease, enabling the student to group the subunits into larger and larger chunks until the entire task can be handled as a single unit.

As reading is a complex activity, the attentional demands for the unskilled reader to decode the words, extract the meaning of individual words, combine the meanings of all the words to comprehend the sentence as a whole, and to relate the meaning of the sentence to the rest of the text exceeds the student's capacity. Consequently, the student must divide the task into subunits of decoding and comprehension. One strategy the unskilled reader can use is to put attention first on

the decoding task and, when it is done, switch attention to comprehension. Not only must the poor reader subdivide the task into decoding and comprehension, very often he must break the words into smaller units. The size of the visual unit used for decoding depends on the energy demands. Generally the less skilled the reader and the less familiar the words, the smaller the unit of visual processing because of the greater energy cost. With practice, the attention demands for decoding decrease. Then the student can decode larger units and finally decode and comprehend simultaneously. When the decoding task requires so little attention that the student can decode and comprehend simultaneously, decoding has become automatic.

Once the visual information is decoded, it moves on to phonological memory where the units are processed into their corresponding sound representations. When the visual units are smaller than a word, their component sounds blend together in phonological memory to form a word and, when the visual input is an entire word, its phonological representation is found. However, when the skilled reader recognizes highly familiar words, the phonological recoding stage may be bypassed and the processing route may go directly from visual memory to semantic memory, i.e. from print to meaning. Once phonological processing is completed, the phonological information is sent to semantic memory where it is processed for meaning.

In this model, the manner in which attention is deployed is one of the most important factors in understanding processing differences between the skilled and the unskilled readers. The unskilled reader must first use considerable amounts of attention to word recognition and then switch attention to the comprehension task. This switching of attention back and forth from word recognition to comprehension places considerable strain on the memory system.

Despite differences among these models, they all agree that words must be rapidly processed for fluent reading to occur (Stanovich,1982). Smith (1978) has repeatedly emphasized that reading must be rapid so that several words can be integrated

as a meaningful sequence in long-term memory. Slow reading strains short-term memory and leads to words being read as isolated units. Bottom-up models also stress the need for rapid reading of words. Laberge and Samuels (1974) have argued that word-meaning codes : "can be organized to make sense only if he can manage to shift his attention activation quickly among these meaning codes to keep them simultaneously active. We are assuming that the process of organizing is promoted by fast scanning at the semantic level in much the same way that fast scanning of feature detectors promotes utilizing of features into new letter patterns" (p.313).

So the general idea from this review of reading models is that skilled reading involves both analytic and synthetic, or bottom-up and top-down activities. The top-down processes ensure that lower order information that is consistent with the reader's expectations will be easily assimilated, while the bottom-up processes ensure that the reader will be alerted to any information that is novel or that does not fit her or his ongoing hypotheses about the content of the text (Adams,1980). For the skilled reader, top-down and bottom-up processing are occurring at all levels of analysis simultaneously as he or she proceeds through the text. He/She is therefore able to make optimal use of the information on the page, the redundancy of the language, and the context environment with minimal effort.

2.2 The Reading Process

"Reading involves coordinating perceptual processes that analyze letter shapes and letter combinations; phonological processes that bring to mind how the letters and the words they form sound; lexical processes that bring to mind the meanings of the words; and syntactic and semantic processes that analyze the meanings of the clauses and sentences that the words form" (Omanson,1984, p.1).

Analysis of the reading process has taken many forms (Gibson,1969) including language, psychological, psycholinguistic and physiological approaches. In general,

reading seems to involve a number of component skills.

Anderson (1972) has proposed a theory of reading comprehension, which focuses on three basic perceptual features: orthographic encoding, which is the identification of letters and groups of letters that form words; phonological encoding, which is the process of rendering words into implicit or explicit speech and semantic encoding, which refers to the meaningful interpretation of the words that readers see or hear themselves pronouncing. Of these three, semantic encoding is thought to be the point at which comprehension occurs.

Miller and several collegues (1975) have also proposed a theory of comprehension that has 3 basic features: identifying important elememts of the text, constructing representations of important text information, and matching representations to existing concepts.

It is suggested that important elements of a text provide cues about the focus of the reader's attention. After the important elements are identified, they are then represented internally. The process of internal representation may be visual, verbal, haptic (touch) or a combination of these. Four subprocesses make up the internal representation process. First of all, information is retrieved from LTM to form representations for the idea read. Second, the text information is elaborated or abstracted to remove unnecessary details. Third, the important information is integrated. This may involve making inferences about a representation and its relationship to new text information or identifying or adjusting inconsistencies between representations. Finally the reader assigns names to these representations, which are then used to construct meanings that make sense to them.

As for Golinkoff (1976), certain subskills need to have been acquired in order for the reader to efficiently extract information from text. They are the subskills of decoding, assessing the meaning of single printed words and text organization or obtaining meaning from larger stretches of text. According to her view, problems in

decoding may affect the reading comprehension process in one or two ways: they may discrupt the reader's search for the meaning of individual words, or they may hamper the extraction of the relations specified between words by a more indirect process e.g. the overloading of STM.

Finally Glynn (1983) suggested that the comprehension of instructional text can be a cognitively demanding task because component comprehension processes compete for limited space in the reader's working memories. The component comprehension processes that readers must perform include recognizing words and retrieving their meanings; parsing sentences; identifying and organizing important text ideas; and integrating those ideas with prior knowledge. Readers cope with the limited capacities of their working memories by attending selectively, by organizing information hierarchically and by automatizing to some degree their component comprehension processes through practice. When these processes are carried out successfully, they produce the cognitive structures that are the desired end products of text comprehension. On the other hand, if one or more of these processes is not carried out successfully, comprehension can break down. The reader will fail to understand certain text or will misunderstand them.

In sum reading is an active process in which readers use the strategies of sampling, predicting, confirmimg or rejecting, and integrating information in order to derive meaning from the graphic, syntactic and semantic cues provided by the author (Goodman & Watson,1977). The overview of reading process above suggests that phonological encoding, semantic encoding, organization and integration of information are important skills that are required in successful reading.

2.3 Individual Differences in Reading Skill

There are many ways in which people can be said to have different reading abilities. Readers can differ in the speed of their text reading, their comprehension, their ability to read aloud, and even their ability to read unfamiliar words.

According to Perfetti and Lesgold (1977), the trade-off between processing and storage seems like a potential source of individual differences in reading comprehension. The better reader might have more efficient processes so that he/she effectively would have more capacity for storing and maintaining information. More efficient processing could have several interpretations (Daneman & Carpenter,1980). One hypothesis is that the processes of good and poor readers differ only in some quantitative way, e.g. a good reader may require fewer processes than a poor reader to perform exactly the same computation, or the intermediate steps might be eliminated in some or all of the stages such as decoding, lexical accessing, parsing, inferencing and integrating in good readers. Such efficiency would imply that the good reader would have fewer computational demands on working memory; hence he/she would have more capacity for storing the necessary intermediate and final products of the reading process. More efficient processes would also mean that better readers are faster at reading-related tasks. A speed advantage could interact with the decay of information from working memory since less of the preceding information would decay simply because of the passage of time. Hence the more efficient processes of the good reader could be functionally equivalent to a larger storage capacity. Since poor readers are less efficient at the reading processes, they devote more capacity to executing the reading processes and consequently have less capacity left for storing and maintaining information in working memory to use during comprehension (Daneman & Carpenter,1982).

Both the initial encoding of facts and their subsequent retrieval involve working memory and could differentiate good and poor readers. Working memory capacity could influence both the duration that a fact remains in working memory and the

probability that it is consolidated in long-term memory. In both cases, the better reader would have an advantage over the poor readers. A fact might persist longer in working memory for the better readers because his processing does not consume all of the available capacity. The fact will not be displaced so quickly because the good reader might have an advantage in consolidating the fact in long-term memory. A larger processing capacity might allow more opportunities for integrating a particular fact into the general representation. The fact would be available during more of the subsequent processing so that later information could be related to it. In fact, reading is a matter of assembling and integrating propositions for long-term memory. Consequently, the integration process also would provide more retrieval routes for later accessing the fact. Finally a reader with more efficient processes might have additional capacity to devote to rehearsal and consolidation, while the poorer reader would require all his processing capacity to perform the minimal computations (Daneman & Carpenter,1980). In summary, fact retrieval is one aspect of reading comprehension that could reflect differences in processing capacity.

2.3.1 Differences in Processing Efficiency

In studies where the poor readers were 1.5 years or more below grade level on standardized reading tests, differences between the good and poor readers on latency measures have been found for objects, colors, numbers and letters (Denckla & Rudel,1976); objects, colors and numbers (Spring,1976; Spring & Capps,1974); color, numbers and letters (Wolf,1982). A more recent study by Katz and Shankweiler (1983) investigated the ability of good 2nd-grade readers and less skilled 2nd-grade readers to name rapidly objects, animals, colors, letters and words. They found significant differences between groups only for letters and words. Two additional studies support the above findings. Perfetti et al. (1978) found no difference between skilled and less skilled 3rd graders on rapid naming of pictures, colors and numbers.

However, significant differences were found on words only. Stanovich (1981) conducted a similar study with 1st-graders and obtained similar results. In addition, he added a letter naming category and found no differences in his two reader groups on this letter naming task.

As a result, much recent research and theory has emphasized the role of verbal coding efficiency in accounting for individual and developmental differences in reading comprehension skill (Perfetti & Lesgold,1977). Good comprehenders have been found to be faster word decoders and have been shown to be more efficient at encoding phonological and semantic information.

Perfetti and Lesgold (1977) have argued that verbal coding speed: the access and retrieval of a word name and its context constrained semantic properties- is a major determiner of individual differences in discourse comprehension. We must access information in memory before we can comprehend what we are reading. The position is that verbal coding speed is a general factor in comprehension. It applies to both listening and reading and is relatively insensitive to strategy differences. So from these studies we know that people who read poorly are also generally slower at recognizing words. The emphasis here is on speed, but not on accuracy of word recognition. Many individuals apparently have large recognition vocabularies and quite adequate word attack skills as long as they are permitted indefinite amount of time to process each word, but they seem to proceed so slowly that they cannot effectively understand what they are trying to read.

In fact, the observation of an association between slow word processing and reading comprehension skill is a relatively recent one. In their initial study, LaBerge and Samuels (1974) showed that poor readers were less automatic in processing individual words, in the sense that they needed to devote more attentional capacity to word recognition than did the less skillful readers. Subsequent research on automation of word recognition has focused on speed of access. In multiple studies using

populations of both children and adults, and both normal and handicapped readers, it has now been shown that those who score low on various reading achievement measures that stress comprehension are almost always slow in accessing individual words. Memory capacity is also crucial, for processes that take up too much working memory or too much direct attention may drive out the other processes that are needed to provide all of the necessary simultaneous information to the working system. Thus those children who can recognize or sound out most of the words they encounter-but who do so very slowly, can be expected to have substantial difficulty in reading and understanding connected discourse. Hence the absence of fast and accurate word recognition skills, developed early in the course of learning to read, will almost surely result in deficient reading comprehension ability later.

Perfetti and Hogaboam (1975) displayed printed words of various kinds to third and fifth grade subjects who were either high or low in reading comprehension. Decoding latency was measured by the time between word presentation and the onset of the subject's vocalization. Decoding latency was shorter for skilled subjects. The difference between groups was smaller for highly familiar words than for less common words. Perfetti and Hogaboam also gave the subjects a vocabulary test following the decoding phase of the experiment. They then considered the question of whether there was a relationship between knowing the meaning of a word, as measured by the vocabulary test, and speed of decoding. Among low-ability readers, decoding was faster for words whose meanings were known to the subject. For high-ability readers this relationship did not hold. Thus for low-ability readers, but not high-ability readers, decoding seems to be dependent on meaning.

A more recent study on the relationship between decoding speed and reading achievement was carried out by Stanovich, Cunningham and Freeman (1984). It was found that measures of general intelligence, decoding speed, phonological awareness and listening comprehension were moderately related to the child's end-of-year reading

comprehension, with decoding speed accounting for the largest amount of unique variance.

These decoding-speed differences between high- and low-ability readers are quite wide ranging. The magnitude of the difference depends on word frequency and word length. Decoding latency differences are less for high-frequency words than low-frequency words (Perfetti & Hogaboam,1975), and greater for 2-syllable words and especially for tri-syllables even when frequency is controlled (Hogaboam & Perfetti,1978; Perfetti, Finger & Hogaboam, 1978). The general result from these findings is that differences between ability groups in decoding latency increase as a function of word difficulty. As a letter string gets more difficult, ability differences in speed of decoding that word increase.

McComick and Samuels (1979) examined the relationships among accuracy and latency of word recognition and comprehension by non-fluent readers. Results of this study indicated that accuracy and latency were each significantly related to comprehension of both 1st and 2nd-grade words. In addition, the more accurate readers were recognizing both 1st and 2nd-grade words more quickly and with much smaller differences among word-length latencies than the less accurate readers.

Perfetti (1977) divided comprehension into 3 components: (1) a surface or phonological component, (2) a syntactic-semantic component and (3) an interpretive-integrative component. He found that the syntactic-semantic and the interpretive-integrative components of comprehension involve memory, and argued that skilled readers can hold strings of words in memory verbatim, in both single and multi-clause sentences while non-skilled readers have the ability to remember only single clause sentences. Likewise, skilled readers can remember up to 6 words while reading a passage whereas the non-skilled readers can remember up to 3 words. Hence Perfetti concluded that comprehension may be slowed down by either poor decoding or poor memory. If the poor reader cannot remember just read sentences, it

makes it impossible for him/her to use the interpretive-integrative processes which would allow him/her to relate incoming information to information already received.

2.3.2 The Effects of Slow Coding on Comprehension

The speed of verbal coding is a critical distinguishing feature of skilled reading (Perfetti & Lesgold,1976). Verbal coding differences have 2 components: the rapid access and retrieval of a word name and the retrieval of its contextually constrained semantic properties. Based on this assumption, there are 2 basic classes of short-term memory problems. The first one is called hysteresis: an inability of short-term memory coding mechanisms to keep up with the demands placed on them. This means either that STM availability will be temporally out of phase with STM input or that some input and output demands on STM will fail to get processed. Experiments by Springs (Springs & Capps,1974; Springs,1976) support this hysteresis hypothesis by showing that poor readers are slower at naming digits, colors and pictures of common objects. An alternative but related view of the STM problem of less-skilled comprehenders is the specificity/ordering hypothesis. It argues that the STM codes of less-skilled comprehenders are less specific and less complete than those of good comprehenders making them less retrievable and less accurately ordered.

Regarding the effects of slow coding on comprehension, it is suggested by Perfetti and Lesgold (1976) that the act of retrieving the conceptual information associated with a name is a basic, recurrent part of comprehension. Ideas are represented as structured relationships among names for other ideas. Any time that comprehension or thinking require any elaboration, extension, or qualification of a concept, those names must be decoded or replaced by the concepts for which they stand. If less-skilled comprehenders are slower at retrieving the conceptual information associated with a name, then they should be slower not only in word identification but also in deeper levels of comprehension processing, since it is hypothesized that these

levels involve decoding too. In addition, such coding speed differences are involved in apprehension of the individual words one reads or hears. Poor readers are not as good at retaining exact word information of sentences they hear during the period of time in which comprehension depends upon having word information available (Perfetti & Goldman,1976).

As evidenced by the above studies, children defined as skilled readers are markedly superior to below-average comprehenders in their ability to name words accurately and rapidly. The relationship between word recognition skills and reading ability is well established.

Likewise Mann, Liberman and Shankweiler (1980) suggested that poor readers' defective performance is a problem extending beyond the act of recording from print to speech, and involving a more general deficit in the use of phonetic coding in working memory. In their experiment, they examined the differences in susceptibility in phonetic interference by testing recall of phonetically controlled sentences and word strings. Although good readers made fewer errors than poor readers when sentences or word strings contained no rhyming words, they did not excel when the materials contained many rhyming words. In contrast to manipulations of phonetic content, systematic manipulations of meaningfulness and variations in syntactic structure did not differentially affect the 2 reading groups. Thus the conclusion reached is that the poor readers' inferior recall of phonetically nonconfusable sentences, word strings and letter strings reflects failure to make full use of phonetic coding in working memory.

Thus a hypothesis has been proposed that failure to make effective use of phonetic coding in short-term memory may account for some of the deficiencies poor readers typically show in language processing (Liberman, Shankweiler, Liberman, Fowler & Fischer,1977). Children who are good readers tend to be strongly affected by rhyme; poor readers are significantly less affected. For them, phonetic similarity has little effect on recall. Subsequent experiments have confirmed and extended this result

under a variety of conditions: when memory is tested by recognition as well as it is tested by recall (Mark, Shankweiler, Liberman & Fowler,1977); when sentences or word strings are the stimuli as well as when letter strings are presented (Mann, Liberman & Shankweiler,1980); when the items are presented auditorily instead of visually (Shankweiler, Liberman, Mark, Fowler & Fischer,1979).

In each of these conditions, it was found that poor readers are relatively insensitive to the phonetic characteristics of the items. It would seem therefore, that one reason for poor readers' deficient performance in short-term memory tasks is their failure to fully exploit phonetic coding. Whereas both good and poor readers were phonetically coding the stimuli, the poor readers were more adept to exchange segments across word boundaries and they experienced greater difficulty in retaining words within each word string.

Stanovich (1981) examined the speed with which skilled and less-skilled readers named colors, pictures, numbers, letters and words and found that words were the only stimulus type that the skilled readers named more rapidly. The equality of naming times for colors, pictures and numbers suggest that a general name retrieval deficit does not appear to be characteristic of less-skilled nondyslexic children. Instead, the marked word decoding speed difference, in conjunction with the lack of a letter naming difference between the 2 groups, supports the idea that phonological coding skills may be important determinants of early reading acquisition.

According to Jorm (1982), it is likely that a phonological deficit would adversely affect the reading process at a number of levels. First of all, such a deficit would probably affect reading at a single-word level. There is some evidence that readers can accesss the lexical entries for single words by either of two mechanisms; either directly from a graphemic analysis of the word, or by recoding the word into a phonological representation (Barron,1978; Coltheart,1978). Coltheart's view is that skilled adult readers can access the lexical entries for familiar words using the

graphemic mechanism alone. However, the phonological recoding mechanism is necessary for the identification of unfamiliar words. For beginning readers, many printed words are unfamiliar, so the phonological recoding mechanism will be particularly important in achieving lexical access. A second area where such a memory deficit might affect the reading process is in the extraction of meaning from text. It is possible that phonological codes retrieved from entries in the lexicon could be important in reading comprehension e.g. Kleimer (1975) has suggested that, in order to extract the meaning of a phrase, a reader must have stored information about words previously identified in order to relate them to the words currently being identified.

While the importance of coding efficiency is not questioned, Kintsch and van Dijk (1978) have suggested that differences in relatively simple working memory operations, which occur after the initial coding stage, could also be important in accounting for comprehension skill differences.

Kintsch and van Dijk's (1978) model of text processing is based on the efficient integration of the different text parts so that a coherent, subjective text base can be formed which will be easily retrieved from long-term memory. Integration between text parts occurs when newly processed semantic propositions share arguments with previously read propositions maintained in working memory. If a large number of old text propositions can be maintained during further processing, the probability that a working memory proposition will share arguments with a new proposition is increased. This will facilitate comprehension not only through the integration of text, but also by eliminating the necessity to perform resource-consuming inferential and search operations in order to establish semantic links between propositions. Thus within this model, the functional capacity of working memory - in terms of the number of old text propositions which can be maintained - is an important determinant of comprehension. Any processes which influence the capacity and which vary among individuals will account for differences in comprehension skill. Obviously coding

efficiency will affect functional capacity, especially if lower-level coding operations are not automatic and thereby use attentional resources that might have been used for maintaining propositions.

2.3.3 Other Differences

Another process that may produce individual differences is the encoding of word meanings i.e. semantic encoding. There are at least two components to this encoding: (1) the availability of a semantic entry in memory and (2) the encoding of a word meaning appropriate for the context (Perfetti,1985). The first is partly the question of the size of vocabulary. As many would expect, low-ability readers have smaller vocabularies than high-ability ones. They are less likely to have a semantic entry for any given word in a text. It is quite plausible that part of the difference in performance between good and poor readers is due to the fact that the poor readers are able to identify fewer words than good readers and know less about the words they do succeed in identifying. Incomplete knowledge of word meanings could in fact reduce reading speed and lower the reader's level of comprehension. In addition, they are also poorer at inferring the meanings of unfamiliar words in context. In McFarland and Rhodes' (1978) experiment, it was found that skilled readers tended to cluster semantically associated words together during recall more readily than unskilled readers. The results were interpreted as providing evidence for reading-skill differences in the semantic encoding of individual words.

Jackson and Myers (1982) found that individual differences in time to access name codes for visual stimuli predict individual differences in reading achievement. Both short-term memory span and efficiency of retrieval of semantic information from long-term memory are related to reading ability. Thus it is concluded that letter identification effficiency measures seem to be tapping some process or set of processes that develop during childhood and that influence performance on a broad range of

cognitive tasks, including reading.

Chabot, Zehr, Prinzo and Petros' (1984) study provides further evidence of the relationships between the speeds of word encoding, lexical access, semantic memory access processes and reading achievement. It was found that the speed of word recognition subprocesses accounted for significant proportions of the variance in reading achievement. However, reading achievement was most strongly related to the speed of semantic memory access for both words and pictures. Thus these results suggest that reading deficiencies may occur as a result of either slow semantic memory access speeds or a lack of organization of information in semantic memory.

Besides the above differences, Steiner, Wiener and Cromer (1971) argued that poor readers may have a problem in the use of contextual cues, which can free a reader from word-by-word reading. In their study, it is found that poor readers were concerned with decoding each word and failed to use the interword relationships that could speed up the decoding process and permit more efficient text sampling. On the other hand, good readers appeared to scan for meaning, organize text into at least phrase-size units and sample from other areas at the same time. This is similar to what Gibson and Levin (1975) have argued of skilled reading: the ability to process textual material in the most economic way possible given the task at hand. According to Gibson and Levin, skilled readers pay most attention to information relevant to their purpose, ignore information that has no utility for the task, read in the largest unit appropriate for the task, and process the least amount of information compatible with the task.

Similarly Willows and Ryan's (1981) study reported that skilled readers made greater use of grammatical and contextual information. In this study, matched pairs of skilled and less skilled readers from the 4th, 5th and 6th grades read aloud a variety of material in cloze procedure format and printed in geometric transformations. The extent to which syntactic and semantic constraints of the text guided their

performance was assessed. In both conditions skilled readers made better use of grammatical and contextual information. There was no significant improvement across grade levels in the proportions of syntactically and semantically appropriate responses. Hence the stability of differences suggests the possibility that differential utilization of syntactic and semantic cues might contribute to differences in the development of reading skill.

The assembling and integrating of words and propositions is another processing factor that differentiates good and poor readers (Perfetti,1985). If poor readers differ in the ability to retain information in short-term or working memory, it may lead to more general differences in the processing of sentences. More specifically, if poor readers are relatively inefficient at retaining unintegrated strings of words, then it is conceivable that there may be occasions on which the storage capacity falls short of that required for efficient sentence processing.

In one study by Cromer (1970), subjects were required to read texts presented in four different ways: (1) normal presentation in the form of a page of prose; (2) presented one word at a time; (3) presentation of words in "meaningful groups"; and (4) partitioned into relatively meaningless segments of text. The comprehension performance for a difference group of poor readers was compared with that for a control group of normal readers. As expected, the poor readers performed worse in the 3 conditions where the material was not explicitly organized into meaningful units. However, in the meaningful phrase conditions their comprehension scores were as high as those for normal readers.

A subsequent study by Oakan, Weiner and Cromer (1971) has shown that these organizational problems are not confined to reading tasks. A group of poor readers and a control group of normal readers were required to listen to a passage that was read either normally or read in a disorganized way (by a poor reader). The results showed that in the later condition, when the material was not preorganized,

comprehension performance was worse for the difference group, while in the former condition there was no difference.

Similarly Pike (1977) examined the relationship between strategies for recall of verbal material and reading ability of 10- to 13-year old children. Data for all children showed that random strings were hardest and meaningful strings were easiest to recall. While all children made some use of linguistic structure in varying degrees, good readers' performances on structured strings surpassed that of poor readers. Only for good readers did random lists show the classic serial position pattern with recency and primacy effects. Poor readers show less differentiation in their handling of random and syntactically ordered strings and tend to approach both as serial lists. Thus the conclusion reached is that good readers remember because they organize verbal materials more efficiently.

Likewise Daneman (1982) proposes that readers cannot process every sentence on a page contemporaneously, they must process in cycles, working with at most several sentences or propositions at a time. Since propositions in one cycle are frequently related to propositions in previous cycles, the reader must integrate or establish the coreference of these propositions in order to establish a coherent representation of the text. If readers have small memory span, they can maintain fewer of the propositions from previous cycles in working memory. Thus they are expected to have comprehension deficits relative to readers who can maintain more of the propositions.

Daneman and Carpenter's (1983) study provided further evidence that working memory capacity may play an important role in text processing, particularly in processes that integrate new information with the prior text. Presumably, less efficient readers devote so much capacity to processing the incoming words that they would be less likely to have the preceding relevant information still in working memory or be less able to retrieve it from long-term memory. Less efficient readers may also devote so much capacity to lower level processes that they do less high-level coding and this

would be functionally equivalent to a smaller capacity in working memory. Successful retrieval depends on initially coding material in a form that can be meaningfully associated with knowledge structures in long-term memory and maintaining some retrieval cue in working memory that would serve to reinstate the coding operations (Chase, Lyon & Ericsson,1979). In their study, it was found that working memory span was correlated with inconsistency detection and recovering from an inconsistency.

Finally it has also been suggested that poor readers do not use prior knowledge effectively during reading or listening. Holmes (1983) selected 5th-grade students, with equivalent I.Q.'s, but varying in reading ability and extent of general prior knowledge for the passage topics as subjects in this study. They read an expository passage written on their approximate instructional reading level. The results indicated that poor readers did not use prior knowledge to the same extent as did good readers. This was especially true when students were learning new information. The results also suggest that poor readers have difficulty answering text implicit questions even if they possess adequate prior knowledge for passage topics.

Taylor (1979) reported that poor readers' use of prior knowledge affects their comprehension performance. In her study, which investigated good and poor readers' recall of familiar and unfamiliar text, she found that 5th-grade good readers, 5th-grade poor readers, and 3rd-grade readers all recalled more on the familiar than unfamiliar passage. However the poor readers' mean difference score between the two passages was greater than the other two groups' mean difference scores. These findings suggest that poor readers' comprehension suffers when their use of prior knowledge is restricted, as when reading unfamiliar material. Consequently stories were chosen for the reading and listening comprehension tasks in this study. Grade five students have good knowledge of and experience with narratives. They would therefore be able to make use of the text structure to aid their recall.

A large body of research related to the organization of memory and how prior knowledge relates to comprehension and recall has been conducted. The finding is that the organization and accessing of knowledge influences the manner in which the reader organizes the information provided by the author and the reader's organization, which, in turn, affects the quality of that knowledge in recall. Comprehending a text requires the reader to relate the elements in the text to knowledge characterizations in his own memory structure. Information retrieval and the recall of text are affected by the manner in which prior knowledge has been organized in memory. Thus the poor reader's lack of knowledge, or inefficient use of relevant knowledge, may have resulted in their poor comprehension performance.

2.4 Memory Span and Reading Achievement

2.4.1 The Working Memory Model

During the 1960's there was a dramatic increase in the amount of both experimental and theoretical work devoted to the topic of short-term memory (Baddeley,1984). While short-term memory has been traditionally viewed as a passive storage buffer (Atkinson & Shiffrin,1968), working memory here is conceptualized as an active part of the human information processing system (Newell,1973). It is a limited capacity system with both processing and storage functions. In addition, the dominant view of memory between the late 1950's and the early 1970's changed from that of a relatively undifferentiated unitary system to that of a system based on 2 distinct stores: an acoustically based, limited capacity short-term store, and a more durable semantically based, long-term store of enormously greater capacity (Baddeley,1976). The tendency in the 1970's regarded memory as an integral part of other information-processing tasks, such as perception, pattern recognition, comprehension and reasoning, as reflected both in a growing interest in working

memory, and in a growing awareness of the importance of coding.

Baddeley (1981) divides working memory into three separate parts. The first one is a central executive component which is responsible for processing activities. It is assumed to be responsible for running the whole system, and to be limited in attentional capacity, but able to offload some of its demands onto a series of subsidiary slave systems (Baddeley,1984). Activities of the central executive component include the setting up of appropriate rehearsal routines such as the loading up of the phonetic buffer and the [redacted] of information from the buffer if needed. Baddeley expects the central executive to be heavily involved in tasks that measure "fluid intelligence", since working memory is assumed to be involved in verbal reasoning, learning and comprehension.

One of the slave systems that help the central executive is the articulary loop. It is a system based on inner speech that is regarded as responsible for the many speech-like characteristics of short-term memory. It is concerned with maintaining speech information through subvocalization. The articulatory loop is relatively passive and makes few demands on the central executive as long as its capacity is not exceeded. When the capacity is exceeded, the central executive component may become involved in storage activities such as the recoding of information held in the buffer so that proper maintenance can take place. If this is not done, then the information in the buffer is subject to loss due to decay over time or displacement by new information. Decay occurs if the activation of information subsides to a threshold level with time (Collins & Loftus,1975; Hitch,1978). Displacement occurs if additional structures are encoded, activated or constructed until the capacity is exceeded.

Support of the important role of the articulatory loop comes from a cluster of studies which suggest a strong association between verbal coding and short-term memory (Baddeley,1984).

Conrad and Hull (1964) found that if a subject is required to repeat back a sequence of consonants or words, then the more similar in sound or articulation the items comprising the sequence are, the greater the probability of error. This is referred to as the phonological effect.

Baddeley, Thomson and Buchanan (1975) reported that memory span for words is a simple function of their spoken duration. It proves that the crucial variable is spoken duration rather than the number of syllables. Thus disyllabic words with long vowel sounds such as "Friday" are less well recalled in a memory span situation than words that have short rapidly spoken vowels such as "topic". In addition, they also found out the articulatory suppression effect i.e. if subjects are prevented from subvocally rehearsing material by requiring them to utter some irrelevant speech sound such as the word "the", then their immediate memory span is impaired.

Further evidence comes from the unattended speech effect. If a subject is required to remember a sequence of visually presented items, then his performance will be markedly impaired if irrelevant material is spoken at the same time (Colle & Welsh, 1976). The important feature of the irrelevant material is its speech like character. Irrelevant white noise does not produce the effect, but provided the material is spoken, its meaning is unimportant, with nonsense syllables being just as disruptive of performance as words (Salame & Baddeley,1982).

In the case of visually presented items, registration in this system will occur only if the subject subvocally articulates the material. In the case of auditory presentation, however, registration in the store is obligatory, hence irrelevant spoken material will disrupt performance even though the subject is attempting to ignore it. The process of subvocal rehearsal allows the subject to take advantage of this store in two ways. First, by subvocal rehearsal, he is able to revive fading memory traces within the store. Second, by articulating visually presented items, he can supplement the visual store with a more durable phonological memory trace.

The other slave system is the visuo-spatial scratch pad. The scratch pad is regarded as a temporary spatial memory system, and is shown to be involved in manipulating visuo-spatial imagery (Baddeley & Liberman,1980).

Since both processing and storage functions share the same limited capacity, faster processing activities result in more capacity for storage. Likewise a slow speed of processing means that little resources would be left over for the storage and maintenance of the processed information. Thus, if a reader requires considerable processing capacity to decode a single word, his processing capacity is less available for higher order integrated processes e.g. memory for the just previously coded word may suffer, memory for the preceding phase may decrease, and the subject's ability to predict what he is yet to encounter on the printed page may diminish. However, the division of resources is not entirely flexible. In this model, it is assumed that a fixed amount of capacity is assigned to storage functions with the remaining capacity being flexible. That is, whether resources are assigned to processing or storage functions depends on how fast processing can be carried out.

In sum, Baddeley and Hitch (1974) suggested from their studies that there is a single working memory system operating in verbal reasoning, prose comprehension and free-recall learning, and this working memory capacity has a span-like component. According to their view, information presented on the memory span task is processed in the central executive where it is transformed into a speech-like code which is then stored in the buffer until recall. During recall, the central executive retrieves information from the phonetic buffer. If processing is carried out rapidly, then more capacity is left for storage and maintenance of the processed products. This will result in more accurate recall. Thus it is predicted from this model that a fast speed of processing is needed for better recall.

Very often memory span has been used as a measure of working memory capacity. It is in fact a complex psychological phenomenon influenced by at least two

separate components: the ability to identify the items and the ability to remember the order in which items occur in a list. The first reflects speed of accessing from long-term memory the name or label for the presented stimulus, whereas the second requires a successive processing of the stimulus items (Das,1984). Dempster (1981) examined 10 possible sources of individual and developmental differences in memory span. Considerable evidence suggests that the speed with which presented items can be identified is a major source of both individual and developmental differences in span performance (Baddeley, Thomson & Buchanan,1975; Torgesen & Houck,1980). It has been empirically demonstrated that this variable accounts for 25% of variation in performance on the span task among college students (Baddeley et al.,1975), dyslexic subjects (Spring & Capps,1974), and learning disabled subjects (Torgesen & Houck,1980). Nevertheless, performance on the span task requires not only the recall of the items but also the order in which these items are presented. Once again it has been empirically demonstrated that this variable is related to reading achievement (Mason, Katz & Wicklund,1975), and that poor readers may be insensitive to order (Singer,1982).

2.4.2 Empirical Evidence

With regard to successive processing, a typical task indicating this processing is memory span. Baddeley (1981) described the relation between working memory and reading as follows: "In learning to read, a child must decode a series of visually presented letters, store the outcome of his decoding in some temporary system and subsequently blend the content of his store to produce a word"(p.416).

As early as 1931, Saunders reported clinical observations which associated poor performance on span with difficulties in reading.

Raymond (1952) concluded from her study that the superior readers scored higher on all the auditory memory span tasks than did the retarded readers. Her

research implies that superior readers have longer memory span and are better able to organize the stimulus input than the retarded readers.

Pooling (1953) found a high correlation between the scores on the auditory memory span sub-tests and the word recognition ability. Pooling incidentally concluded that children who scored low on the auditory memory span test of the Stanford Binet will almost always have reading problems.

Huelsman (1970) and Rugel (1974) reported that out of the 26 studies considered, 15 found significant differences in performance between good and poor readers on the Digit Span Test. There were no instances in which the performance of reading disbled children was better than good readers. In addition, a large study by [redacted] Adams, Forrest, Stolz & Fisher (1971) found that the Digit Span Test was one of the three subtasks which reliably differentiated good and poor readers in elementary and junior high school. The other two are arithmetic and information.

Jackson (1980) and Jackson & McClelland (1979) investigated the relationship between reading skill and accessing letter codes from memory. Memory access was measured by the time taken to decide familiar and unfamiliar objects, letters and characters belonged to the same category or not. It is assumed that memory codes exist for familiar objects and letters. Good readers were found to perform better only in the categorization of familiar objects and letters. This suggested that better readers were faster at accessing memory codes and that slow processing of memory codes may account for individual variation in reading performance.

Further support of the working memory model comes from Wagner & Allans' (1983) study. In their experiment, 30 grade four students were individually tested on a digit span test of working memory capacity (Case & Kurland) and the Reading Span Test (Daneman & Carpenter). The Reading Span Test was administered using sentences at a grade 2, grade 4 and grade 6 reading level. It was found that as the decoding demands of the stimulus sentences in the Reading Span Test were increased,

the working memory capacity available for other reading tasks such as comprehension decreased relative to a subject's working memory span as measured on the digit span test. Thus the working memory capacity of an individual is a function of the interaction between the amount of central capacity required for processing operations and the amount of working memory capacity left over for storage.

Besides item identification, item order has been proposed as a source of variation in span performance (Dempster,1981; Huttenlocher & Burke,1976; Torgesen & Houck,1980). A more recent study on the relationship between naming time and digit span was carried out by Das (1985). In this study, naming time was found to correlate with memory span for Educable Mentally Retarded subjects. For non-retarded subjects, no relationship between the two was observed. Yet order memory and digit span had significant correlations for both groups. This implies that the ability to retain ordered information may be a source of performance difference between normal and disabled readers on span.

There are several studies which support the notion that there is a close relationship between the ability to order and reading performance (e.g. Mason et al.,1975; Katz, Shankweiler & Liberman,1981). Mason (1975) and Mason & Katz (1976) have reported results suggesting that poor readers fail to exploit orthographic information. In letter detection tasks, good and poor readers perform comparably when the letters are embedded in nonsense letter strings. These nonsense strings are composed of letters that occur in improbable positions. These same groups of good and poor readers, however, perform disparately when the target letters are embedded in probable letter strings - ones that conform to orthographic rules. So good readers are better at detecting target letters only when the target is embedded in a letter string that conforms to normal spelling patterns - which reflect ordered information.

In Guttentag's (1978) study, good and poor readers differed only in a letter-recognition task when pseudowords conformed to normal spelling patterns. On

nonsense strings and highly familiar words, good and poor readers performed comparably. All these findings are comparable with Schwartz and Doehring's report (1977) that poor readers lag behind good readers in their knowledge of spelling patterns. An inability to detect, remember or compare ordered information would explain, in some ways, the poor readers' lack of orthographic knowledge. Because orthographic knowledge includes sequential dependencies between letters as well as pictorial frequency information, order-related skills would be essential in abstracting that information.

In Mason et al. (1975), it was found that skilled sixth grade readers were very much better at reconstructing the order of 6 and 8 letter consonant strings and 8 digit strings than their disabled peers. The skilled readers were also better at identifying the items presented. It was also found that only item order related significantly to reading achievement. Katz et al. (1981) contrasted the performance of good and poor readers on an order recognition task using linguistic (pictures of familiar objects) and non-linguistic (doodle drawings) drawings as stimuli. From the results, it was shown that poor readers performed poorly on the recognition of the order of the linguistic stimuli.

In addition, Brady, Shankweiler & Mann (1983) reported that poor readers were found to perform less well on recall of random word strings and produce more errors of transpositions (in the non-rhyming strings of words) than did good readers, a further indication of poor readers' problems with memory for order.

Similarly Massaro (1984) has proposed that orthographic structure (spelling constraints) contributes to the perceptual processing of letter strings. In her study fourth-graders of varying reading ability were given pairs of letter strings and asked to pick the string that most resembled English spelling. The letter strings were varied systematically in terms of lexical status, frequency of sublexical patterns and rule-based regularity. The results revealed a significant positive relationship between reading

ability and appropriate decisions about English spelling.

On the whole, spelling patterns, or the orthographic information that poor readers fail to exploit, certainly reflect ordered information. An inability to detect, remember or compare ordered information would explain, in some ways, the poor reader's lack of orthographic knowledge. Because orthographic knowledge includes sequential dependencies between letters as well as positional frequency information, ordered skills would be essential in abstracting that information.

Daneman and Carpenter (1980) examined individual differences in working memory and reading. The results showed that subjects with large spans were better at abstracting a theme from a written or spoken narrative passage. In both listening and reading comprehension tasks, subjects with large spans scored much higher than subjects with small spans. In addition, the ability to abstract a theme from written narratives correlated significantly with silent reading span ($r=0.71$). Similarly the ability to abstract a theme from spoken narratives correlated significantly with listening span ($r=0.82$).

In Masson and Miller's (1983) study, the ability to store and process information is shown to be positively related to scores on a standardized reading comprehension test, long-term memory encoding and retrieval of explicitly stated text information, and integration of text information for the purpose of drawing inferences. Thus it is concluded that in the task of reading, not only does the reader have to encode new information in working memory, but he/she must also activate recently processed information or related information held in long-term memory. This procedure is critical for maintaining coherence of consecutive propositions in a text (Kintsch & van Dijk,1978) and for integrating new information with previously known information retrieved from long-term memory (Carpenter & Just, 1977). Both of these operation are important for comprehension and memory of text.

Other empirical evidence for the role of working memory in integration and comprehension comes from studies of how individuals comprehend extended discourse. Correlation studies of Baddeley, Logie, Nimmo-Smith & Brereton (1985); Daneman & Blennerhassett (1984); Daneman & Carpenter (1983) have shown that individuals with smaller working memory spans perform more poorly on general tests of verbal comprehension and on specific tests of integration requiring them to compute a pronoun's reference, monitor for semantic inconsistencies within and between sentences, and abstract the main theme.

From the above research, item identification and item order are found to be the 2 variables which are most probably common to performance on both span and reading.

2.5 Listening and the Process of Comprehension

Listening is a complex multi-dimensional set of skills (Backlund,1983). Despite the importance of listening in the classroom, the ability to listen often has been taken for granted and given little attention in language arts program (Friedman,1978). However, listening ability is worthy of educators' attention for several reasons. First, a child's level of listening comprehension is related to subsequent development of reading skills. Listening and reading comprehension scores are usually correlated. Also, studies show that while listening ability improves normally with age, students exposed to structured training experiences have performance scores higher than those of their peers who receive no training or who receive only daily reminders to listen carefully. Educators become interested in listening as a result of their interest in speaking or in hearing a language in general (Gilman & Moody,1984).

According to Friedman (1978), listening is a process that actually subsumes a whole series of subprocesses. These components of listening may be thought to fall along a bipolar continuum. At one end is a mental state characterized by attentiveness

i.e. maintaining an external focus only on the speaker and on the message being transmitted. In the middle is a state in which the listener is more actively selecting and organizing the material being received. The focus is on understanding the message. At the far end, the listener is weighing the message and evaluating what is being said. These three states can be viewed as occurring sequentially, cumulatively and almost concurrently in the ongoing process of communication.

In fact, the skill of listening has always been underestimated. It was once labelled a passive skill, but it is passive to the extent that it does not involve the physical activity of writing and speaking. The mental activity involved can be intense, particularly at the early stages of language learning (Davies,1980).

Goss' (1982) model of listening consists of two stages: in the first stage called auditory perception, it involves segmenting the speech signal into units that are potentially meaningful. In the second stage called comprehension, it involves two substages in literal processing, the listener assigns meaning to the message parts; whereas in reflective processing, the listener thinks about the message, makes more extreme inferences, evaluates and judges the speaker and the message. The latter substage is a deeper level of comprehension.

Pearson and Fielding (1983) identified the processes involved in listening comprehension and put forward the idea that one cannot understand auditory messages in a language unless one has some command over key components of that language, namely phonology, syntax, semantics and text structure. At the phonological level, the listener has to be able to distinguish the significant phonemes of that knowledge. He/She has to be sensitive to intonation patterns, variations in stress, patterns across words, and the subtle cues that allow them to determine where one word stops and another begins. At the syntactic lavel, listeners must be able to recognize paraphrases, disambiguate and recognize cues regarding form class. At the semantic level, listeners need to know what words mean and how words relate to one another. Finally at the

text structure level, listeners have to know how things like stories are organized in their culture.

Coots and Snow (1984) suggested the information processing model of speech perception, which assumes that sentences are initially segmented in working memory in groups of lexical items forming clauses or phrases. This surface structure string is interpreted through a series of phonological, lexical, surface syntactic and deep syntactic analyses in short-term storage eventually resulting in an abstract semantic representation. The semantic representation is transferred to long-term storage for retention. According to this model, prosodic cues, then, serve several functions: they indicate the speaker's attituide and affect; focus attention on particular aspects of the message and mark the structural boundaries of sentence and intersentence units. In fact prosodic cues give the listener cues to the perceptual segmentation of sentences, and reflect major syntactic-semantic relationships that underlie the content of sentences. In addition to highlighting meaningful relationships, prosody also serves to package sentences in a way that permits efficient allocation of memory resources in sentence processing.

In sum, the process of listening comprehension requires the same subskills as reading: phonological encoding, semantic encoding, and integration of materials as reading does.

2.6 Relationship between Reading and Listening

Reading and listening comprehension make up the receptive side of language. Broadly speaking, there are two extreme views concerning their relationship. Advocates of the unitary comprehension process hold the position that a unitary comprehension process is activated regardless of the mode of input. They see reading as the translation of graphic symbols to speech and reading comprehension, therefore, as the same process of comprehension as listening.

Fries (1963) put forward the argument that: "Learning to read... is not a process of learning new or other language signals than those the child has already learned. The language signals are all the same. The difference lies in the medium through which the physical stimuli make contact with his nervous system. In talk...by means of sound waves received by the ear. In reading, the physical stimuli of the same language signals consist of graphic shapes that make their contact with his nervous system through light waves received by the eye. The process of learning to read is the transfer from the auditory signals which the child has already learned, to the new visual signs for the same signals."

Carroll (1970) also considered listening and reading to be involving similar processes: "The child must learn that words are signals for spoken words and that they have meanings analogous to those of spoken words. While decoding a printed message into its spoken equivalent, the child must be able to apprehend the meaning of the comprehending spoken message."

Similarly, Wanat (1971) claimed that the task of the reader is to translate graphemes into phonemes. This is the task particular to reading. After reading to speech has been accomplished, comprehension processes associated with speech comprehension are brought into play.

Sticht and his associates (1974) have considered explicitly the question of the relationship between auding and reading and have proposed a developmental model of all language processes. They offer four lines of evidence which support predictions from their model. First, the ability of children to comprehend spoken messages should exceed their ability to comprehend written messages during the early school years, presumably because beginning readers lack competency in decoding printed language. It is predicted that auding is initially superior to reading and that the two processes become equally effective sometime around 7th or 8th grade. Secondly, auding ability will predict reading comprehension, once decoding skills develop. Data relating to this

prediction shows that the correlations between these abilities increase from [illegible] to [illegible] grades and remain stable (around +.60). Moreover, upper elementary and junior high aged students who are poor readers also perform badly on listening tasks, suggesting a general comprehension. Thirdly, if similar language and cognitive competencies are responsible for both auding and reading, then similar rates of information input, whether by printed or by spoken language, should yield similar levels of comprehension. Finally this model predicts that training which improves auding ability will be reflected in improved reading ability at least for those individuals who can decode print. Of the 12 studies reviewed by Sticht et al. (1974), in which specific auding abilities were improved through training, 10 reported improved reading ab[illegible] which paralleled the improvement in auding ability.

Goodsmith (1975) also thought that reading, like listening, is a language based skill. It shares with listening the possibility of use of syntactic and semantic redundancies of language as well as the phonemic and articulatory recodings that tend to activate under conditions of difficulty.

Goodman (1976) suggested that children learn to read and write in the same way and for the same reason they learn to speak and listen. The way is to discover language as a vehicle of communicating meaning. Language learning, whether oral or written, is motivated by the need to communicate, to understand and be understood. His view is that reading is the active process of reconstructing meaning from language presented by graphic symbols (letters) just as the active process of reconstructing meaning from the sound symbols (phonemes) of oral language.

Jackson and McClelland (1979) examined the nature of the processing differences that separate better readers from less efficient readers. The major source of individual differences in reading ability lies in general modality independent language comprehension skills. Better readers tend to achieve better comprehension than poorer readers whether they are reading text or listening to spoken discourse. In fact

performance on a test of listening comprehension accounted for 51% of the variance in reading ability for the sample of subjects.

Pearson and Fielding (1983) hold the same opinion that listening comprehension involves the same orchestration of skills in phonology, syntax, semantics and knowledge of text structure, and seem to be controlled by the same set of cognitive processes as reading comprehension.

Guthrie and Tyler (1976) studied 4 related phenomena : comprehension difficulties in listening for poor readers; the relationship between semantic and syntactic processing for both good and poor readers in both written and oral forms; the impact of the lack of automaticity in decoding and the importance of incomplete decoding as an explanation of poor reading comprehension. They made up 8-word strings of 3 catrgories: meaningful, syntactically correct, and random word lists. These 3 different types of sentences were presented to the good and poor readers in oral and written form. In both listening and reading, both kinds of students could repeat more words in the meaningful sentences than in the syntactically correct sentences, and more words in the syntactic sentences than in the random ones. Thus it is concluded that the processing of semantic and syntactic information in the two modalities appears to be similar. Furthermore, it is also found in this study that the poor readers were worse in reading than in listening, suggesting that decoding did play a role in reading performance.

Support for the unitary comprehension process was also provided by Devine (1968), who claimed that:

1. both reading and listening are concerned with the intake half of the communication process (e.g.Walker,1973).
2. each seems to be a complex of related skills components (e.g.Klntsch & Kozminsky,1977).
3. the same higher mental processes seem to underlie both high correlations

between them (e.g.Johnson,1974).

4. the teaching of one seems to affect the other (e.g.Lemons & Moore,1982).

On the other hand, others see reading comprehension as a parallel but different form from listening comprehension. Borth (1972) proposed that: "Although reading and listening abilities share some elements in common, they exhibit substantial differences, and...we can no longer use listening abilities to estimate reading aptitude in the simple fashion we heretofore thought possible.

Adams (1980) pointed out the processing differences between reading and listening by saying that reading demands more syntactic sophistication than does listening. Whereas the syntactic structure of a spoken sentence is largely given to the listener through prosodic cues, the syntactic structure of a written sentence must be discovered by the reader. The intonation patterns, variations in stress patterns across words and the subtle cues allow them to determine where one word stops and the other begins. They give much information about the underlying structure of sentences. For the written language, it conveys this prosodic information only partially and only clumsily through punctuations (Crowder,1982), demarcation of paragraphs and textual devices such as underlying and italicizing (Rubin,1980). Temporal characteristics of speech such as pauses and changes in speed often provide clues for the chunking of words into larger constituents.

In addition, one of the greatest advantages which may accrue from the ability to read and comprehend is the resulting alleviation of the strain on memory (Jackson,1970; Crowder,1982). The permanence of printed material allows the reader to return to the printed message, whenever he feels required to do so, thus freeing him from the strain of memorizing large masses of material for later retrieval.

Another argument is that speech and print are sufficiently different so as to command different processing strategies. As early as 1928, Aristotle said that "the style of written prose is not that of spoken oratory". There are large differences in

grammar, vocabulary and style in what we write and in what we say.

Furthermore, Miller (1972) noted a historical development that tangentially bears on the point that comprehension is not unitary. Writing did not originate as a permanent form of speech. Rather writing, as pictographs, evolved independently of speech as an alternate form of communication. This development of writing was considerably later in man's evolution than speech. Only recently in mankind's history, say 3000 years ago, was writing associated more directly with speech when an alphabet was invented.

In sum, the relationship between reading and listening is best summarized by Sticht and his associates (1974): "The receptive language components (listening and reading) serve to transform verbal and printed displays into non-language conceptualizations which constitute the meaning of the message to the receiver. The conceptualizing process continually merges input from the language process with information from the cognitive content store to build the subjectively experienced, meaningful message...Listening and reading are considered to be similar processes because both require the use of language and languaging, and because, with identical messages, both result in the formation of a single, mutual internal conceptualizations...Listening and reading differ primarily in the manner in which the individual receives the stimulus words, they are similar in the sense that they are both receptive communication acts that require a central language and conceptualizing base."

2.7 Studies which compared Listening and Reading Comprehension

Studies comparing listening and silent reading have arrived at 2 generalizations (Diane,1974):

1. an auditory presentation (i.e. listening) brings better comprehension at early ages (e.g. age 6), but a visual presentation (i.e. reading) is more effective for comprehension for older children (age 16).

2. comprehension of easy material [redacted] more effective with an auditory presentation, while difficult material was better understood when presented visually.

Durell (1969) found, in presenting the same material in both oral and written form to first- through eighth-graders, that sentence-paragraph comprehension in listening surpasses that in reading in first-graders. However, in eighth-graders, reading comprehension was 12% superior to listening comprehension.

Since the surveys of the literature show that listening is generally better for learning purposes in the primary grades and that reading is more effective for learning in the upper grades, Swalm (1974) carried out a study in a large elementary district containing a representative cross-section of students. The sample was composed of 216 students, 72 in 2nd, 3rd and 4th grades. The amount of comprehension gained after one exposure was measured by the cloze technique following a 10% random deletion pattern admitting only lexical words. The finding was that when all subjects were considered together, no significant differences emerged at any grade level. Both methods of learning (reading vs. listening) were the same at each grade.

Sticht et al. (1974) reviewed 31 studies that compared reading vs. listening comprehension at various grade levels. What they found was that in the elementary grades (1-6), almost all of the comparisons favor the listening comprehension mode. As one moves from grade 7 through 12, the proportion of studies showing an advantage to reading comprehension increases, as does the proportion of studies showing no difference between the 2 modes. They suggested that the extra advantage demonstrated beyond grade 8 for reading over listening stems from the fact that the data display for reading is stable and can be re-examined, whereas the data display for listening is transitory and not subject to re-examination.

Elgart (1978) examined the relative effectiveness of each of the 3 modes of reception: oral reading, silent reading and listening. Results showed that there was a

significant difference between the 3 modes of reception with oral reading significantly more effective than silent reading in comprehending material.

In contrast, Saleem and Heerman (1981) found no significant difference among different modes of presentation. In their study, 3 segments of the Gates-MacGinite Reading Comprehension Test, Level C, Form 2 (1978) were administered to third grade pupils as listening tasks, oral reading tasks and silent reading tasks. Comparisons of answers to the literal-inferential questions within each mode revealed that the third grade sample possessed approximately equal achievement in both levels of comprehension within each mode of reception.

In Kintsch & Kozminsky's study (1977), subjects either listened to or read 3 tape-recorded stories, each about 200 words in length. Immediately after processing each study, the subjects wrote a summary in 60-80 words. A comparison of the summaries written after reading with those written after listening revealed only minor differences. Subjects tended to include a little more idiosyncratic detail in their summaries after listening than after reading, but the shared content of the summaries remained remarkably unchanged.

Johnson (1982) tested 96 randomly selected children aged 7 to 9 for their recall after hearing, orally reading and silently reading comparable 200-word stories. It was found that the older children made fewer substitutions than the younger children, and also hesitated less often. Not only were the older children more competent oral readers than the younger children, they were also able to assimilate and recall more of the information presented to them.

Duker (1965) claimed that the variability of results was due to the difference between the learning materials used, the diversity of characteristics among subjects, and the different testing procedures used in the investigations. Swalm (1974), on the other hand, specifically attributed the disagreement in results to the interaction between the pupils' reading ability and the level of difficulty of the reading material presented. He

reported that when 2nd, 3rd and 4th grade subjects were analyzed according to their reading ability, listening was significantly more effective than silent reading for below-average readers. Silent reading, however, appeared statistically more effective for average and above-average readers at the 2nd and 4th grades. Swalm claimed that when the material presented is above the student's reading level, comprehension is facilitated through listening.

2.8 Studies Comparing Comprehension of Good and Poor Readers

Significant differences in comprehension can be found between good and poor readers. This can be accounted for by several views.

In considering the nature of reading comprehension and the source of reading difficulties, there are two predominant conceptualizations. They are distinguished by their assumptions regarding the relationships among reading comprehension, decoding and language comprehension (Berger & Perfetti,1977). The first conceptualization of reading comprehension assumes the interdependence of language comprehension and decoding skills in successful reading comprehension. Successful reading comprehension in this model requires integration and interfacilitation of decoding and language comprehension subskills. Poor reading can be attributed to either a specific deficit in a particular subskill which would prevent normal development of other subskills or a lack of positive transfer and interfacilitation among subskills.

This notion of the interdependence of decoding and reading comprehension has been supported in the research of Golinkoff and Rosinski (1976), who found that poor comprehenders possessed weak decoding skills. Third and fifth grade subjects read through two word lists. One contained nonsense words (20 trigrams with consonant-vowel-consonant-CVC structure), and one contained common first grade level words. When the time required by the good and poor comprehenders to read each of these lists was compared, it was found that good and poor comprehenders did not

differ on the time to decode common first grade level words. However, the poor comprehenders took almost twice as long as the good comprehenders to decode the CVC trigrams. So the conclusion reached in this study is that good comprehenders are capable of rapid and accurate word recognition.

Likewise Perfetti and Lesgold (1979) have related the processing requirements of decoding and comprehension to well documented limitations in human information processing capacity. Thus the remedy for poor comprehension ability is development of decoding skills to the point where they operate automatically. It is argued that processing capacity will be freed so that the reader can begin to focus attention on the task of comprehending the text.

Further evidence of the decoding sufficiency hypothesis is supported by observation of oral reading behavior. Most poor comprehenders are also poor oral readers as well. They read slowly, word by word. They have considerable difficulty decoding unfamiliar words and they make numerous decoding errors (Golinkoff,1976).

Based on her view of more than 70 studies, the following conclusions was suggested:

1. good and poor comprehenders can often be differentiated by decoding ability, but not always.
2. poor comprehenders do not possess all developed text organization skills.
3. poor comprehenders do not exhibit difficulty in accessing the meanings of individual text words from memory so long as those words are short and familiar.

Besides reading text in a word-by-word manner, poor readers seem to have difficulty in organizing story information according to some overall structure (Weaver,1978).

In the more extreme case, Fleisher, Jenkins and Pany (1979) forward the idea that decoding ability is necessary, even sufficient for the development of comprehension

skills. It is assumed that once the written code is learned, text comprehension will be equivalent to comprehension of oral language.

On the other hand, Weiner and Cromer (1967) did not consider the relationship between decoding and comprehending to be a simple and straight forward one. They argued that there exist several possible relationships between decoding and reading comprehension. They identified 4 categories of poor readers, each referenced by some functional relationship between decoding skills, comprehension skills and the learning ability of the reader: the defect group, the deficiency group, the disruption and the difference groups. In the case of both disruption and difference poor readers, the lack of comprehension ability is not attributable to poorly developed decoding skills.

Oaken, Weiner & Cromer (1971) compared good and poor comprehenders under good auditory input, good visual input, poor auditory input and poor visual input conditions. The authors reported that under good auditory input, good and poor comprehenders performed equally well but good comprehenders performed better under good visual input than under good auditory input. Good comprehenders may have developed more efficient and more effective strategies for processing visual than auditory information.

Smiley, Oakley, Worthen, Campione & Brown (1977) investigated the importance of decoding skills as an explanation of poor reading performance. They opted for recall of passages of relative importance as the best measure of comprehension and put forward the following ratinale for using it: "The ability to concentrate on main events to the exclusion of nonessential material is a basic cognitive process essential for all comprehension activities, whether in the context of listening or of reading" (p.382). They used two relatively obscure folk[illegible] that the student's general background knowledge would be of little help in r[illegible]ng. Each pausal unit in the two stories (54 and 59 respectively) was rated on one of four levels according to its importance. For good readers, there was a significant difference in the amount of

material recalled from Level 1 material (the least important) to Level 4 (the most important). For the poor readers, however, only Level 4 material produced a significant change in the % of material recalled. Poor readers had about as difficult a time after listening as they did after reading. Thus the conclusion is that good readers show better comprehension than poor readers and they are sensitive to more gradations of importance. In addition, the fact that both of these effects are obtained when the material to be comprehended is either read or heard suggests that the same processes are involved in the two tasks.

Minsky (1975) suggested that good comprehenders may have an active and efficient retrieval system for locating exactly the appropriate frame to apply to a new situation. Perhaps they make good hypotheses so that they know what might be expected. They use their prior knowledge efficiently when they search for meaning in new situations.

Guthrie (1976) found a significant group by modality interaction, in that poor readers did significantly better on listening than they did on reading, while good readers did equally well in both modalities. Guthrie attributed these to incomplete decoding by poor readers, not to a general memory deficit, since differences between the groups were not significant in the aural mode.

Berger & Perfetti (1977) investigated the relationship between reading comprehension and language comprehension through the comparison of listening and reading for two memory tasks. Fifth grade children matched on I.Q. but representing two levels of reading achievement heard and read passages and were tested by questions and paraphrase recall. Performance of the skilled readers exceeded less skilled readers by equal amounts for reading and listening and by equal for paraphrase recall and literal question answering. The result suggests that localized processing skills i.e. encoding more immediate language units, rather than global and organizational skills are a major source of individual differences.

Christopher and Schultz (1977) studied the processing of prose by good and poor readers. In their study, a sample of 174 11th-grade students divided 2 passages into idea units and rated predetermined idea units according to three attributes that have been shown to correlate with recall. For each passage, there was no significant difference between good and poor readers in the mean or standard deviation of the number of units identified. There were also no differences between good and poor readers in the percent agreement with the judge's decision of each passage into idea units. However, good readers did recall significantly more of each passage than poor readers, though there were no significant differences in good and poor readers' means and distributions of ratings for interest, for importance and for concreteness.

-- Eamon (1979) had better and poorer readers among college students judged the importance of certain statements about the topic or theme of a paragraph as well as statements that were not about topical concepts of the paragraph. Differences in how the better readers rated the importance of statements about the topic over statements about non-topical concepts were significantly greater than differences in the ratings of poorer readers. When they were tested on recall of topical and non-topical information, better readers showed recall of information about the topic that was superior to their recall of non-topical information, while no such differences were found for poorer readers. It is therefore argued that good readers evaluate information presented in the paragraph with respect to its relevance to the topic, and tend to process this information at the expense of information about non-topical concepts. For poorer readers, these distinctions are less apparent.

McGee (1982) examined whether good and poor readers in elementary school are aware of text structure and whether an awareness of text structure influences recall. All subjects read and orally recalled two expository passages. The results indicated that 5th-grade good readers are more aware of text structure and recall proportionately more total and superordinate idea units than 5th-grade poor and

3rd-grade good readers. Further, 5th-grade poor readers displayed some awareness of text structure and recalled proportionately more superordinate ideas than 3rd-grade good readers. These results suggest that 5th-grade good readers were more sensitive to text structure than 5th-grade poor readers and this awareness correlated with their recall of important textual information.

Other studies reported that after listening to stories, young good readers recalled more superordinate ideas than subordinate ideas (Brown & Smiley,1977,1978; Meyer,1977) whereas after reading text, young students and poor readers in particular, recalled subordinate ideas as well as superordinate ideas (Taylor,1980; Tierney, Bridge & Cera, 1978-79).

In Miller and Smith's study (1984), it was found that poor readers were more adept at understanding when reading orally than they were when reading silently. Moreover, they were more successful at answering inferential than literal questions. Yet their performance levels were relatively low for both literal and inferential questions, and across both test formats: reading and listening. On the other hand, good readers read well in both test formats and they answered literal and inferential questions with fairly high accuracy. Also they were more successful at answering literal as contrasted with inferential questions.

Oakhill (1984) investigated 7-8 year-olds use of implicit inferences in understanding stories. Two groups of children, differentiated by their ability at text comprehension, read 4 short stories and were asked a series of questions. The results showed that skilled readers were better than less skilled readers at answering from memory shortly after reading a story, both when the questions could be answered directly from the text, and when they required an inference. However, when the text was made available, the less skilled group remained poorer at answering questions that required an inference, although their performance on literal questions improved to the same level as that of the skilled group. Thus this experiment supported the idea that

a major distinguishing characteristic of skilled readers is that they are good at making inferences, which enable them to relate the ideas in a text one to another and to general knowledge. From this it is suggested that skilled comprehenders are more likely to use relevant general knowledge to make sense of information implied in a text, and that such inferential and constructive processing helps not only their understanding but also their literal memory for the text. The memory representation formed when inferences are made may be more complete and logical, and may facilitate later recall.

McKen (1984) investigated the oral and written recalls of 42 good and poor 6th grade readers to see whether poor readers were able to attend to important information to the same extent as good readers and if so, whether differences occurred under the different receptive modalities of reading and listening. The study was also intended to see whether poor readers employed a different story schema when retrieving story information. 4 short stories with a common theme were used in the study and the readibility level was that of grade four.. A different story was presented in each of the 4 conditions: listening-oral recall; reading-oral recall; listening-written recall and reading-written recall. In the listening input mode, students heard a tape recorded version of the story read, while for the reading input, stories were presented in a single paragraph. After reading or listening to a story, students were instructed to summarize the story, telling only what they considered to be the most important parts of the meaning of the story. The results showed that there was no main effect for reader level i.e. regardless of the input and output mode, good and poor readers were able to pick out the most important propositions for their summaries and leave out irrelevant details. There was a significant main effect for modality. Significantly more inferences were produced in the listening input-oral output situation.

McConaughy (1985) examined story comprehension patterns of good and poor 6th grade readers across 4 modality combinations for input and output:listening-oral recall; reading-oral recall; listening-written recall and reading-written recall. 21 good readers and 21 poor readers were asked to summarize important information in a different short story presented for each condition. The results showed that good readers recalled more story propositions, but that the organization of the story schema represented in the summaries was similar for the 2 groups. This included the pattern of story grammar categories for explicit propositions recalled, the number and types of additions and the levels of importance of summary propositions in the hierarchical structures of the stories. There were no significant differences between the groups related to input or output modalities, though oral recall conditions produced longer summaries overall.

Weisberg (1979) compared good and poor reader's ability to comprehend explicit and implicit information in short stories based on two modes of presentation: listening and silent reading. Results indicated that good readers recalled significantly more propositions than did poor readers. There was no significant difference between the two modes of presentation and there was no significant interaction between the type of reader and the mode of presentation. The interaction indicated that there was a large difference between the amount of explicit information recalled by each group of readers, but the difference between the two reader groups in the amount of implicit information recalled was small. Since significantly less explicit and implicit information was freely recalled by poor readers, this would suggest that there are differences between the 2 groups of readers in processing language at the macro-level of analysis. That significantly fewer comprehension questions measuring factual recall and inferential thinking were answered by the poor readers would seem to support the conclusion that there are also differences at the micro-level of analysis. The author further suggested that if retention of meaningful material is a result of the depth of its processing,

then perhaps poor readers do not attend sufficiently to relevant cues indicating important semantic relations in passages. Because good readers recalled significantly more explicit information than did poor readers, the structure of the stories seemed to be used by good readers to aid their free recall.

2.9 Summary

The review of literature provides evidence for the complexity of the reading process, which involves the coordination of perceptual processes, phonological processes, lexical processes, and syntactic and semantic processes. Advocates of the bottom-up model suggest that the component levels of the processing in reading appear to be organized hierarchically and the attainment of any given presumes the execution of all subordinate levels. Thus the reading of the text depends on the reading of individual letters, words and sentences. According to this view, then, the measurement of reading will put more emphasis on word recognition speed, word recognition accuracy, and the knowledge of the meaning of words.

On the other hand, theorists supporting the top-down model argue that prior knowledge of the world and language enables readers to make predictions of what they are reading. Thus the reader's background, cognitive styles, strategies and the context constraints will guide the selection of visual information during reading. Consequently the measure of reading comprehension will be on how the reader makes use of his/her background to arrive at an understanding of the text. Recall is very often the measure chosen.

Because of the onesidedness of the above two models, the interactive model has been put forward. It says that readers are using both text and information about the world to get at the meaning of print. Literal information seems to activate schema that lead the reader to hypothesize about story structure, words, language features and meaning. From this view, then, reading is a constantl shifting interactive process.

The present study was designed to look at the different sides of the same coin: the difference in the comprehension performance of both good and poor readers. Besides examining micro-processes such as word recognition speed and memory span, the way they organized story recall was investigated as well. As different processes might be involved in reading and listening, the recall protocols after both reading and listening were analyzed for more understanding of these two processes. In addition, the correlations between these variables were calculated for a better understanding of the relationships between them.

Though some parts of the present study were replications of past research, there were several things new in it:

1. Many studies have been done to compare the reading comprehension performance of good and poor readers, yet not many have been done on their listening comprehension performance.
2. Mandler and Johnson's (1977) study was done with different age groups (of average or good readers). An attempt was made here to use both good and poor readers as subjects.
3. Many studies on comprehension have found similarities and/or differences between good and poor readers. However, no effort has been made to explain these results in the light of reading models. In this study, the working memory model was used as the framework to explain differences in word recognition speed, memory span and comprehension of both good and poor readers.

3. Problem and Hypotheses

3.1 Statement of the problem

The general purpose of this study was to investigate the quantity and quality of information recalled by both good and poor readers under both reading and listening conditions to see whether there would be significant differences between them. In addition, attempts were made to examine the interrelationships between word recognition speed, memory span, reading and listening comprehension of good and poor fifth-grade readers.

Several specific research questions were studied. They were:

1. What is the relative efficacy of the mode of presentation on the comprehension performance of both good and poor readers?

2. Do good and poor readers organize their recall of stories in similar ways under both listening and reading conditions?

3. Is there any significant difference between good and poor readers in word naming tasks and word span tasks?

4. What is the relationship between word recognition, memory span, listening and reading comprehension of good and poor readers?

3.2 Statement of Hypotheses

1. Within the working memory model, the inefficient processes of poor readers are assumed to result in more capacity devoted to executing the comprehension process. Consequently poor readers have less capacity left for storing and maintaining information in working memory. Thus it was expected that poor readers would perform worse than good readers under both reading and listening conditions. In addition, the literature review has indicated that poor readers in general are slower in decoding. Since the vocabulary of the stories used was at Grade 2 level, it was expected that

their performance would be poor under [redacted] conditions.

2. The developmental study by Mandler and Johnson (1977) has shown that both children and adults are sensitive to the structure of stories and are able to make use of the story schema to guide encoding and recall. Thus it was hypothesized that poor readers, like young children, were able to organize their recall of stories in more or less the same way as good readers did. Yet there was also an expectation that the amount of information recalled might be less. Furthermore, it was hypothesized that the recall patterns after reading and listening might be different owing to the fact that different processes might be involved.

3. As Perfetti and Lesgold (1976) have argued, there is a verbal coding efficiency difference between good and poor readers. Therefore it was predicted that good readers would perform faster in naming all three types of words: 1-syllable, 2-syllable and 3-syllable words than poor readers. In addition, they were expected to score higher on both auditory and visual word span tasks owing to the possibility that poor readers fail to acquire orthographic knowledge because of an insensitivity to ordered information.

4. Finally it was hypothesized that for both good and poor readers, the time taken for word recognition would relate negatively to memory span performance and to reading and listening performance i.e. the faster the speed to identify the words, the higher the score on memory span and on reading and listening comprehension because of more capacity left over for the integration of materials and the storing of the final products.

4. The Experimental Design

4.1 The Selection of Sample

The research sample was drawn from grade five students of the elementary schools in the Edmonton Public School District.

Using the records of the Edmonton Public School District, 38 students: 19 good and 19 poor readers were chosen according to their I.Q. scores and reading performance. Intelligence was measured by the Canadian Cognitive Abilities Test, whereas reading achievement was measured by the comprehension section of the Edmonton Public Schools Elementary Reading Test that was given in June of the previous school year i.e. when the subjects were in grade 4.

The sample was divided into good and poor readers on the basis of cut-off points on the comprehension scores. Since the scores were given in percentiles, good readers were defined as those students whose comprehension percentile was at or above the 75th percentile, while poor readers were those students whose comprehension percentile was at or below the 30th percentile. The comprehension percentile scores of the good readers ranged from 75 to 99, with a mean of 85.58. For the poor readers, the scores ranged from 1 to 30, with a mean of 17.58.

Attempts were made to choose subjects with normal intelligence so that differences between good and poor readers would not be attributable to differences in intelligence. Overall the subjects had a verbal I.Q. range from 95 to 115. The means of the good and poor readers were 111.3 and 101.2 respectively, which were significantly different at the .01 level. In spite of the attempt to control the variable of intelligence, it is in fact very difficult to match good and poor readers on similar I.Q. scores. Reading difficulties may have affected the I.Q. scores of the subject on the group intelligence test. All of them received regular classroom instruction. None were in remedial or special class.

4.2 Testing Instruments and Procedures

The results of two tests: The Edmonton Public Schools Elementary Reading Test and the Canadian Cognitive Abilities Test were used in this study.

In order to obtain a measure of each student's intellectual ability, results from the Canadian Cognitive Abilities Test (1970) were administered. The Primary Battery of the test is an integrated series designed to assess the cognitive development of children from kindergarten to grade 9. The test for grades 3 to 9 was normed in 1973, using a stratified random sample of 139 schools across Canada in which English was the medium of instruction. The administration manual does not provide information on the reliability and validity of this test. This test has 3 scores: a verbal I.Q. score, a quantitative I.Q. score and a nonverbal I.Q. score. The mean scores for each subtest in the norm group are 108.1, 104.0 and 104.1 respectively.

For the measure of each student's reading performance, the Edmonton Public Schools Elementary Reading Test was used. The comprehension section of this test contains 84 questions designed to assess the student's vocabulary, literal, inferential and critical comprehension. It was a group test administered to all grade 4 students by their teachers in June, 1985.

Both the Canadian Cognitive Abilities Test and the Edmonton Public Schools Elementary Reading Test were administered by the classroom teachers in group situations, according to the instructions for administration in the test manuals.

4.2.1 Naming Time Task

In this task, 60 words: 20 1-syllable, 20 2-syllable and 20 3-syllable words were arranged in a random order in 12 rows, 5 words to a row. The words used were all simple, common nouns. Words with the same number of syllables were printed on the same card. Both good and poor readers were tested individually. Each of them was asked to read the rows of words from left to right aloud without

stopping, and to do it as quickly as possible. The following instruction was given:

" I have 60 words, 20 on each card that I'd like you to read. Please read the rows of words from left to right aloud without stopping, and do so as quickly as possible. If you find that you don't know a word, try to pronounce it or skip it and then go on to the next until you have finished reading all of them."

" Here is a practice trial. Please read the following 5 words from left to right as quickly as possible."

(The examiner showed the student the sample. The student read them out and the examiner recorded the time taken)

A stop watch was used to record separately the time taken to read those 20 words with 1 syllable, 2 syllables and 3 syllables, together with the time taken to read out all 60 words. All testing was done in the school in a quiet room. The naming time was used as a measure of word identification. It was predicted that there would be a linear relationship between naming time for words (reading rate) and word span.

4.2.2 Word Span Task

For the Word Span Test, the Word Recall Test designed by Das and Naglieri (1985) was used. Nine words: book, key, bird, car, sun, dog, bat, shoe, and man are chosen according to the following guidelines: they are all one syllable, nouns, 100% in word list for familiarity, easy to say, do not rhyme, vary in sound and begin with a hard sound. They are randomized and grouped in 3 sets , each of 2 to 9 words. In this experiment, they are modified and presented to each subject in both visual and auditory conditions, each of which contains 2 sets of words from to 2 to 9 items.

In the visual condition, lists of words of increasing length from 2 to 9 items were given to the subjects to read on a card booklet. There was only one word on each card. At the beginning each subject was given a list of two words on 2 consecutive cards. The following instruction was given:

" I am going to ask you to read out the words on these cards. You are asked to read them out at a rate of one word per second. When you see a blank card, stop reading and recall verbally the words you have just read in the correct order. After doing this, please go on to other sets of words."

A practice trial of Dog-Bird was given. If the subject did not understand what he/she was asked to do, further explanation was given. The same procedure was repeated for other sets of words. All responses were recorded in the boxes under the item to score.

In the auditory condition, subjects were also required to recall sets of individual words. The words were grouped in 12 sets , each of 2 to 9 words. The directions given were the same as those used by Das and Naglieri (1985):

'" I am going to say some words. When I am through I want you to say them just as I did. You are asked to recall all of the words in the exact order of presentation. Listen, say "Book-Car"."

(The examiner then paused, gave a signal and allowed the child to respond. If the child responded correctly, then the examiner proceeded to item 1. If not, the examiner explained the task further until the child fully understood what he/she was supposed to do.

The examiner then presented the words orally to the subject at a rate of one word per second. Subjects were asked to recall all of the words of a set in the exact order of presentation. Sets of increasing length were administered until the subject had finished all items. All responses were recorded in the boxes under the item to score.

In both conditions, practice trials were given to the subjects to familiarize them with the task. There were 3 ways of scoring: free recall, serial recall and span size. In free recall, each series of words was scored for the total number of words correctly recalled. For instance, if item 1 was Car-Shoe-Sun-Book and the subject recalled

Car-Sun-Book-Shoe, the score was 4. The maximum score was 88. In serial recall, each series of words was scored in the correct serial position. For instance, if item 1 was Car-Shoe-Sun-Book and the subject recalled Car-Sun-Book-Shoe, then his/her score was 1. The maximum score was 88. In the [illegible] recall, the maximum number of words that could be recalled correctly [illegible] was taken as the word span of the subject. If the subject was unable [illegible] correctly any series of words, he/she was given a [illegible] of identical length. When the child failed to recall correctly both series of [illegible]th, the score was equivalent to the highest series of words correctly recalled. [illegible] maximum of 9 points.

In order to assess the listening and reading comprehension, two passages were used: one for listening and the other for reading. Following Mandler and Johnson (1977), 2 narratives, constructed by Bisanz, Das, Henderson and Varnhagen (1985), were used. They have central and elabora[illegible]entences conforming to the following formula: setting + setting + elaboration + 2 (beginning event, elaboraion, reaction, goal, attempt, elaboration, outcome, elaboration, ending). These 2 stories were chosen because of several reasons. First of all, narratives are familiar to grade 5 students so that they would be able to use the text structure of the stories to aid their recall. Second, the vocabulary of these two passages is at grade 2 level, thus ruling out the possibility that decoding problems may be the obstacle to comprehension. Furtheremore, each story is parsed into 21 sentences. In order to score recall, one or two core propositions are identified as best representing the meaning of each sentence. The presence of core propositions is the criterion for sentence recall. So the quantity of information recalled can be calculated easily by adding up all the sentences that the subject recalled.

The mode of presentation of the 2 passages was counterbalanced across subjects within each ability group i.e. half of the subjects within each group were assigned to receive the oral mode of presentation first.

During the individual session of reading comprehension, the following directions were given to the subjects:

"I have a short story I'd like you to read. You can read it at your own rate but make sure that you understand it well. You are asked to read it once and are not allowed to re-read it. Tell me when you have finished reading it. When you have finished reading I will ask you to tell the story back. Please try to recall as much as you can remember about the story. I will use a tape recorder to record what you are going to say. Here is a short practice paragraph. When you have finished, I will ask you to tell the paragraph back."

"Please read this paragraph."

(The student read the short paragraph)

"Now, will you please tell me the paragraph back?"

(The student told the paragraph back and it was recorded on tape.)

"Good. Do you understand what you are asked to do? If there is any question, please feel free to ask."

"Now , please read this story and tell it back to me when you have finished reading."

(The student read story 2).

"Can you tell me the story back?"

(The student told the story back and it was recorded on tape)

The same instructions were given in the listening mode. The examiner then used the transcribed, oral recall of the students for analysis.

4.3 Recall Analysis

The system used for protocol analysis is based on the story grammar of Mandler and Johnson (1977). The story is categorized into 7 syntactic groups: the setting, the beginning event, the reaction, the goal, the attempt, the outcome and the

ending. Further descriptions of these story are found in the introduction section.

Since there are unequal number of sentences in each category, the proportion of recall of the amount of information in each category of each subject is taken. The mean proportion of recall in each category of each group is calculated to see whether there are significant main effects or interaction effects for reading groups, syntactic categories or conditions of presentation.

4.4 Summary

A sample of 38 grade 5 students were chosen from the elementary schools in the Edmonton Public School District. They were categorized into good and poor readers according to their comprehension percentile scores on the Edmonton Public School Elementary Reading Test (at or above the 75th percentile and at or below the 30th percentile respectively).

During the experiment, each subject was tested individually in a quiet room. He/She was asked to name 3 sets of words: 20 1-syllable, 20 2-syllable and 20 3-syllable words as fast as possible. The time taken to vocalize these words was taken. Afterwards he/she was tested on 2 word span task: one visual and the other auditory. The total number of words recalled correctly was recorded. Finally each was given one story to read and another to listen. The order of presentation of each mode was counterbalanced among subjects. After reading/listening, each subject was asked to tell the story back. The results were tape recorded and transcribed for analysis.

5. Results and Discussions

5.1 Statistical Analysis of the Data

The statistical analysis was divided into four parts:

In part 1, two-way analysis of variance with repeated measures on one factor was used to see whether there were any main or interaction effects between grouping (good vs. poor) and mode of presentation (reading vs.listening).

In part 2, three-way analysis of variance with repeated measures on two factors was used to see whether there were significant main or interaction effects for grouping, recall category and mode of presentation.

In part 3, two-way analyses of variance with repeated measures on one factor were used to test whether there wefe significant differences between good and poor readers in naming time, visual memory span and auditory memory span.

In part 4, Pearson product-moment correlations between naming time, memory span, reading and listening comprehension performances were calculated separately for good readers, poor readers and all subjects.

5.2 Reading and Listening Comprehension

Results of the 2(Type of Reader) X 2(Mode of Presentation) analysis of variance were shown in Table 1. They indicated that good readers recalled significantly more information than poor readers did, $F(1,36)=9.58$, $p<0.01$. There was no significant difference between the two modes of presentation (reading vs. listening) and there was no significant interaction between type of reader and mode of presentation. These results indicate that comprehension and memory for stories reflected in an oral recall task is significantly better for good readers than for poor readers, regardless of the mode of presentation.

Table 1

Summary of Two-Way Analysis of Variance with Repeated Measures for Reading Group on Comprehension

Source of Variation	d.f.	M.S.	F	p
Between Subjects	37			
'A' Main Effect	1	113.80	9.58	.004*
Subjects within group	36	11.88		
Within Subjects	38			
'B' Main Effect	1	18.01	3.48	.070
'A X B" Interaction	1	8.23	1.59	.215
'B' X Subjects within group	36	5.17		

Factor A : Reading Achievement Level

Factor B : Mode of Presentation of Materials for Recall

* Significant at .01 ($p < .01$)

N=38

The present findings are consistent with those of Weisberg (1979), who found that although good readers recalled more propositions than did poor readers, there was no significant difference between the two modes of presentation and there was no significant interaction between the type of reader and the mode of presentation. These results indicated that memory for prose passages reflected in a free recall task was significantly better for good readers than for poor readers, regardless of the mode of presentation. It is therefore suggested that there is a general processing deficit in poor readers.

The results also indicated no significant difference between the two modes of presentation: reading and listening. This is similar the study by Saleem and Heerman (1981), who found no significant difference among different modes of presentation. Yet a closer look at the results showed that both good and poor readers performed slightly better under listening condition ($\bar{X}$=13.26 & 11.47 for good and poor readers respectively) than reading condition ($\bar{X}$=12.95 & 9.84 for good and poor readers respectively).

Stieht's (1974) study provided some support to the present findings. He reviewed 31 studies and found that in the elementary grades (1-6), almost all of the comparisons favor the listening comprehension mode. Since the subjects in the present study were from elementary school (grade 5 students), they were also expected to perform better in the listening comprehension task. Furthermore, the students here could only read the story once and they were not allowed to go back to re-read and re-examine the reading material. So there was no advantage of reading because of the relief from memory load.

The lack of interaction between reader ability and mode of presentation is not consistent with Chippen's (1968) study. He found that above-average readers were better in silent reading while below-average readers were better in listening comprehension at the 5th-grade level. However, significance was not reached in his

comparison. Once again this lack of interaction might be explained by the readibility of the story chosen. Since the readibility of the stories had been controlled to be manageable at the poor readers' level of decoding skills, perhaps all the readers were reading at the independent level. Consequently, their performance on reading comprehension task was as good as that on listening comprehension task. Thus the results indicated neither good nor poor readers differed significantly in the amount of information they recalled following the reading or listening of a narrative passage. Both groups were able to select, remember and retrieve a similar amount of information for recall.

5.3 Oral Recall of Stories

The present analysis examined the proportion scores for statements which represent text propositions in the 7 syntactic categories defined by Mandler and Johnson's (1977) story grammar. An inter-rater reliability on a 30% sample for the scoring came up with 91% reliability for both stories.

A 2(Reader Type) X 2(Mode of Presentation) X 7(Syntactic Category) three-way analysis of variance was performed on recall scores (with mean proportions transformed into ARCSIN data). The mean proportions of recall were transformed into arcsin data before analyzed. These transformations had the primary purpose of attaining the homogeneity of error variance; normalizing the within-cell distributions; and obtaining additivity of effects (Winer,1972). Reader Group was treated as a between-subject measure while Mode of Presentation and Syntactic Category were treated as repeated measures. The results of Table 2 showed that good readers recalled more information under both reading and listening conditions ($\overline{X}$=1.839 & 1.509 for good and poor readers respectively), $F(1,36)=8.26$, $p<0.01$. There were also significant differences between the proportion of recall units falling into each of the recall categories, $F(7,252)=6.83$, $p<0.01$. A Newman-Keuls post hoc comparison was

Table 2

Summary of Three Way Analysis of Variance with Repeated Measures on Mode of Presentation and Recall Category

Source of Variation	d.f.	M.S.	F	p
A	1	14.48	8.26	.007*
S-within	36	1.75		
B	1	.76	.86	.36
AB	1	2.00	2.29	.14
BS-within	36	.88		
C	6	4.48	6.83	.001*
AC	6	.95	1.46	.195
CS-within	216	.66		
BC	6	2.29	4.20	.001*
ABC	6	.49	.89	.503
ABCS-within	216	.55		

Factor A : Reading Achievement Level

Factor B : Mode of Presentation of Materials for Recall

Factor C : Syntactic Category

* Significant at .01 ($p \leq .01$)

N=38

performed on the recall category means (transformed) to find out which pairs of recall categories were significantly different in the proportion of units recalled under them. Table 3 indicated that the subjects in this study recalled significantly more information about the beginning event and the outcome of the stories than the reaction and the goal, $p<0.05$. A significant interaction effect was found between the mode of presentation and the proportion of information recalled under each category, $F(7,252)=4.20$, $p<0.01$. The Newman-Keuls post hoc comparisons, as shown by Table 4, indicated that after listening, significantly more information about the setting, the beginning event, the attempt, the outcome and the ending was recalled than the reaction and the goal. However, Table 5 showed that only the recall of the beginning event and the outcome was significantly higher than the recall of the goal after reading. Table 2 also indicated that there was no significant main effect for the Mode of Presentation and no significant Reading Group X Mode of Presentation and Reading Group X Syntactic Category interaction effects.

Like the results obtained above, it was found that good readers recalled more information than poor readers did, $F(1,36)=8.26$, $p<0.01$. Yet there was no significant differences between the two modes of presentation and there was no significant interaction between the type of reader and the mode of presentation, indicating that the modality effects were the same for both good and poor readers.

The lack of significant difference between reading and listening could be accounted for by several reasons. First of all, the stories used in these studies were two Indian folk tales, which were quite familiar to elementary school students. As a result, both groups of readers might have possessed sufficient background knowledge to comprehend. As Dickinson & Weaver (1979) reported, poor readers were equivalent to good readers in their general knowledge of story structure. In addition, the types of reading/listening materials used were narratives, which readers have been exposed to from an early age. So both groups of readers should be familiar with them because

Table 3

Test on Recall Category Means Using Newman-Keuls Procedure (N=38)

Ordered Means		1.302	1.385	1.674	1.759	1.764	1.915
		IV	III	VII	I	V	II, VI
Differences between pairs divided by $S_{\bar{x}}$	IV		.63	2.84	3.49	3.53	4.68*
	III			2.21	2.84	2.89	4.05*
	VII				.65	.69	1.84
	I					.04	1.19
	V						1.15

I: Setting
II: Beginning Event
III: Reaction
IV: Goal
V: Attempt
VI: Outcome
VII: Ending

Q2=2.27
Q3=3.31
Q4=3.63
Q5=3.86
Q6=4.03
Q7=4.17

Table 4

Test on Recall Category Means Using Newman-Keuls Procedure after Listening (N=38)

Ordered Means		1.158	1.282	1.654	1.888	1.957	1.998	2.004
Differences between pairs divided by $S_{\bar{x}}$		III	IV	VII	VI	II	V	I
	III		1.03	4.13*	6.08*	6.66*	7.00*	7.38*
	IV			3.10*	5.05*	5.63*	5.97*	6.35*
	VII				1.95	2.53	2.87	3.25
	VI					.58	.92	1.30
	II						.34	.73
	V							.38

Table 5

Test on Recall Category Means Using Newman-Keuls Procedure after Reading (N=38)

Ordered Means		1.323	1.474	1.529	1.612	1.695	1.874	1.943
Differences between pairs divided by $S_{\bar{x}}$		IV	I	V	III	VII	II	VI
	IV		1.26	1.72	2.41	3.10	4.59*	5.17*
	I			.46	1.15	1.84	3.33	3.90
	V				.69	1.38	2.88	3.45
	III					.69	2.18	2.76
	VII						1.49	2.07
	II							.58

they should have developed a sense of story from their youth (Applebee,1978) and use the underlying organization of stories to aid their encoding and retrieval of information.

From this study, it was found that there were no significant differences between good and poor readers in the proportion of recall units under each syntactic group. The findings are consistent with Berger and Perfetti (1977); who found that skilled and unskilled readers recalled the same type of information, but that skilled readers recalled more. It is also consistent with McConaughy's (1985) finding that good readers recalled more story propositions, but that the organization of the story schemata represented in the summaries was similar to the two groups.

As Mandler and Johnson (1977) have mentioned, the underlying organization of stories can be described as a macro-structure, or idealized story schema. This represents people's conceptions of how a well-formed story is organized from beginning to end, and operates as a general framework for organizing different categories of information in memory. It is argued that people rely on the schema to understand stories as they read or listen to them and when they attempt to recall information from the story (Rumelhart,1977). The results of the present study did indicate that poor readers seemed to have the same general knowledge of the underlying story structure as good readers did. The present results indicated that good readers were similar to poor readers in their internal cognitive schemata for stories.

A significant main effect was found for Syntactic Category, indicating that both good and poor readers did emphasize certain types of information over others in the stories. Newman-Keuls comparisons were performed among syntactic categories across groups and modalities. The results showed that there were significantly higher proportions of statements representing the beginning event and the outcome as compared to the reaction and the goal. Thus it appears from the results that after reading or listening a story at a reader's independent level, both good and poor

readers do not reproduce text through verbatim recall, or recall at random. Instead they retrieve information according to a certain pattern.

The present results are quite similar to Mandler and Johnson's (1977) study. Overall, the schemata which both good and poor readers use to organize their recall emphasize the outcomes of action sequences rather then the attempts themselves or the internal events motivating them.

The similar ordering among nodes between good and poor readers suggests that even poor readers are sensitive to the structure of stories and have schemata which organize retrieval in a fashion similar to good readers. This is consistent with Dickinson and Weaver's (1979) finding that poor readers were equivalent to good readers in their general knowledge of story structure.

Thus the basic organization of information appears quite similar in good and poor readers. When children are given prose structure which is meaningful to them and with which they have had extensive experience, they make use of it to organize their recall of information.

Another important finding of this study was the significant difference in the proportion of statements in the various syntactic categories as a function of the mode of presentation. Newman-Keuls Tests show that the structure of the recall of the subjects after reading or listening to a story was not exactly the same. Not the same type of information was salient after reading and listening. After listening, the recall of the setting, the beginning event, the attempt, the outcome and the ending of the story was significantly higher than the recall of the goal of the story ($p<0.05$), while the recall of the beginning event and the outcome was significantly higher than the reaction and the goal after reading ($p<0.05$).

Table 6 shows that significantly more sentences of the setting were recalled after listening than reading, $F(1,36)=10.70$, $p<0.01$. This could be explained by the fact that the subjects paid special attention to the beginning of a story when they

were listening. As the sentences of the story were read out one after the other, students might have been strongly attentive to sentence 1 and then sentence 2, which were about the setting of the story. On the other hand, the subjects had the chance to read both sentence 1 and 2 at the same time under reading. Consequently they might have integrated the information in a coherent way. As a result, they might have processed the information together in their memory and could not recall sentence 1 and 2 separately when they were tested. So their scores on the recall of setting might have been depressed in such a way.

Overall the subjects recalled the beginning event and the outcome of the story better under both situations, while the recall of the goal, the reaction was poor. Thus it was found that grade 5 subjects paid more attention to the external events of the story, while the internal feelings, motivation of the characters were very much ignored. Table 7 also shows that there was no significant Reading Group difference in the recall of the attempt of the story.

As expected, the ending of the story was not very well recalled after both reading and listening. Table 8 shows that there was no significant difference between the reading and listening conditions. This might be due to the reason that subjects made up their own ending when they came to the last part of the story they read. Grade 5 students are familiar with and have a good knowledge and certain expectations of how story structures are like. So in their recall they made up the ending of the story instead of telling what they had exactly read. As a result, their recall of the ending was logical but inaccurate when compared with the original text. When they were listening, they might not be able to detect when the ending of the story would exactly come about. Consequently their recall of the ending of the story would be low.

From the above results, it was found that the poor readers in the present study were able to recall stories in a similar way as good readers did. Yet there were

Table 6

Summary of Two Way Analysis of Variance with Repeated Measures for Reading Group on the Recall of the Setting

Source of Variation	d.f.	M.S.	F	p
Between Subjects	37			
'A' Main Effect	1	5.26	6.24	.017*
Subjects within group	36	.84		
Within Subjects	38			
'B' Main Effect	1	6.37	10.70	.002**
'A X B' Interaction	1	.21	.35	.56
'B' X Subjects within group	36	.60		

Factor A : Reading Achievement Level

Factor B : Mode of Presentation of Materials

* Significant at .05 ($p < .05$)

** Significant at .01 ($p \leq .01$)

N=38

Table 7

Summary of Two Way Analysis of Variance for Repeated Measures for Reading Group on the Recall of the Attempt

Source of Variation	d.f.	M.S.	F	p
Between Subjects	37			
'A' Main Effect	1	.84	1.06	.31
Subjects within group	36	.79		
Within Subjects	38			
'B' Main Effect	1	10.32	15.17	.00*
'A X B' Interaction	1	.21	.31	.58
'B' X Subjects within group	36	.68		

Factor A : Reading Achievement Level

Factor : Mode of Presentation of Materials

* Significant at .01 ($p<.01$)

N=38

Table 8

Summary of Two Way Analysis of Variance with Repeated Measures for Reading Group on the Recall of the Ending

Source of Variation	d.f.	M.S.	F	P
Between Subjects	37			
'A' Main Effect	1	3.80	7.07	.012*
Subjects within group	36	.54		
Within Subjects	38			
'B' Main Effect	1	.01	.03	.86
'A X B' Main Interaction	1	1.07	2.66	.11
'B' X Subjects within group	36	.40		

Factor A : Reading Achievement Level

Factor B : Mode of Presentation of Materials

* Significant at .05 ($p<.05$)

N=38

significant differences between these two groups in the recall of the setting, $F(1,36)=6.24$, $p<0.05$ and the ending, $F(1,36)=7.07$, $p<0.05$ of the story. Further analysis of the recall of the elaboration by the two-way analysis of variance, as indicated by Table 9, shows that there were significant main effects of Reading Group and Mode of Presentation. Overall good readers recalled significantly more sentences about the elaboration, $F(1,36)=4.62$, $p<0.05$. The recall of the elaboration was significantly higher after listening than reading, $F(1,36)=8.19$, $p<0.01$. This may be due to the fact that reading is a process controlled by the subject, while listening is examiner paced. During reading, the subject can look ahead or make use of the contextual cues to arrive at an understanding of the passage. Important parts are processed while elaborations are ignored. These advantages are absent for listening comprehension. As a result, the subject is forced to pay attention to every part of the passage. In this way even elaborations are processed and remembered to a greater extent after listening than after reading.

5.4 Naming Time Task

The performance of good and poor readers on naming time tasks is shown in Table 10 and Table 11. Two-way analysis of variance with repeated measures indicated significant main effect of reading skill, $F(1,36)=10.7$, $p<0.01$, main effect of number of syllables, $F(2,72)=11.92$, $p<0.01$. The Scheffe Comparisons of unweighted main effects indicated that significant differences were found between the naming time of 1- and 3-syllable words, $F(1,36)=48.05$, $p<0.01$; 2- and 3-syllable words, $F(1,36)=44.89$, $p<0.01$ but not between 1- and 2-syllable words.

Part of the results are consistent with the studies by Perfetti et al. (1978), Stanovich (1981) and Katz and Shankweiler (1983) who found that there were significant differences between good and poor readers on rapid naming of words.

Table 9

Summary of Two Way Analysis of Variance with Repeated Measures for Reading Group on the Recall of the Elaboration

Source of Variation	d.f.	M.S.	F	p
Between Subjects	37			
'A' Main Effect	1	17.05	4.62	.04*
Subjects within group	36	3.69		
Within Subjects	38			
'B' Main Effect	1	8.90	8.19	.007**
'A X B' Interaction	1	.00	.00	1.00
'B' X Subjects within group	36	1.09		

Factor A : Reading Achievement Level

Factor B : Mode of Presentation of Materials

* Significant at .05 ($p<.05$)

** Significant at .01 ($P<.01$)

N=38

Table 10

Mean time taken to name 20 words (in seconds) N=38

	Good Readers	Poor Readers
1-syllable	9.20 S.D.=1.71	11.74 S.D.=4.35
2-syllable	9.64 S.D.=1.31	11.82 S.D.=2.97
3-syllable	13.70 S.D.=2.40	22.75 S.D.=10.65

Table 11

Summary of Two Way Analysis of Variance with Repeated Measures for Reading Group on Words with different number of Syllables

Source of Variation	d.f.	M.S.	F	p
Between Subjects	37			
'A' Main Effect	1	600.90	10.70	.002*
Subjects within group	36	56.15		
Within Subjects	76			
'B' Main Effect	2	737.44	62.00	.000*
'A X B' Interaction	2	141.78	11.92	.000*
'B' X Subjects within group	72	11.89		

Factor A : Reading Achievement Level

Factor B : No. of Syllables

* Significant at .01 level ($p < .01$)

N=38

On the whole, naming time was shorter for good readers in naming 1-syllable, 2-syllable and 3-syllable words ($\bar{X}$=9.20, 9.64 & 13.70 seconds respectively) than poor readers ($\bar{X}$=11.74, 11.82 &22.8 seconds respectively). As far as the syllable effect is concerned, the results suggest that naming time of subject increases for words with more syllables. However, the Reading X Number of Syllable interaction indicated that the magnitudes of syllable effects were different betwen groups. Good readers showed less of an increase for syllables compared with poor readers.

An examination of the results reveals that good readers took shorter time than poor readers to name all three types of words. However, significant differences were found for 3-syllable words only. This might be due to the fact that readers used different strategies to read out different groups of words. When subjects were asked to read out 1-syllable and 2-syllable words, they treated each word as a unit of processing since they were familiar with them i.e. they used a whole-word approach to identify words. As a result, the entire word was processed into their corresponding sound representation and read out. On the other hand, when they were asked to read out the 3-syllable words, they did not process the whole word as a unit because it was long. Instead they might have broken up the words into smaller visual units, tried to pronounce each part and then blended the parts together to form the word. For the good readers, the operation of these processes might be automatic, whereas for the poor readers, it might be clumsy and slow. In addition, there is also the possibility that good readers might be familiar with the 3-syllable words and were successful in identifying them by visualization; whereas poor readers might be unsuccessful with this method and resorted to the use of other approaches which involved symbol-sound correspondence or phonological coding (Gajraj,1983).

5.5 Word Span Task

The performance of good and poor readers on word span tasks is shown in Table 12, 13, 14, and 15.

From Table 13, it was found that there was a significant difference between good and poor readers in the number of words freely recalled, $F(11,36)=6.51$, $p<0.05$. The effect of different mode of presentation on the number of words recalled also reached significance, $F(1,36)=4.97$, $p<0.05$; auditory was superior to visual presentation. Yet there was no significant interaction effect of Reading Skill X Mode of Presentation.

From Table 14, it was also found that there were significant differences between good and poor readers in the number of words serially recalled, $F(1,36)=5.55$, $p<0.05$. In addition, there was a significant difference between the visual and the auditory mode of presentation on the number of words serially recalled, $F(1,36)=8.92$, $p<0.01$. Once again auditory was superior to visual presentation. However, the interaction was also insignificant.

Finally Table 15 also shows similar results. There were significant main effects of Reading Skill, $F(1,36)=4.54$, $p<0.05$ and Mode of presentation, $F(1,36)=13.14$, $p<0.01$ on span size, and interaction effect was not observed.

From the findings of 5.4, it was observed that good and poor readers did not differ too much in word identification speed of 1- and 2-syllable words. However the findings of 5.5 indicated that there were significant differences between good an poor readers in the visual and auditory word span tasks. Since the words used in the word span tasks were all 1-syllable words, both groups of readers could identify the items with relative ease. Yet the results of 5.5 might indicate that besides word identification speed, item order was a source of variation in span performance (Dempster,1981; Huttenlocher & Burke,1976; Torgesen & Houck,1980; Gajraj,1983). A logical analysis of the performance requirements of the span task would indicate that

Table 12

Mean number of words recalled on the word span task (N=38)

	Good Readers	Poor Readers
Visual Free	68.21	64.05
	S.D.=5.21	S.D.=5.68
Auditory Free	70.16	65.39
	S.D.=4.97	S.D.=7.30
Visual Serial	39.05	32.53
	S.D.=10.48	S.D.=8.55
Auditory Serial	42.58	37.16
	S.D.=7.16	S.D.=9.01
Visual Span	4.34	3.95
	S.D.=0.87	S.D.=0.69
Auditory Span	4.79	4.47
	S.D.=0.51	S.D.=0.51

Table 13

Summary of Two Way Analysis of Variance with Repeated Measures for Reading Group on Free Word Recall (N=38)

Source of Variation	d.f.	M.S.	F	p
Between Subjects	37			
'A' Main Effect	1	380.74	6.51	.015*
Subjects within group	36	58.52		
Within Subjects	38			
'B' Main Effect	1	51.14	4.97	.032*
'A X B' Interaction	1	1.37	.13	.72
'B' X Subjects within group	36	10.29		

Factor A : Reading Achievement Level

Factor B : Mode of Presentation of the Word Span Task

* Significant at .05 level ($p < .05$)

Table 14

Summary of Two Way Analysis of Variance with Repeated Measures for Reading Group on Serial Word Recall (N=38)

Source of Variation	d.f.	M.S.	F	p
Between Subjects	37	---		
'A' Main Effect	1	677.99	5.55	.024*
Subjects within group	36	122.15		
Within Subjects	38			
'B' Main Effect	1	316.10	8.92	.005**
'A X B' Interaction	1	5.79	.16	.688
'B' X Subjects within group	36	35.43		

Factor A : Reading Achievement

Factor B : Mode of Presentation of the Word Span Task

* Significant at .05 ($P < .05$)

** Significant at .01 ($p < .01$)

Table 15

Summary of Two Way Analysis of Variance with Repeated Measures for Reading Group on Span Size (N=38)

Source of Variation	d.f.	M.S.	F	p
Between Subjects	37			
'A' Main Effect	1	2.40	4.54	.040*
Subjects within group	36	.53		—
Within Subjects	38			
'B' Main Effect	1	4.50	13.14	.001**
'A X B' Interaction	1	.03	.09	.771
'B' X Subjects within group	36	.34		

Factor A : Reading Achievement

Factor B : Mode of Presentation of the Word Span Task

* Significant at .05 level ($p < .05$)

** Significant at .01 level ($p < .01$)

an individual must identify the items presented and retain the order in which they are presented so as to succeed on this task.

5.6 Relationship between Word NT, Word Span, RC and LC

It was predicted that, there would be a negative correlation between naming time and memory span, as well as between naming time time and comprehension score; whereas there would be a positive relationship between memory span and comprehension scores as measured by the oral recall. Pearson product-moment correlation coefficients computed for all variables of both groups and all subjects are presented in Table 16.

It can be seen from Table 16 that the naming time for 2-syllable and 3-syllable words were significantly negatively related to all measures of word span. The negative correlations obtained give further support to the working memory model, which says that the faster one processes incoming information, the more capacity left for storing and maintaining that information in working memory. Thus inefficient processes of the poor reader, as measured by the naming time task, will be functionally equivalent to a smaller storage capacity, as measured by the word span task.

The relationship between naming time of 3-syllable words and word span size is shown in Table 17. The visual/auditory span size is negatively related to the naming time of 3-syllable words. Thus an increase in span size will result in a decrease in naming time. So the conclusion reached is that item identification is a source of individual differences in word span performance. These results offer a strong evidence for the relationship between naming time and span for both good and poor readers, as indicated by Das'(1985) similar findings on mentally retarded sample.

The slow speed of word identification of poor readers could have affected word span performance at either accuracy or speed level. However, the effect on the level

Table 16

Correlations between Word Naming Time, Word Span and Comprehension (N=38)

	Naming Time 1	Naming Time 2	Naming Time 3	Reading Comprehension	Listening Comprehension
Visual Free	-.34*	-.48*	-.54*	.37*	.26
Visual Serial	-.32	-.49*	-.46*	.27	.38*
Visual Span	-.14	-.39*	-.34*	.18	.18
Auditory Free	-.45*	-.47*	-.65*	.53*	.30
Auditory Serial	-.33*	-.35*	-.43*	.44*	.35*
Auditory Span	-.36*	-.34*	-.44*	.32*	.39*
Reading	-.27	-.39*	-.47*	----	.47*
Listening	-.17	-.26	-.25	.47*	----

* Significant at .05 ($p < .05$)

Table 17

Relationship between Span Size and Word Naming Time of 3-syllable words (N=38)

Visual Span Size	Naming Time in seconds
2-3	27.22
3-4	24.44
4-5	18.98
5-6	15.73
6-7	12.41
Auditory Span Size	**Naming Time in seconds**
3-4	42.63
4-5	21.45
5-6	15.19
6-7	14.06

of accuracy was highly unlikely because all subjects were able to pronounce all words accurately. So the possibility left is that word identification speed could have affected span performance at the proficiency level. Even though poor readers were accurate in identifying all words, they could not do it fast enough. So the presentation of stimulus words at one item per second might not have allowed sufficient time for them to identify words as well as retain word order on the span task.

Table 16 also showed a significant negative relationship between word recognition speed and reading comprehension. Except the naming of 1-syllable words, the naming time of 2-syllable and 3-syllable words correlated significantly with the subject's reading comprehension ($r=-.392$, $t=2.55$, $p<0.005$; $r=-.471$, $t=3.2$, $p<0.003$ respectively). Even though the correlation of 1-syllable word with reading comprehension was not significant, it still showed a negative relationship with RC.

The present results are consistent with the limited-capacity models (e.g. LaBerge & Samuels,1974; Lesgold & Perfetti,1978) and the working memory model of reading (Baddeley & Hitch,1974). It is generally agreed among these theorists that fluent reading requires the execution of many subprocesses within a limited amount of attentional resource. If less attention is necessary for the execution of lower-level processes such as word recognition, more can be directed to high-level ones such as the integration of words into meaningful sentences. The slow word identification speed of poor readers in the present study may result in their poor performance on reading comprehension. Interesting enough, there was no significant relationship between naming time and listening comprehension, though the correlations showed a negative sign. The theoretical explanation for this is as yet uncertain. There was a significant correlation between reading comprehension and listening comprehension ($r=.471$), but it is not strong. Thus research indicating which similar processes might be involved in both types of comprehension tasks and which processes are unique to each mode will provide an explanation.

Finally it was also found that there was a positive relationship between memory span and comprehension performance. Although only some of the correlations were significant, they all showed a positive sign. Results showed that reading comprehension was correlated most highly with auditory free recall ($r = .53$), while listening comprehension has the highest correlation with auditory span size ($r = .386$). The findings also give support to the notion that good readers process information efficiently and have more capacity for the integration of materials. Consequently they perform better during recall on the comprehension task.

6. General Discussion and Implications

6.1 General Discussion

The recall of subjects revealed that poor readers did make use of the story schema to aid their organization of recall. They were able to recall stories in a similar way as good readers did, whether listening or reading. Yet the amount of information recalled was significantly different. Good readers were able to recall more information, especially the details while poor readers were able to recall the important parts of the story, with the elaborations being ommitted.

Since all grade 5 students have a good background knowledge of and experience with stories, they are able to use the story schema as a framework to guide the encoding and retrieving processes. Even though the processing of poor readers is inefficient when compared with good readers', they know which part of the story they need to pay attention to. Thus the result is that they can remember the gist of the stories, while the details are forgotten in their recall.

Another important finding in this study was that not the same type of statement was salient after reading and listening. After listening, the recall of the setting, the beginning event, the attempt, the outcome and the ending of the story was significantly higher than the recall of the goal of the story, while the recall of the beginning event and outcome was significantly higher than the recall of the reaction and the goal after reading. This suggests that different processes may be involved in reading and listening comprehension.

The findings of the present study also indicated that there were significant differences between good and poor readers in word naming tasks and word span tasks. This is in line with the working memory model, which argues that a major difference between good and poor readers is the efficiency of their processing rather than their static memory capacity.

The results of the naming time tasks showed that good readers were faster than poor readers at retrieving the name of a word, and the largest difference was found for 3-syllable words. Thus it is suggested that when asked to read out 1- and 2-syllable words, poor readers might have used a whole-word approach; but when they were asked to name 3-syllable words, they might have used other approaches which involved symbol-sound correspondence. They might have broken up the words into smaller visual units, tried to pronounce each part and blended the parts together to form the word. Thus the inefficient processing of the poor readers resulted in their poor performance on naming 3-syllable words.

The present findings are also consistent with current theories of reading (e.g.Gough,1972; LaBerge & Samuels,1974; Lesgold & Perfetti,1978). It is generally agreed that fluent reading requires the execution of many processes within a fixed amount of attentional resource. If less attention is directed to the execution of some lower-level component processes such as word recognition, then one can allocate more attentional resources to higher level processes such as the integration of words into meaningful units in order to extract meaning. Such a fast rate of word identification may be crucial to successful performance on reading.

Finally the positive correlations between word span tasks and comprehension tasks indicated that word span reflects working memory capacity and that this capacity is a crucial source of individual differences in comprehension. In fact, deficits in comprehension can be caused by investing more time to encode and retrieve a word meaning. This inefficient processing reduces the effective storage capacity of working memory. In addition, the time devoted to retrieval cannot be used for other higher level processes such as integration of information, thus limiting comprehension processes.

6.2 Implications for Education

6.2.1 The structure of the materials

From the present study it was found that good and poor readers did not differ significantly in the type of information but only differed in the amount of information recalled under both reading and listening. This indicates that poor readers (who are in fifth grade, but can read second grade materials) use similar processes to organize the reading/listening materials and recall in a similar way. They are able to attend, select, remember and recall the most important elements in the stories as good readers do.

Since the reading/listening materials used are narrative passages, with well-organized structures and simple vocabularies, several implications are drawn.

First of all, it might be encouraging for teachers to present materials which the children have a background knowledge of. Researches on story comprehension have arrived at a generalization that the underlying organization of stories can be described by a macrostructure, or idealized story schema (Mandler & Johnson,1977; Rumelhart,1977; Thorndyke,1977). This story schema refers to a set of expectations about the internal structure of stories which serves to facilitate both encoding and retrieval (Mandler & Johnson,1977). People construct story schema from two possible sources. One source comes from listening to many stories and consists of knowledge about the sequencing of events in stories, including how they typically begin and end. The other source comes from experience and includes knowledge about causal relations and action sequences.

During encoding, the story schema acts as a general framework within which detailed comprehension processes take place. Besides directing attention to certain aspects of the incoming material, it enables the reader/listener to keep track of what has gone before, and tells the reader/listener when some sort of the story is complete

and therefore be stored, or is incomplete and therefore must be held until more material has been encoded.

From this study, it was found that both good and poor readers were able to attend, select, organize and remember similar elements of a story after reading/listening, provided that the students have knowledge of what story structures are like and these structures are well-organized. If "the ability to concentrate on main events to the exclusion of nonessential material is a basic cognitive process essential for all comprehension activities, whether in the context of listening or of reading" (Smiley, Oakley & Worthen,1977, p. 382), then the present results indicate that good readers are equivalent to the poor readers in their internal cognitive schemata for stories. Thus it would be beneficial for teachers to provide reading and listening materials to students in a well-structured form.

6.2.2 The readibility of the materials presented

The present finding that there was no significanct difference between reading and listening was quite unexpected but understandable, since the readibility of the stories had been controlled at grade 2 level. Thus it is concluded that poor readers are capable of high quality story comprehension when they are presented with text materials which they are familiar with and which has a predictable underlying structure, such as the simple narrative stories in the present study (McConnaughy,1985).

Another major implication for practice which has arisen from the present study is the necessity of training children to be both accurate and fast at recognizing words if fluent reading is to be attained. Poor readers in this study were accurate in identifying words, but did it very slowly. So rapid word identification is necessary, and a suitable training programme should promote comprehension.

6.3 Implications for Further Research

As mentioned above, the reading/listening materials are stories, whose structure Grade 5 students are familiar with. So the results cannot be generalized to other types of passages. As Freedman (1980) has pointed out, certain types of expository texts are more difficult for poor readers to comprehend. Maybe poor readers have more difficulty with expository texts owing to their lack of or inflexibility with appropriate strategies to deal with them.

Also important in the selection is the length of the reading/listening materials. In this study, only short stories were used. According to Kintsch & Kozminsky (1977), different psychological processes are involved when reading or listening to materials of different length. The recall of short paragraphs tells us primarily about reproductive processes, the recall of long texts reveals something about reconstructive processes, whereas summarization of long texts reveals organizational processes. Thus testing the children with materials of different lengths may yield different results because of the demands placed on recall.

The length of the recall protocols, together with the numbers of additions, deletions and substitutions are not considered for protocol analysis in this study; such an analysis may be helpful for a better understanding of how readers process information and retrieve it when needed. So further investigation can make use of these information as well.

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Appendix A: Word Naming Task

land eye wall cow bee

jar food doll kite fork

moon boy tree king hill

hen salt bus house lamp

sugar table river color lion

star people window woman ruler

music city apple paper pencil

water mother driver farmer kitchen

animal furniture handkerchief pineapple seventy

photograph avenue gardener elephant aeroplane

butterfly piano gentleman hospital carpenter

enemy capital theatre grandfather customer

Appendix B: Visual and Auditory Word Span Task

Visual Word Span Task

1. key sun
2. car man
3. shoe bat key
4. dog bird book
5. car shoe sun book
6. man bat key dog
7. man bird car book shoe
8. bat dog sun bird key
9. shoe car bird man sun bat
10. man key book bat sun dog
11. man sun book car bird shoe key
12. book dog sun bat key man bird
13. car bat key shoe bird dog man sun
14. sun man car bird key book shoe dog
15. book dog man car sun shoe bird key bat
16. bat shoe key book car bird sun dog man

Auditory Word Span Task

1. bat key
2. dog sun
3. man car dog
4. shoe sun book
5. book shoe bat bird
6. key sun dog man
7. bird car book man shoe
8. sun bird key bat dog
9. sun bat dog key shoe book
10. key man bird book shoe car
11. dog sun bat bird car shoe book
12. bat key sun man car dog shoe
13. dog car book shoe bird sun man key
14. man key dog bird book bat shoe sun
15. key sun bat dog man book shoe bird car
16. car book bird key dog shoe man sun bat

Appendix C: Story Recall

Story 1: The Cakes and The Tiger

4. Once a brother and sister lived in a house near the woods.
5. Each day they baked a cake for dinner and left it on the window to cool.
6. The cakes smelled very sweet and good.
7. One day a tiger came by the house and smelled their cake.
8. The sweet smell came to him on the morning air.
9. The tiger really liked the smell.
10. He wanted to have the cake himself.
11. So he walked up to the window and knocked the cake down with his paw.
12. The cake crashed to the ground and broke into pieces.
13. Then the tiger sat below the window eating the cake.
14. He smacked his lips and hummed as he ate.
15. When the cake was gone, the tiger felt very good indeed.
16. The next day the tiger came back for a second cake.
17. He sat near the house waiting for the cake to appear.
18. This made the children very mad.
19. They wanted to get even with this tiger.
20. So they filled the centre of the cake with ants.
21. Then they placed it upon the window like they did the day before.
22. When the tiger ate the cake he gave a cry of surprise.
23. He began to roll on the ground and howl in anger.
24. From that day on the tiger never came back to eat cakes.

Story 2: The Bear And The Bees

1. Once there were some bees and a bear.
2. The bees lived in a tree near the bear's home.
3. The tree was very tall and the bee's home was very high up in it.
4. One day the bees went away leaving their honey behind.
5. They flew away from the tree in one great swarm.
6. The bear was very surprised to see the bees leave.
7. He knew that now was a good time to eat their honey.
8. So he walked over to the tree and climbed it.
9. Very soon he was at the bees' home.
10. He ate all of the honey very quickly.
11. Then he cleaned himself up.
12. Feeling very full the bear walked happily home.
13. Not much later the bees came back and saw that their honey was gone.
14. They looked and looked but could not find a single drop.
15. The bees knew that the bear had stolen their honey.
16. They wanted to punish the bear.
17. So they flew all around looking for the thief.
18. They looked in the fields and in the tops of trees.
19. When they found him they bit the bear all over.
20. A black cloud of angry bees covered the bear.
21. Never again did the bear take anything from his little friends.