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UNIVERSITY OF ALBERTA

COGNITIVE REMEDIATION OF READING COMPREHENSION DIFFICULTIES, USING GLOBAL AND BRIDGING TASKS

BY

JAMES P. KEPRON

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

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J. P. Kepron

327 MONTGOMERY AVE.

WINNIPEG, MANITOBA

CANADA

R3L 1T6

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UNIVERSITY OF ALBERTA

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THE UNDERSIGNED CERTIFY THAT THEY HAVE READ, AND RECOMMEND TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH FOR ACCEPTANCE, A THESIS ENTITLED COGNITIVE REMEDIATION OF READING COMPREHENSION DIFFICULTIES, USING GLOBAL AND BRIDGING TASKS
SUBMITTED BY JAMES P. KEPRON
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

F. SNART

S. HUNKA

H. JANZEN

J. GOLDBERG

M. JULIEBO

L. MCDONALD

J. NAGLIERI

C. VARNHAGEN

Date: June 24, 1991

ABSTRACT

This study investigated the effect of a program of cognitive remediation using global and bridging tasks on levels of reading comprehension, cognitive processing, and perception of academic ability. The sixteen subjects who were selected for the study had all been placed in Grade 5 or Grade 6 for the 1989/90 school year. They were experiencing serious and longstanding problems with reading comprehension, but they were all operating within a normal range of intellectual functioning. Selection was followed by random assignment to either the experimental group (n=8) or the control group (n=8).

The intervention consisted of twenty forty-five minute sessions of individualized remediation. Every other day, students from the experimental group were presented with two different sets of paired global (i.e. content-free) and bridging (i.e. content-based) tasks which had been constructed to conform to the Planning, Attention, Simultaneous, Successive (PASS) Model (Das, Kirby, & Jarman,1979; Naglieri & Das, 1990) of information processing. These tasks were employed to train students in the use of simultaneous processing, planning, and, to a lesser extent, successive processing and attention, specifically for the purpose of deriving meaning from a variety of print materials. As the students of the experimental group proceeded through the intervention, the students of the control group continued in the resource program.

Subjects were assessed at pretest and at posttest by means of three measures of reading comprehension, a measure of cognitive processing, and a measure of perceived academic competence. Analysis of variance indicated that none of the observed improvements were statistically significant. However, nonparametric analyses of the data revealed: a) that students of the experimental group improved significantly on a measure of silent reading comprehension ($p=0.041$ and $p=0.057$), and b) that there was a strong trend

toward significant improvement on both a measure of oral reading comprehension ($p=0.074$) and the measure of student's perception of reading/spelling ability ($p=0.069$).

Analysis of students' responses to the intervention tasks suggested that most students were able to show marked improvement in their ability to comprehend printed passages and to transfer newly acquired skills and strategies to related tasks in subsequent sessions. The discussion of the results focused on: a) factors which may have contributed to problems with nonsignificance, b) evidence for transfer that could be inferred from the data, c) the utility of the PASS model as a basis for cognitive/academic remediation, and d) implications for future research.

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Introduction

Early Reading Instruction

Prior to 1970, programs of reading instruction tended to emphasize the acquisition and application of operationally defined reading skills. It was generally assumed that the families of skills (e.g. decoding, comprehension) and the skills within families could be arranged hierarchically and that mastery of lower level skills was necessary before skills of the next higher level could be attempted (Bond, Tinker, Wasson, & Wasson, 1984; Klein, 1988; Perry & Woodington, 1985). Therefore learning to read became identified with orderly progress through the hierarchy of decoding skills, comprehension skills, critical reading skills, and, possibly, recreational reading skills. Disagreements among researchers and practitioners tended to focus primarily on the most effective way to move students through the first level, the level of decoding (Feitelson, 1988; Harris & Sipay, 1990). Some favoured approaches which emphasized the direct extraction of meaning, usually involving the acquisition of lists of basic sight words, while others favoured approaches which concentrated on cracking the written code (e.g. phonetic approaches).

One problem with focusing only on operationally defined skills during reading instruction is that the approach does not possess much explanatory power (Klein,1988). The acquisition of skills can be monitored effectively, but not the mechanism by which mastery was accomplished. The corollary to this is that the approach does not help to explain reading dysfunction. Drill and practice on lower level skills, to the point of automaticity, is regarded by many as essential in the progress toward reading competence (Bond et al., 1984; Lapp & Flood, 1983; Samuels & Kamil, 1984). When competence does not arrive, regardless of the extent to which skills are drilled and practiced, it becomes

necessary to look beyond the hierarchy of skills for a suitable explanation (Klein, 1988). A second and related problem with skills oriented approaches is that students, especially dysfunctional students, tend to spend excessive amounts of time on lower level skills (e.g. practicing decoding) and comparatively little time at the higher levels (Durkin in Ekwall & Shanker, 1988; Feitelson, 1988; Harris & Sipay, 1990; Perry & Woodington, 1985). For many students this approach to programming has a disasterous effect on their ability to comprehend printed text.

An Evolving Discipline

During the 1970's, reading instruction experienced something of a paradigm shift as researchers moved away from text-centred approaches to reading and toward text-processing ones (Klein, !988). People from various areas within psychology, linguistics, philosophy, and education began to investigate: a) how reading skill develops; b) why it fails to develop adequately in a sizable part of the population, frequently in spite of intensive instruction; and c) how research findings can be used to develop appropriate remedial programs. The models of the reading process that have guided these investigators are generally separated into three categories: bottom-up, top-down, and interactive (Harris & Sipay, 1990; Lapp & Flood, 1983; Samuels & Kamil, 1984).

The bottom-up models, typified by that of Gough (In Samuels & Kamil, 1984), were the first to appear. They reflected the traditional view of reading-skill development in that they tended to be serial, hierarchical, and text-based. Readers, it was suggested, began at the level of the grapheme and were brought to an understanding of text as they progressed in their analysis of syllables, words, phrases, sentences, etc. Proponents of the top-down approach, on the other hand, discounted the importance of decoding and word

analysis in the development of reading competence (Harris & Sipay,1990; Lapp & Flood, 1983; Samuels & Kamil, 1984). They continue to suggest that the act of reading involves the use of prior knowledge and cognitive/linguistic competence to form hypotheses about the meaning of text. As reading continues, hypotheses are either confirmed or rejected, with decoding entering the process only as a last resort.

One of the current directions of reading research can probably best be characterized as an ongoing investigation of the act of reading as an interactive process (Irwin, 1986; Klein, 1988; Spiro & Myers, 1984). Rather than being driven by text, it is being suggested that the act of reading is the product of the interaction of reader, text, context, and tasks (Irwin, 1986; Samuels & Kamil, 1984). This view, which is best exemplified by the models of Just and Carpenter (1987), Laberge and Samuels, and Rumelhart (In Samuels & Kamil, 1984), therefore suggests that reading proficiency results from the interaction of both bottom-up and top-down processes. Depending on the developmental stage of the reader and the level of difficulty of the text, either bottom-up or top-down processing may take precedence at any given time. Alternatively, there may be times when they function simultaneously (Harris & Sipay, 1990; Spiro & Myers, 1984). The important point is that, according to the interactive view of the reading process, each form of processing serves to guide the other toward the meaningful interpretation of text (Perfetti, 1985).

Implicit in interactive models of the reading process is the assumption that the component processes that contribute to overall reading ability can be defined, studied, and, where necessary, remediated. An alternative view of the reading process, the transactional view, says that this is not possible. Proponents of the transactional view, like Harste, Woodward, and Burke (1984), maintain that the component processes do not operate additively. Rather, they

say that these components transact such that the end product (e.g. reading ability, writing ability, verbal ability) becomes more than the sum of its parts. In addition, reflecting a position that has been put forward by Vygotsky (1978), Harste et al. (1984) are convinced that the development of language, in general, and reading ability, in particular, is context-dependent, in that it is heavily influenced by the linguistic and social environment in which the individual is expected to function.

This view of the reading process implies a level of complexity which, according to Harste et al. (1984), cannot be approached by means of traditional experimental designs. As an alternative, Harste and his colleagues have resorted to analyzing the development of language, reading, and writing in naturalistic settings, using techniques that are typically characterized as ethnographic. In addition, Harste et al. (1984) suggest that where remediation becomes necessary, it cannot proceed piecemeal (e.g. focusing on phonological encoding to the exclusion of comprehension), but must be directed at the process as a whole. The complexity of this approach has not deterred practitioners from incorporating it into programs of language and reading development. In fact, many proponents of whole language approaches to literacy development maintain that the transactional view is one of the only models that truly reflects the manner in which children proceed toward competence in speaking, reading, and writing (Weaver, 1990).

Information Processing and Reading Proficiency

The attention that is being paid in the literature to the models of Gough, Laberge and Samuels, Rumelhart, Kintsch and van Dijk, Just and Carpenter, and others testifies to the importance of information processing in the area of reading achievement. Models of information processing are being used not only to investigate the development of reading proficiency but also to provide a

foundation upon which effective remedial programs can be built. These sorts of practical applications are particularly apparent in the work of people like Borkowski and his colleagues (Borkowski, Estrada, Milstead, & Hale, 1989; Borkowski, Weyhing, & Carr, 1988), Bradley and Bryant (1983), Brown and Campione (1986, 1990), Bransford and his colleagues (Bransford, Stein, Arbitman-Smith, & Vye, 1985), Feuerstein and his colleagues (Feuerstein, Rand, & Hoffman, 1979; Feuerstein, Rand, Hoffman, & Miller, 1980), Olson and his colleagues (Olson, Foltz, & Wise, 1986; Wise, Olson, Anstett, Andrews, Terjak, Schneider, Kostuch, Kriho, 1989), Palincsar and her colleagues (Palincsar, Brown, & Martin, 1987), Paris and his colleagues (Paris & Oka, 1986a, 1986b, 1989; Cross & Paris, 1988),and, to a certain extent, Belmont and Butterfield (Borkowski, & Buchel, 1983), Clay (1985), and Stanovich (1986, 1988a).

Within this broad area, one of the remedial approaches that appears to be especially promising is one that is based on the Planning, Attention, Simultaneous, Successive (PASS) Model (Das, Kirby, & Jarman, 1979; Naglieri & Das, 1990). This model employs terminology which is different from that of the interactive approaches which were discussed previously, but the similarities with regard to bottom-up and top-down processing are readily apparent. According to the principles of the model, the ability to read fluently with good comprehension requires proficiency in the areas of successive processing, simultaneous processing, and planning (Cummins & Das, 1977; Das, 1984b), coupled with an adequate knowledge base and sufficient levels of attention (Naglieri & Das, 1990). However, proficiency in all of these areas does not appear to be necessary at all levels of reading skill development. In the early grades, where reading is synonymous with the decoding of printed symbols, successive processing becomes particularly important for the beginning reader.

Later on, when students are required not only to decode printed symbols but also to derive meaning from phrases, sentences, and longer passages, simultaneous processing and planning become critical (Cummins & Das, 1977; Naglieri & Das, 1987). Whether they are operating primarily successively or primarily simultaneously, good readers must, therefore, have the ability to encode incoming information efficiently. As part of the planning process, they must also be able to survey a personal repertoire of acquired strategies (i.e. involving either successive processing, simultaneous processing, or a combination of the two) and to select the alternative that is most suitable to the task-at-hand.

Children who are without intellectual impairments but who still experience serious difficulties in the area of reading may do so because they have lacked either the opportunity or the motivation to learn the required reading skills. In these cases, successful remediation can, and frequently does, involve the teaching or reteaching of those skills that are missing from the children's repertoires (Bond et al., 1984; Clay, 1985; Harris & Sipay, 1990; Lapp & Flood, 1983; Perry & Woodington, 1985). According to the Planning, Attention, Simultaneous, Successive (PASS) Model (Das et al., 1979; Naglieri & Das, 1990), though, for this approach to work, the coding and planning processes must be more or less intact. With many children who are unable to read or able to read only with great difficulty, there appear to be significant deficiencies in the requisite cognitive processes (Cummins & Das, 1977; Das, 1984b). In some instances, the coding function seems not to have developed adequately; in others, the children appear to be unable to select and to use the appropriate strategies efficiently. In many cases, however, the reading difficulty seems to be the result of these two factors working in combination (Das, Snart, & Mulcahy, 1982). Therefore, current research suggests that, where children

are experiencing serious difficulties with the learning and application of reading skills, remedial programs should concentrate not only on the specific skills themselves but also on the coding and planning processes that appear to be pre-requisite to the acquisition and application of those skills (Das, 1985).

The purpose of the present study was to investigate the relationship between a cognitively oriented remedial program and the cognitive/academic performance of children who were experiencing serious learning difficulties in the area of reading comprehension. The remedial program consisted of a series of content-free or global tasks and content-specific or bridging tasks which were paired and presented in a way that encouraged the use of planful behaviour. The effectiveness of the remedial program was judged according to the following criteria: a) improved level of reading comprehension; b) improved cognitive functioning, including simultaneous processing, successive processing, planning, and arousal/attention; and c) improved perception of one's own academic competence.

Chapter II

Review of the Literature

Introduction

Reading Disability: An Information Processing Perspective

The difficulties that are experienced by some children as they try to decode words or to extract meaning from printed passages are still frequently attributed to a lack of drill and practice in the use of essential reading skills. Remedial programs for these children, many of whom become diagnosed as reading disabled, therefore tend to highlight drill and practice on lower level components, such as word attack skills and beginning comprehension activities (Brown & Campione, 1986; Durkin in Ekwall & Shanker, 1988; Feitelson, 1988; Harris & Sipay, 1990; Perry & Woodington, 1985). Currently it is being acknowledged that the acquisition of reading skills, or any other academic skill, is influenced by a number of cognitive factors. These factors can operate, either singly or in combination, to facilitate or to disrupt the normal course of reading-skill development.

Many of the cognitive factors which are thought to contribute to reading disability have been identified and discussed in the information processing literature. Among others, these factors include: problems with selective and/or sustained attention (Samuels, 1987); limited processing capacity (Cherkes-Julkowski, Gertner, & Norlander, 1986; Gelzheiser, Shepherd, & Wozniak, 1986; Samuels, 1987; Winn & Sutherland, 1989); a lack of automaticity in the development of basic decoding and/or comprehension skills (Gerber & Hall,1987; Harris & Sipay, 1990; Lapp & Flood, 1983; Samuels & Kamil, 1984; Snart, Das, & Mensink, 1988; Swanson, 1987); inefficient lexical access (Cherkes-Julkowski et al., 1986; Samuels, 1987; Snart et al., 1988); inefficient encoding of information in short-term memory (Borkowski & Buchel, 1983;

Butterfield & Belmont, 1977; Das, Snart, & Mulcahy, 1982); problems with orthographic encoding (Stanovich & West, 1989); problems with phonological encoding (Bryant, Bradley, MacLean, & Crossland, 1989; MacLean, Bryant, & Bradley, 1987; Olson, Wise, Conners, Rack, & Fulker, 1989; Stanovich, 1988a; Wise, Olson, & Treiman, 1990); failure to grasp the syntactical structure of text (Kirby & Robinson, 1987); an inadequate knowledge base or the lack of appropriate schemata (Anderson & Pearson, 1984; Ekwall & Shanker, 1988; Perfetti, 1985; Spiro & Myers, 1984; Tierney & Cunningham, 1984); and difficulty converting visual-spatial forms into sequential order (Das et al., 1982).

A somewhat different but nevertheless related class of factors may be characterized as problems with the metacognitive aspects of reading behaviour (Baker & Brown, 1984; Ekwall & Shanker, 1988; Spiro & Myers, 1984; Tierney & Cunningham, 1984) or with the organization of strategic behaviour (Das et al., 1982). This can refer to the monitoring of both lower order mechanisms like phonological encoding (Kirtley, Bryant, MacLean, & Bradley, 1989; Stanovich, 1988b; Swanson, 1987) and higher order comprehension activities. Specific problems that would fall into the latter category include: the connecting of stimuli in arbitrary, nonessential, loose ways rather than in a purposeful, organized manner (Cherkes-Julkowski et al. 1986); the failure to use active strategies, like skimming for main ideas and strategic rereading, to improve comprehension (Borkowski, Schneider, & Pressley, 1989; Brown & Campione, 1986; Cross & Paris, 1988; Paris & Oka, 1989); the inability to recognize that text is not being interpreted accurately and the inability to resolve problems, even when errors of comprehension are suspected (Brown & Campione, 1986; Kirby & Robinson, 1987; Stevens, 1988); and failure to attribute comprehension successes and failures appropriately (Borkowski et al., 1988, 1989; Paris & Oka, 1989).

In short, information processing approaches to specific learning disabilities, such as reading disability, are characterized by the importance that is placed on the cognitive and metacognitive processes that are thought to underlie the acquisition and utilization of specific skills. From the information processing perspective, academic dysfunction necessitates the assessment of those underlying processes, followed by the remediation of any identified deficiencies (Borkowski & Buchel, 1983; Brown & Campione, 1986; Das, 1985b). Within the field of information processing, however, no single model predominates. Rather, the models on which assessment and remediation procedures are based are many and varied.

Specific Applications of Four Models of Information Processing

Since the early 1950's, a number of models of information processing have played a part in the evolution of current assessment and remediation procedures for children who are experiencing cognitive/academic dysfunction. In some cases, the influence of specific models has diminished as more relevant approaches have emerged to take their place. In other cases, a process of re-evaluation and refinement has allowed certain models to move into and/or to retain positions of prominence. Four information processing models which can be regarded as being representative of this evolutionary process include: Osgood's (1957) model of language behaviour, the multistage model of memory that was proposed by Atkinson and Shiffrin (1968), Feuerstein's model of cognitive functioning (Feuerstein, Rand, & Hoffman, 1979), and the Planning, Attention, Simultaneous, Successive (PASS) Model (Das, Kirby, & Jarman, 1979; Naglieri & Das, 1990). Brief descriptions of specific applications of these models will be presented in this section. A more detailed discussion of the PASS Model (Das et al, 1979; Naglieri & Das, 1990) will be presented in the section which follows.

Osgood's (1957) model of language behaviour. In the late 1950's and early 1960's, researchers like Kephart (1960), Frostig (1961), Getman and Kane (1964), and Barsch (1965) suggested that the cognitive deficits which were thought to impede normal conceptual development could be remediated through the use of various forms of perceptual and/or motor training. It was within this context that Osgood (1957) proposed the model of language behaviour that ultimately gave rise to the notion of psycholinguistic remediation. Investigatons into the efficacy of the remedial programs which were derived from these models have produced results which have been equivocal, at best (Sattler, 1982; Smith, 1983). While this situation has allowed certain practitioners to feel justified in continuing to employ the perceptual training programs that were developed by Kephart, Frostig, Getman, Barsch, and others, the view of contemporary researchers tends, for the most part, to be that the above approaches retain a certain amount of historical significance, but relatively little practical value.

The best known application of Osgood's model is undoubtedly the Illinois Test of Psycholinguistic Abilities (ITPA). Kirk, McCarthy, and Kirk (1968) created the ITPA for the purpose of assessing those specific abilities which, according to Osgood, are thought to underlie both language behaviour and, by extension, general cognitive functioning. The instrument is said to assess auditory and visual association/reception, verbal and manual expression, and habitual patterns of retention and retrieval of language (Sattler, 1982). The ITPA has led to the development of at least two sets of training activities which are widely used for the remediation of functions that are found to be deficient. One set of activities is found in the MWM Program for Developing Language Abilities (Minskoff, Wiseman, & Minskoff, 1972),while the second has been developed by two of the test's authors, Kirk and Kirk (1971).

Atkinson and Shiffrin. Multistage models of memory, of the sort that were proposed by Atkinson and Shiffrin (1968), have strongly influenced researchers who have been working in the area of memory dysfunction (Borkowski & Buchel, 1983). Two of these researchers, Belmont and Butterfield, have spent considerable time investigating the particular problems with recall that are experienced by students with mild mental handicap (Borkowski & Buchel, 1983). This work has been concerned not only with assessing individual differences in performance on recall tasks, but also with improving performance through strategy training (Butterfield & Belmont, 1977).

Feuerstein also believes that deficient cognitive functions can be identified and then strengthened through the use of appropriate interventions. His notion of cognitive modifiability is based, in large part, on the work of Vygotsky, in that he has come to share Vygotsky's view that "the more advanced human mental processes have their origin in collaborative activity which is mediated by verbal interaction" (Minick, 1987). Feuerstien refers to this process as Mediated Learning Experience (Feuerstein et al, 1979).

Feuerstein et al. (1979) developed the Learning Potential Assessment Device (LPAD) not for the purpose of identifying those tasks that children can or cannot perform, but rather for the purpose of analyzing why children are unable to perform certain tasks satisfactorily. Student responses are analyzed according to the seven parameters of Feuerstein's cognitive map, his model of cognitive functioning. This analysis allows deficient functions in the input, elaborational, and output phases to be identified and targeted for remediation. Instrumental Enrichment (IE), the remedial program that was developed by Feuerstein, Rand, Hoffman, and Miller (1980), is then brought into play. IE consists of fifteen separate instruments which provide the context within which mediated learning is supposed to take place.

The Planning, Attention, Simultaneous, Successive (PASS) Model that was originally proposed by Das, Kirby, and Jarman (1979) as the Information Integration Model and subsequently elaborated by Naglieri and Das (1990) is based on Luria's (1966) analysis of neuropsychological functioning. As one result of his work with brain-injured patients, Luria put forward a model which emphasized the notion of functional organization. Rather than identifying specific neurological structures as the centres within which particular functions were localized, Luria conceptualized function as "a complete system of co-ordinated behavioural and neurological activity" (Das & Varnhagen, 1986).

Luria's model has been adapted by Das and his colleagues for use with students who are experiencing either mental handicap or specific learning disability. This work has provided the basis for the development of two assessment instruments, namely: the Das-Naglieri: Cognitive Assessment System Experimental Test Battery (Das & Naglieri, 1989) and the Kaufman Assessment Battery for Children (Kaufman & Kaufman, 1983). Remedial tasks, designed to strengthen those cognitive functions which are found to be deficient, have also been developed by Kaufman (1978), Das and Conway (Tasks under development), Kaufman and Kaufman (1983), and several other authors.

Conclusion. Although the above applications are based on different models of information processing, and although they tend to focus on different aspects of the respective information processing systems, they still have important features in common. They all emphasize the processes which underlie and contribute to skill development. They also place considerable weight on the need for remediation once deficient processes are identified during the assessment phase. These are the very features which characterize information processing approaches to academic dysfunction.

The Luria-Das Model of Information Integration

Luria's (1966) Functional Units

Central to Luria's model of psychological functioning is the idea of the functional unit, of which there are three. Luria has referred to these simply as Block 1, Block 2, and Block 3.

Block 1 is involved in the maintenance of wakefulness, arousal, and attention. It is associated with those neurological structures that are found in the upper brainstem, the reticular formation, and parts of the limbic cortex and hippocampus.

Block 2 is generally concerned with the input, coding, and storage of information. This block is conceptualized as an association of two different sets of neurological structures, with each set controlling a separate class of coding functions. The occipital and parietal areas of the brain are specialized for the simultaneous processing of incoming stimuli, while the frontal and temporal lobes are responsible for successive processing.

Block 3 is concerned with the planning and decision-making aspects of human behaviour. In this case, the critical neurological structures are located in the prefrontal lobes.

Coding, Attention, and Planning

Simultaneous and successive processing. "Simultaneous processing involves the formation of a code that is quasi-spatial in nature, having the characteristic that all parts of it are immediately surveyable" (Das et al., 1982). When incoming stimuli can be encoded separately but can take on their full meaning only when they are being considered in relation to each other and to the set of incoming information as a whole, then simultaneous processing must come into play. Examples of tasks that require simultaneous processing include: classifying objects according to function, copying geometric figures,

using closure to complete unfinished pictures, and comprehending lexically ambiguous sentences.

Successive processing, on the other hand, "involves the formation of a code that is more temporal in nature, being accessible only in a linear way" (Das et al., 1982). When an incoming stimulus takes its meaning from its particular position within the sequence of stimuli (i.e. from the preceding stimulus and from the following stimulus only), then successive processing is called for. Examples of tasks requiring successive processing would, therefore, include the memorization and recall of sequences of digits or unrelated words, and the reproduction from memory of strings of coloured beads.

Simultaneous and successive processing are used for the encoding of both verbal and nonverbal material, regardless of the modality through which the information is presented (Naglieri & Das, 1988a). Furthermore, as cognitive operations which are used to interpret incoming stimuli, the two forms of processing are not necessarily mutually exclusive. In certain instances, stimuli can be made meaningful only when the two operations are used co-operatively. For example, the reading of a list of unfamiliar words requires successive processing, whereas simultaneous processing is needed to establish relationships among the words. In other instances, it may be possible to use the two operations interchangeably, with similar results. For example, word lists may be rehearsed and recalled serially or as clusters of related words. However, in many cases, certain sets of information will be processed most efficiently using a simultaneous approach (e.g. interpreting the floorplan of a room), while other sets will be processed most efficiently using a successive approach (e.g. completing a connect-the-dots puzzle).

Attention. According to Das (1988) and Naglieri and Das (1988a; 1990), attention exists as a separate factor within the Planning, Attention,

Simultaneous, Successive (PASS) Model. It does not, however, function in isolation. Rather, it operates interactively with the coding and planning processes (Das, 1984a, 1988). Because it has been identified as a separate factor within the model, it is further hypothesized that attention will be sensitive to remediation, where it is found to be deficient.

It is suggested that attention is present in two distinct forms. Sustained attention refers to an individual's ability to maintain his/her concentration over time, while selective attention refers to the ability to discriminate relevant from irrelevant stimuli without becoming distracted (Snart et al., 1988). In either of its forms, the level of attention that is exhibited by an individual is thought to be dependent on that individual's state of arousal or mental alertness, with too much or too little arousal being detrimental to efficient and effective attending (Naglieri & Das, 1988a; 1988b).

Conclusions regarding the existence and role of attention within the Planning, Attention, Simultaneous, Successive (PASS) Model (Das et al., 1979; Naglieri & Das, 1990) have considerably more theoretical than empirical support. To date, effective measures of selective and sustained attention have simply not been researched adequately (Das, Mensink, & Janzen, 1990). However, at the present time, it would seem that relevant supportive data are beginning to appear (Das, 1984a; Das, Mensink, & Mishra, 1990).

Planning can be defined as the generation or selection of a program in the face of a particular cognitive task, the execution of the chosen program, and the subsequent evaluation of that program (Das, 1984a; Das & Heemsbergen, 1983). Planning has been identified as a separate and stable function operating within the information processing system (Das, Mensink, & Janzen, 1990; Snart, O'Grady, & Das, 1982; Snart & Swann, 1982). Factor analytic studies have also shown that as planning ability continues to develop, it

operates orthogonally to the coding function (Das & Heemsbergen, 1983; Das et al., 1982).

Although planning can thus be described as a distinct entity that contributes significantly to overall cognitive functioning, like attention, it does not operate in isolation from the other contributors. For example, when an inappropriate state of arousal causes attention to remain unfocused, planning becomes very difficult , or even impossible (Naglieri & Das, 1988b). Planning is also related to knowledge base, in the sense that the development of a broader knowledge base permits the emergence of more sophisticated levels of planning (Das, 1984a; Sternberg, 1984). With regard to the relationship between coding and planning, it appears that some competence in the coding of information is necessary before planning ability can begin to evolve, probably because the planning function requires coded material on which to operate. At the same time, however, it is now acknowledged that the ability to plan makes for the more efficient coding of new information (Das, 1984b).

The Model in Operation

The components of the original Information Integration Model (Das et al., 1979) are illustrated in Figure 1. The functioning of the model has been described in detail by Das et al. (1979) and, more recently, by Das and Varnhagen (1986) and by Das (1988). Incoming stimuli excite one or more of the sensory receptors. The corresponding impulses pass to the sensory register by means of which they are selectively transmitted, in serial fashion, to the central processing unit. In the central processing unit, the simultaneous processing component or the successive processing component organizes the information into the respective quasi-spatial scheme or temporally-based sequence. At this point, the planning and decision-making component uses the

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Figure 1. Components of the Information Integration Model (Das, Kirby, & Jarman, 1979).

coded information to determine the best possible plan of action. Plans are then translated into cognitive and/or motoric behaviours via the output component.

The following principles are believed to apply to the functioning of the system as a whole. a) Either simultaneous or successive organization of information can occur at the input level, within the central processing unit, or at the output level. b) At any given level, the type of processing that goes on is not a function of the kind of processing that has gone on before. For example, information that is input successively can be dealt with simultaneously in the

central processing unit and can lead to either simultaneous or successive output. c) With any given individual, the kind of information processing that goes on is influenced by: (i) specific task demands (e.g. Many tasks require either a simultaneous or a successive approach.), and (ii) the individual's preferred style of processing information.

The Planning, Attention, Simultaneous, Successive (PASS) Model. In the revised version of the Information Integration Model, recently renamed the Planning, Attention, Simultaneous, Successive (PASS) Model (Naglieri & Das, 1990), inferences regarding the manner in which the coding and planning functions influence each other have remained, more or less, unaltered. However, inferences regarding the role of knowledge base (i.e. the sum total of one's acquired knowledge to the time of processing) and the role of attention have been made more explicit. The interactive nature of the relationships among these components has been illustrated in Figure 2.

Where new information is to be acquired, the presence of an effective plan means that the coding processes are able to operate more efficiently. However, planning ability is dependent upon the quality of the knowledge base, because it is from the reservoir of stored procedural and declarative knowledge that plans are constructed. Therefore, a broader and deeper knowledge base leads to more effective planning; more effective planning permits more effecient encoding; and more efficient encoding means that new knowledge can be acquired more easily. Improvements to the existing store of knowledge due to the incorporation of the new information then permits the construction of plans that are even more elaborate and effective. In this way, not only does the cycle continue, but the process of learning accelerates. Of course, the functioning of the information processing system is able to approach optimum efficiency only

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Figure 2. The Planning, Attention, Simultaneous, Successive (PASS) Model (Naglieri & Das, 1990)

with the emergence of an appropriate state of arousal. This final component, which is psychologically expressed as the attentional processes (Das, 1988; Naglieri & Das, 1988b), is drawn into the interaction as it both influences and is influenced by the roles that are played by the other parts of the system.

The Direct Remediation of Deficient Cognitive Processes

It has been pointed out that there is considerable variation in the specific aspects of cognitive functioning which Kirk, McCarthy, and Kirk, Belmont and Butterfield, Feuerstein, and Das have selected for study. It has also been pointed out, though, that the approaches of these researchers show similarity, in that they have chosen to attack the problems that are associated with cognitive deficiency by assessing and remediating the deficient processes directly. For the most part, this has been attempted through the use of tasks which have been designed to make minimal demands on a student's knowledge base and which have, therefore, been constructed to be free of academic content.

Psycholinguistic Ability, Memory, and General Cognitive Functioning

The ITPA (Kirk et al., 1968) has been criticized on a number of grounds (Sattler, 1982), with some of the most severe criticism being directed at the basic assumptions which underlie the development of the test. Based on a number of studies which have examined the ITPA and the training activities that have been developed from it, Hammill and Larsen (1974) and Larsen, Parker, and Hammill (1982) concluded that the effectiveness of psycholinguistic training remains unproven. Specifically they pointed out that the majority of attempts at remediation in this area have not been able to demonstrate significant treatment effects. Kavale (1981), however, disagreed. In his re-analysis of those psycholinguistic training studies which used the ITPA as the dependent measure, Kavale chose to focus on effect size, rather than overall significance,

as the criterion by which success or failure was to be ascertained. His unqualified conclusion was that psycholinguistic training was, in fact, successful, and that this was particularly true for expressive, representational, and visual-motor abilities. As support for his conclusion, Kavale pointed to the rise of fifteen percentile points which appeared in the overall mean score following training. Although these results have been criticized for not having practical significance (Larsen et al., 1982; Sternberg & Taylor, 1982), they are, nevertheless, important because they appear to affirm the conviction that cognitive functions, in this case psycholinguistic abilities, are sensitive to remediation.

A similar pattern of results has been revealed by Belmot and Butterfield and by Feuerstein. In a series of investigations which focused on serial recall, Butterfield and Belmont (1977) made the discovery that students with mild mental handicap tended not to use active rehearsal strategies when faced with simple recall tasks. In the same body of research, however, the authors reported that, once the students had been taught a very simple rehearsal strategy, they were easily able to outperform the untrained, nonhandicapped peers with whom they had been matched for chronological age. This sort of dramatic improvement in recall ability has also been reported by others (Borkowski & Buchel, 1983; Brown & Campione, 1986).

Evidence from the research that has been conducted by Feuerstein et al. (1980) also indicates that the deficient functions which were identified by means of the LPAD (Feuerstein et al., 1979) were substantially improved through the use of IE (Feuerstein et al., 1980). Furthermore, these findings have received support from a major group of researchers who have been investigating Feuerstein's model in North America (Bransford, Stein, Arbitman-Smith, & Vye,

1987; Haywood & Arbitman-Smith, 1981; Vye, Burns, Delclos, & Bransford, 1987).

The Planning, Attention, Simultaneous, Successive (PASS) Model and Reading Ability

Like Kirk and Kirk (1971), Butterfield and Belmont (1977), and Feuerstein et al. (1980), Das and his colleagues have been concerned with remediating deficient cognitive processes directly. However, unlike the other authors, Das has chosen to extend his work with the Planning, Attention, Simultaneous, Successive (PASS) Model (Das et al., 1979; Naglieri & Das, 1990) into the area of reading achievement, the purpose being to link the assessment and remediation of cognitive dysfunction to the assessment and remediation of reading disability. Generally speaking, the steps in this process have been as follows: a) to identify clearly the component processes that make up the PASS Model; b) to demonstrate the existence of a relationship between reading ability (i.e. decoding, understanding word meaning, reading comprehension, etc.) and the component processes of the model; c) to demonstrate the modifiability of those cognitive processes that have been identified as being deficient; and d) to demonstrate that improved cognitive functioning can lead to improved reading ability. The purpose of the present section is to examine more closely the relationship that exists between reading ability and the component processes of the PASS Model. The topic of the remediation of cognitive dysfunction and reading disability will be dealt with subsequently.

Coding. Successive processing has been identified as a key factor in the development of a child's ability to decode printed words (Cummins & Das, 1977; Das, 1984b; Kirby & Robinson, 1987). It's importance has also been recognized in the ability to unravel syntactical structure (Das, 1984b; Kirby & Robinson, 1987). Therefore, whether a child is analyzing sequences of

graphemes in an attempt to identify an unfamiliar word, or analyzing sequences of words or phrases in an attempt to identify the corresponding thought-units, successive processing plays a major role. Simultaneous processing, on the other hand, is "a necessary pre-requisite to the understanding of complex conceptual-linguistic relationships" (Cummins & Das, 1977). As such, it is an essential component in the development of semantic analysis, verbal reasoning, and reading comprehension (Cummins & Das, 1977; Das, 1984b; Kirby & Robinson, 1987; Solan, 1987).

As a child progresses through the various stages of reading-skill development, simultaneous and successive processing take on differential importance. In the very early stages, when a child is preoccupied with learning how to decode printed words, successive processing is the dominant means by which incoming information is encoded. Later on, as decoding strategies are mastered, and as the child's task shifts to one of reading for meaning, simultaneous processing begins to take precedence. Usually this relationship between reading ability and simultaneous processing continues to intensify as the child matures (Cummins & Das, 1977; Naglieri & Das, 1987). Simultaneous processing does not completely supplant successive processing as reading skills improve, however. Even after decoding skills have become more or less automatic, thereby indicating mastery, successive processing remains as an important component in syntactic analysis.

The relationship between the overall ability to encode information and academic achievement is an important one (Naglieri & Das, 1987). For example, proficient readers tend to exhibit high levels of simultaneous and successive processing ability (Cummins & Das, 1977; Solan, 1987). Readers who are skilled at processing information either simultaneously or successively tend not to do as well on reading tasks, as neither method, by itself, is sufficient

to ensure high levels of reading achievement (Cummins & Das, 1977). Children who experience significant levels of reading difficulty (i.e. two or more years below grade level) are generally inferior to average readers of the same age in their use of both simultaneous and successive processing strategies (Cummins & Das, 1977; Das et al., 1982). In addition, they generally perform even more poorly on successive tasks than they do on simultaneous tasks (Cummins & Das, 1977; Das et al., 1982; Snart et al., 1988). This latter finding has led certain researchers to suggest that deficient successive processing ability plays a particularly important role in the development of reading disability (Bannatyne, 1968; Hooper & Hynd, 1986; Kirby & Robinson, 1987; Solan, 1987). At early ages it leads to problems with decoding, while, among older children, confusion over syntactical structure causes them to be unable to extract meaning from printed passages (Cummins & Das, 1977; Kirby & Robinson, 1987; Snart et al., 1988).

Attention. The importance of arousal/attention within the Planning, Attention, Simultaneous, Successive (PASS) Model (Das et al., 1979; Naglieri & Das, 1990) has been established, at least in a theoretical sense, by Das (1984a; 1988) and by Naglieri and Das (1988a; 1988b). What has not been established is the extent to which students who experience reading difficulty also experience problems with sustained and/or selective attention. Bryan and Bryan (1978) and Keogh and Margolis (1976) have suggested that attention deficits play a key, and probably a paramount, role in the development of learning disability. Samuels (1987), on the other hand, disagrees. On the basis of his research, he states that "the low academic achievement of the learning disabled is not necessarily the result of attentional deficits", as children who experience learning disability consistently have shown themselves to be as attentive as their normal controls.

Planning. The emergence and development of the ability to plan effectively is characterized by children's becoming able to regulate their own behaviour and to organize, in a progressively more meaningful way, the activities which they undertake to perform (Das, 1988). This means that, as children mature, they become increasing adept at assessing requirements of tasks, directing their actions toward particular goals by selecting or creating appropriate strategies, evaluating the results of their efforts, and making necessary adjustments when their efforts do not fully satisfy task demands (Das, 1984a). This collection of abilities which are subsumed under the category of planning is very important to the successful completion of reading tasks, particularly when the primary goal involves reading for meaning.

Compared to children who are experiencing reading difficulty, proficient readers are generally more competent in the application of their planning ability (Das et al., 1982; Snart et al.,1988). As with coding strategies, the relationship between planning and reading achievement increases with age (Naglieri & Das, 1987). Whereas the reading achievement of beginning readers is related principally to the ability to encode information, both coding and planning figure prominently in the reading achievement of older children (Naglieri & Das, 1987).

The consideration of planning as an important factor in the overall process of reading for meaning provides researchers and educators with additional ways to explain the prevalence of reading disability. Specifically, reading disability may originate in: a) a child's inability to encode incoming information (i.e. a coding deficit), b) the child's inability to regulate his/her behaviour and/or to apply strategies which exist in his/her repertoire (i.e. a planning deficit), or c) a combination of both types of deficit. Currently the explanation that is being offered by researchers in the area tends toward the

third alternative, namely that both problems with encoding and problems with planning contribute to the occurrence of reading disability (Das et al., 1982; Naglieri & Das, 1988a).

Knowledge base is now considered to be an important part of the Planning, Attention, Simultaneous, Successive (PASS) Model (Das et al., 1979; Naglieri & Das, 1990), as there are strong theoretical arguments that it functions interactively with the coding and planning components (Naglieri & Das, 1988b, 1990; Swanson, 1987a). The role that knowledge base plays in the development of reading ability/disability, however, is still open to conjecture. Notions that it is possible to make a clear distinction between acquired knowledge and native cognitive ability have proven to be false. For example, it is acknowledged that it is extremely difficult to separate acquired factual knowledge (i.e. the substance of the knowledge base) from the native cognitive ability that is used to solve unfamiliar problems (Goetz & Hall, 1984), as problem solving ability is now known to be heavily dependent on both procedural and declarative, or factual, knowledge (Sternberg, 1984). Therefore, where a restricted knowledge base is in operation, we should logically expect to find corresponding restrictions on the sorts of strategies that can be employed during problem solving, within and outside of the academic domain (Swanson, 1987). In other words, it is to be expected that a restricted knowledge base will have an adverse effect on any aspect of academic achievement, including reading achievement.

Early Applications of the Planning, Attention, Simultaneous, Successive (PASS) Model

Krywaniuk (1974), Kaufman (1978), Brailsford, Snart, and Das (1984) all used remedial tasks that were based on the Luria-Das Model of Information Integration (Das et al., 1979; Das, 1988) in their attempts to correct the reading

difficulties that were being experienced by their subjects. Krywaniuk (1974) chose to work with native Canadian children who had been placed at a Grade three level and who had all been identified as low achievers. Children in the experimental group were given approximately 15 hours of individualized cognitive skills training which focused principally on successive processing. Children in the control group received three hours of group instruction which was designed to aid the development of visual-perceptual skills.

Kaufman's (1978) subjects were all working at a Grade four level. Scores from a standardized achievement test and an IQ test allowed Kaufman to identify one group of these children as learning disabled because they exhibited normal intelligence but below average achievement. Children in the experimental group received ten hours of cognitive skills training as well as selected exercises to aid the development of visual-perceptual skills. Children in the control group participated in their regular classsroom activities. Some of the remedial tasks required simultaneous processing; however, like Krywaniuk (1974), Kaufman's focus was clearly on the training of successive strategies. Some aspects of planning were also incorporated into the intervention, as children were encouraged, through the use of verbal mediation, to verbalize strategies as they worked through tasks and to summarize successful strategies at the beginning and at the end of sessions.

Brailsford et al. (1984) selected subjects who ranged in age from nine to twelve years. All of them had been diagnosed as reading disabled because their nonverbal IQ's were above 85, while their levels of reading comprehension were below the 35th percentile. As a consequence of their diagnoses, the subjects were all receiving resource help. In the experimental condition, the children received 15 hours of individualized cognitive skills training. For this purpose, Brailsford et al. used a total of 18 tasks, of which ten

required simultaneous processing, six required successive processing, and two required both forms of processing. Throughout the intervention, Brailsford et al. also placed considerable emphasis on planning. Children were required to repeat task directions, to verbalize their strategies as they worked through tasks, to summarize tasks at the end of a session, and to review tasks at the beginning of the following session. Children in the control group also received fifteen hours of intervention, but this took the form of small-group reading instruction as part of the regular resource program

Summary of the results. All three of the programs included tasks which were designed to encourage the development of successive processing ability; and in all three of the programs, significant improvement on post-treatment tests of successive processing was consistently observed (Brailsford et al., 1984; Kaufman, 1978; Krywaniuk, 1974). In addition, training in the use of successive processing strategies appeared to have a positive, although less dramatic, effect on other abilities, including selective attention and simultaneous processing (Kaufman. 1978; Krywaniuk, 1974). Where simultaneous processing was specifically targeted for remediation, results were noticeably less positive. In the study of Brailsford et al. (1984), there was significant improvement on some measures of simultaneous processing ability, but training effects did not appear to have been any greater than they were in the studies of Krywaniuk (1974) and Kaufman (1978), where children received little, if any, training in the use of simultaneous processing strategies. Improvements in certain areas of academic functioning were also noticed in the three studies. A discussion of these particular training effects will be presented subsequently.

Problems with Remediation and Transfer

Campione and Brown (1987) used a variant of Raven's Progressive Matrices (Raven, 1938) as well as a letter series completion task to investigate

the mechanisms which underlie the acquisition and transfer of learning. Their subjects included children with educable mental handicap and children with no apparent learning difficulties, while their method took the form of dynamic assessment (Lidz, 1987). Detailed analysis of the responses to the assessment/training tasks allowed Campione and Brown to measure the rate at which new material was learned. In their case, rate of learning was operationally defined as the number of hints or prompts that were necessary to bring the task to a successful conclusion.

The conclusions that Campione and Brown (1987) were able to reach are very similar to the conclusions that were presented by Vye et al.(1987), following their investigation of learning and transfer among children who had been diagnosed as having low ability. Specifically, Campione and Brown were able to demonstrate: a) that it was possible to bring children with educable mental handicap to criterion on learning tasks, such that it was not possible to discriminate the group of children with mild mental handicap from the group of nonhandicapped peers; b) that the children with mental handicap consistently achieved scores on transfer tasks which were lower than those of their nonhandicapped peers; c) that group differences favouring the nonhandicapped group increased dramatically with transfer distance; and d) that nearly all of the children had difficulty with tasks involving the far-transfer of learned skills.

The mechanisms that have been identified by Campione and Brown (1987) serve a useful purpose in the analysis of the research into the direct remediation of deficient cognitive processes. It has been demonstrated by Kavale (1981), Butterfield and Belmont (1977), Feuerstein et al. (1980), Krywaniuk (1974), Kaufman (1978), and Brailsford et al. (1984) that, where deficient cognitive functioning is a problem, the use of relevant remedial tasks

can lead to significantly improved performance on related assessment tasks. However, it has also become apparent that there are problems associated with 'direct' approaches, and that these problems can appear at both the acquisition and transfer stages of the procedure.

Problems associated with acquisition. Research programs that focused on rehearsal and recall strategies (Butterfield & Belmont, 1977) or successive processing strategies (Kaufman, 1978; Krywaniuk, 1974) were able to generate high levels of success. In other studies, though, success has not been achieved as readily. For example, in the case of the ITPA (Kirk et al., 1968) training studies which were re-analyzed by Kavale (1981), the training effect of fifteen percentile points was equivalent to less than one-half of one standard deviation and was close to the result that ought to have been expected, given the standard error of measurement of the assessment instrument (Larsen et al., 1982). Furthermore, the result was achieved only after more than fifty hours of individualized intervention. It was for these reasons that Larsen et al. (1982) seriously questioned whether the gains were worth the effort.

Generating substantial treatment effects was also a problem for Brailsford et al. (1984), as simultaneous processing strategies proved to be less sensitive to remediation than were successive processing strategies. One explanation for this result emphasizes the relative complexity of the two forms of processing. Tasks which require successive processing can generally be cast into the form of standard recall tasks which require little more than rote learning (Goetz & Hall, 1984; Sternberg, 1984). Simultaneous processing, on the other hand, has been identified as a more complex form of mental processing (Bracken, 1985). It is, therefore, to be expected that the remediation of simultaneous processing ability will be more arduous and complicated than the remediation of

successive processing ability, and that more powerful forms of intervention will, as a consequence, be called for.

Problems associated with transfer. In all of the studies that were cited in the previous section, transfer of knowledge, at some level, proved to be a problem that was difficult to resolve. This was particularly the case for the far-transfer of acquired skills and strategies to academic tasks. Once an intervention has been completed and training tasks have been mastered, students need to be able to transfer their new knowledge to related tasks, and especially to academic tasks. If new skills can be employed only in the context within which they were acquired, then their utility is obviously profoundly limited (Das et al.,1982)

While teaching their subjects to use simple rehearsal strategies, Butterfield and Belmont (1977) acknowledged the presence and seriousness of a problem with transfer, a problem which they have been working to solve. Feuerstein et al. (1980), on the other hand, asserted that the problem-solving strategies which were mastered during Instrumental Enrichment were made to generalize to everyday life outside of the classroom. This claim has been disputed by both Bransford et al. (1987) and Vye et al. (1987). In the course of their investigations into the application of Feuerstein's model, both groups of researchers found little evidence of success on tasks which were not similar to the ones on which their students had received practice.

With regard to the research of Krywaniuk (1974), Kaufman (1978), and Brailsford et al. (1984), there was clear evidence of the near-transfer of cognitive skills because the assessment tasks, on which significantly improved performance became apparent, were related to, but were not the same as, the remedial tasks. In addition, there was evidence of the far-transfer of the acquired skills, as training in the use of successive processing strategies

appeared to have a positive influence on the performance of certain types of academic tasks. These included word recognition (Kaufman, 1978; Krywaniuk, 1974), the understanding of mathematical concepts, and mathematical computation (Kaufman, 1978). The same appeared to be true of the relationship between the remediation of simultaneous and successive processing deficiencies and one measure of reading ability, instructional reading level (Brailsford et al., 1984).

Training in the use of simultaneous and/or successive processing strategies did not, however, appear to have any effect on the measures of word knowledge (Kaufman, 1978), reading comprehension (Brailsford et al. 1984; Kaufman, 1978), or mathematical problem-solving (Kaufman, 1978) that were used by the respective researchers. This is somewhat surprising, given the strong theoretical relationship that is still thought to exist between the three academic areas and simultaneous processing ability (Kirby & Robinson, 1987). For most educators and researchers, this is also disappointing, as the three areas in question are among the most important in which school children are currently expected to function.

Summary

The results that were achieved by Krywaniuk (1974), Kaufman (1978), and Brailsford et al. (1984) tended to reflect the results that have been reported by Kavale (1981), Butterfield and Belmont (1977), Feuerstein et al. (1980), and others. Deficient cognitive processes appeared to be sensitive to remediation, although not all of the processes were remediated easily. Acquired skills and strategies were made to transfer to tasks that were similar to the training tasks, but the far-transfer of skills and strategies to academic tasks was much harder to generate. The far-transfer that occurred (i.e. to word recognition, math concepts, and math computation) was plainly desirable, but ways must be found

to extend far-transfer to the more critical areas of word knowledge, reading comprehension, and math problem-solving.

Alternative Approaches to the Remediation of Deficient Cognitive Processes

A Focus on Content-Specific Remediation

Direct measurement, task analysis, and transfer. Goetz and Hall (1984) have proposed an instructional model for children who are experiencing learning difficulties. This informal model has been adapted from Belmont and Butterfield (1977) and has two of their components as its central features. These are direct measurement and task analysis. By direct measurement, Belmont and Butterfield (1977) meant that the logical distance between the behaviour that is being measured and the cognitive process that is subsequently being inferred ought to be held to a minimum. This implies that cognitive operations, deficient or otherwise, should be assessed as closely and as straightforwardly as possible (Goetz & Hall, 1984). In this instance, task analysis is carried out on the training/learning tasks. It refers to the logical sequencing of those cognitive steps that are required for effective problem-solving (Goetz & Hall, 1984).

In practical terms, using direct measurement in the assessment and remediation of cognitive dysfunction means basing the procedures in valid academic skill-areas. At least three major advantages should accompany remedial programs which are carried out in this fashion. First, recommendations regarding appropriate interventions ought to emerge directly from the assessment process, thereby avoiding the need to make inferential leaps from nonacademic assessment tasks to academic instructional tasks (Meyers & Lytle, 1986). Secondly, by nesting the intervention procedures in the

academic domain in which the student's problem was initially experienced, particularly where the information processing requirements of the tasks have received detailed analysis, it should be possible to minimize the logical distance across which transfer has to occur during the application/evaluation stage. This is the procedure that is referred to by Brown and Campione (1986) as finessing the transfer problem. Finally, the ecological validity of the assessment, instructional, and evaluation tasks ought to be safe-guarded, as performance on the series of tasks, by definition, would correlate very highly with the kind and quality of performance that is required in the 'real world' of academic functioning (Swanson,1987).

An example. Cherkes-Julkowski et al. (1986) used a paired-associates learning task to teach mentally handicapped, learning disabled, and normally developing children three strategies for rehearsing and recalling pairs of pictures. Because their method involved the teaching of strategies using content-specific materials, their study serves as an example of the dynamic approach to assessment and remediation. Their results are important for three reasons. First, during the posttest, under the near-transfer condition, the performance of the children with mental handicap equaled the performance of the nonhandicapped peer group. This result reflects the findings of Campione and Brown (1987) and Vye et al. (1987). Secondly, the performance of the nonhandicapped peer group was exceeded by that of the children who had been classified as learning disabled, suggesting that dynamic forms of intervention may be particularly appropriate for children who are experiencing learning disability. Finally, problems with the far-transfer of knowledge did not disappear under content-specific remediation, implying that still other factors have to be taken into account before acquired skills and abilities can be made to transfer to cognitively related but dissimilar academic tasks.

A Focus on Metacognition

Where students have demonstrated the ability to acquire necessary skills and strategies, but where they apparently lack the ability to transfer their knowledge to academic tasks, perceptual, attentional, and /or coding dysfunctions might account for only part of the overall problem. Students who are exhibiting forms of specific learning disability frequently encounter problems when they are required: a) to search their repertoires of acquired skills and strategies, b) to select the ones that will be most effective for meeting the demands of particular tasks, and c) to apply the chosen strategies to the task at hand (Borkowski & Buchel, 1983; Brown & Campione, 1986; Cherkes-Julkowski et al., 1986; Kirby & Robinson, 1987). For such students, it is not enough to teach specific strategies, for they also need to learn when and how to apply the strategies effectively. In short, the training paradigm has to be broadened to include the remediation of executive functioning, or the more metacognitive aspects of strategy application (Borkowski et al., 1989; Brown & Campione, 1986; Butterfield & Belmont, 1977; Cavanaugh & Borkowski, 1980; Cross & Paris, 1988; Das, 1984b; Day, 1983; Kirby & Robinson, 1987; Palincsar, 1986; Paris, Cross, & Lipson, 1984; Paris & Oka, 1986; Stevens, 1988).

Metacognitive training has been described by Brown and Campione (1986) as teaching students about the use of particular strategies and skills, including the consideration of why they work and the conditions under which they work best. Palincsar (1986) has elaborated on this definition by identifying several of the components of metacognition. In Palincsar's view, these include: a) knowing one's personal strengths and weaknesses; b) being aware of the goal of a given activity; c) being able to identify potential obstacles; d) surveying one's personal repertoire of acquired strategies and skills; e) selecting the strategy that best matches the demands of the task; and f) being aware of how

well a strategy is working and when it ought to be exchanged for a new one. Most practitioners who are employing metacognitive training, either in research or in applied settings, would probably agree with the principles that underlie these definitions. However, when approaches to metacognitive training are examined, it quickly becomes apparent that specific methods of training show considerable variation.

General programs to teach learning and thinking skills. Several programs which have been designed to teach learning and thinking skills place considerable emphasis on metacognition. Odessey (Harvard University, Bolt, Beranek, & Newman, & the Republic of Venezuela, in press) is representative of one group of these programs. Odessey resembles Instrumental Enrichment (Feuerstein et al., 1980), in that it makes extensive use of global tasks (i.e. which are free of any academic content) to train the cognitive and metacognitive skills that form the basis for efficient learning. Thus, its primary objective is not to teach the content of particular academic subjects, but rather to provide the skills which will facilitate the learning of those subjects (Chance, 1986c). Odessey aims for development in four major areas: a) specific abilities such as comparing/contrasting, recognizing patterns, making inferences, and finding main ideas; b) methods of approaching tasks, such as checking work, rereading, representing problems schematically; c) knowledge of relevant facts, concepts, or principles; and d) attitudes which enhance performance. What makes Odessey very similar to programs like CoRT Thinking (deBono, 1985) and Productive Thinking (Covington, Crutchfield, Davies, & Olton, 1974) is both the list of topics that make up the curriculum and the fact that the program is taught in isolation from the academic subjects, presumably with bridging being one of the skills which are expected of the teacher. Varying degrees of success have been reported for Odessey, as well as for the other programs in the group.

However, to date, the bulk of the research has been conducted either by the authors or by those people who have been directly concerned with program implementation. In virtually every case, independent evaluations have not yet appeared (Chance, 1986a, 1986b, 1986c).

Curriculum-centred programs. A second group of programs which have also incorporated metacognitive training into their respective models have been taken in quite a different direction by their authors. Dancereau (1985), who has been working with college students, and Deshler, Alley, Warner and Schumaker (1981), who have been working with learning disabled adolescents, all suggest that metacognitive training programs ought to be curriculum-based. Students need to practice the skills and strategies that they are being expected to learn, and it makes sense to allow them to practice on the content of their regular curricula. In addition, the generalization of acquired skills to specific academic subjects will likely come about more readily if those skills are taught within the designated areas.

Mulcahy, Marfo, Peat, and Andrews (1987) have also adopted this orientation for their program, a Strategies Program for Effective Learning and Thinking (SPELT). Within the SPELT program, Mulcahy et al., like many others, stress both general learning and thinking strategies as well as strategies that are specific to certain types of problems in particular content areas. However, the SPELT program also possesses attributes which make it unique. For example, the program has been developed for students in the elementary school, a population that is somewhat younger than the one that has been receiving most of the attention in the learning disability literature. The program has been designed to be delivered by the classroom teacher. It is meant to be taught through the full range of academic subjects, not just in one or two specially designated courses. Finally, the SPELT program places heavy

emphasis on social competence, including its relationship to academic competence. Evaluation data are still coming in, but preliminary results are encouraging. After a three-year study, during which SPELT was compared to IE (Feuerstein et al., 1980) and a control condition, SPELT emerged as the superior treatment, with learning disabled students in Grades four and seven being the primary beneficiaries of the intervention.(Mulcahy et al., 1989).

Although Techniques of Learning (Dancereau, 1985) and a Strategies Program for Effective Learning and Thinking (Mulcahy et al., 1987) appear to give the students of the respective populations useful learning and thinking tools, potential problems exist. For example, in attempting to organize and simplify some rather complicated learning procedures, both programs make extensive use of acronyms and other mnemonic devices. Chance (1986d) suspects that these devices might serve to confuse students who are experiencing specific learning disabilities. In fact, there is evidence that learning disabled students, who were given fewer procedural rules to learn, acquired and generalized content-specific learning strategies more readily than peers, who were also required to learn general, self-regulatory skills (Gelzheiser et al., 1986).

The results from the Cognitive Education Project (Mulcahy et al., 1989) demonstrated that improved performance on achievement tests does not automatically accompany training in the application of metacognitive strategies. While the results from the Grade four students were very positive, the results from Grade seven were noticeably less so. The authors have not yet tried to explain why the program, which is clearly one of the most comprehensive that has ever been developed, was not able to generate widespread improvements in academic performance. Plainly, though, additional refinements to existing

programs are in order, if they are to be used for the remediation of deficient cognitive/academic functioning.

Combined Approaches

The move from global or content-free assessment and training tasks toward content-based or content-specific tasks is certainly a desirable one (Brown & Campione, 1986). At the very least it means that students learn to function, if only in a limited way, within those domains in which serious problems have been encountered. To increase the possibility that acquired skills and strategies will transfer within and across domains, however, researchers are now suggesting that content-based interventions ought to be combined with metacognitive approaches (Borkowski et al., 1989; Brown, 1990; Clay, 1985; Cross & Paris, 1988; Montague & Boz, 1986; Palincsar, 1986; Spencer,1988).

Clay. The Reading Recovery Program (Clay, 1985) was developed for children who experience difficulties with reading during their first year of school. Once they are identified, these children are given daily instruction, one-to-one, with a specially trained Reading Recovery teacher. The object of the intervention is to close the gap between the child's performance and that of an average reader in the child's age-group. To accomplish this, the child practices applying reading skills to the texts of real books which are chosen "to retain the power of semantic and syntactic richness" (Clay, 1985). In addition, the child is given practice in the use of metacognitive strategies necessary to the development of skilled reading, as well as practice in writing his or her own stories. In Clay's field-test of her program in 1978, subjects were discontinued from the program after only twelve weeks of the intervention (Clay, 1985). At that time, their performance had risen to average levels, and they were performing significantly better than a control group on almost all of the tests of

reading proficiency that were employed by Clay. These results were subsequently replicated in New Zealand (Clay, 1985), in the United States of America (Pinnell, Fried, & Estice, 1990), and in Canada (Juliebo, Norman, & Malicky, 1989).

Clay's (1985) Reading Recovery Program was never an option for the students of the current investigation. Not only were the students much older than Clay's subjects, but their reading difficulties were far too well established. However, the impressive levels of success that have appeared in the field-tests of Clay's remedial program cannot be denied. Furthermore, it is likely that this success can be attributed not only to the timing of the intervention but also to the teaching of content-based skills, and to the attention that was paid to the use of metacognitive strategies, factors that were central to the present study.

Spencer. Subjects for Spencer's (1988) study included 20 children whose ages ranged from eight to twelve years and who were attending special education classes. IQ scores were all greater than 85, but Grade Equivalent scores on a standardized test of spelling achievement ranged from only 1.0 to 3.8. Therefore, it was accurate to describe the children as being spelling disabled. The ten children who were placed in the experimental group received 20 hours of individualized cognitive skills training. The tasks were taken from the Coding, Attention, Planning (CAP) training package which is being developed by Das and Conway (Tasks under development) from the Planning, Attention, Simultaneous, Successive (PASS) Model (Das et al., 1979; Naglieri & Das, 1990). The CAP training tasks were designed to promote the development of simultaneous and successive processing ability, and were deliberately constructed to be free from any academic content. Spencer selected five of the tasks, all of which focused on successive processing, and paired each one with a similar task that was based on the academic content (i.e.

the spelling words) that she wanted the children to learn. The children then worked through the five pairs of training tasks, as they studied their spelling words. Each session also contained training in the use of metacognitive or planning strategies and ended with a cumulative spelling test. Children in the control condition received the regular program of remedial spelling activities.

When the two groups were compared at the end of the intervention phase, it was clearly apparent that the experimental group had made significant gains: a) on all measures of successive processing ability; b) on three of four measures of planning ability; and c) in their mastery of their lists of spelling words. Even more importantly, though, the experimental group demonstrated significant improvement on the standardized measure of spelling ability, which, in this case, can probably be regarded as an appropriate test of the far-transfer of acquired spelling skills. Taken together, these results represent a highly successful application of the Planning, Attention, Simultaneous, Successive (PASS) Model (Das et al., 1979; Naglieri & Das, 1990) to the remediation of spelling disability. The question to be answered now, though, is whether or not similar procedures will serve to correct other, possibly more complex, forms of academic disability.

Montague and Boz (1986) and Palincsar (1986) have been working with models of cognitive processing that are different from the one that was adopted by Spencer (1988). However, their approaches to the remediation of academic disability is similar to Spencer's, in that they have chosen to use content-specific training tasks and to balance them with metacognitive training activities. Montague and Boz (1986) were concerned with the development of a verbal math problem solving strategy which could be used by students who were experiencing difficulties with mathematics. Their approach emphasized the collection and confirmation of relevant information, hypothesis generation,

estimation/calculation, and calculation monitoring. Palincsar (1986), on the other hand, developed Reciprocal Teaching as a procedure to foster reading comprehension and comprehension monitoring in reading disabled students. While working in small groups, students were taught essential comprehension skills, such as summarizing, self-questioning, clarifying, and predicting. In addition, they were taught to identify when there had been a breakdown in their comprehension, and how to take steps to restore meaning to the passage.

The two procedures appear to have been very effective, as the authors reported not only the successful acquisition of the target skills and strategies, but also the generalization of those skills and strategies to related areas. Palincsar's results are particularly encouraging, as she reported that the mean score on a standardized test of reading comprehension moved from the 20th to the 50th percentile, that the comprehension skills and strategies generalized to social studies and science texts (Palincsar, 1986), and that academic gains across samples were maintained even when adult teachers were replaced by peer tutors (Palincsar, Brown, & Martin, 1987). That the results were influenced by training in the use of specific math or comprehension skills is obvious. However, it is also probable that they were affected by the particular format that was employed. Both procedures emphasized the use of guided practice, which included the identification of target skills or strategies, modeling, extended practice, and ongoing corrective feedback, all of which are now acknowledged to play an important role in the remediation of cognitive/academic disability (Borkowski & Buchel, 1983; Campione & Brown, 1987; Meyers & Lytle, 1986; Palincsar, 1986).

A Plan of Action

In the present study, the difficulty that the elementary school students were having with reading comprehension was approached from an information processing perspective. The particular remedial program that was investigated was based on an assumption that is prevalent in the current literature, namely that models of information processing provide an appropriate context for the assessment and remediation of academic dysfunction (Campione, Brown, & Bryant, 1985; Das, 1985; Mulcahy et al., 1986, Sternberg, 1984; Swanson, 1987). Stated more explicitly, the rationale says that, because cognitive processes underlie specific academic skills, cognitive dysfunction tends to appear as inadequate skill development. Therefore, before skill deficiencies can be corrected, it is likely that deficient cognitive processes have to be strengthened (Brown & Campione, 1986; Das, 1985)..

The specific model of information processing that was used in the present study was the Planning, Attention, Simultaneous, Successive (PASS) Model (Das et al., 1979; Naglieri & Das, 1990). This model seemed to be particularly appropriate for investigating the assessment and remediation of reading disability. The component processes of coding, attention, and planning have been researched extensively (Das & Heemsbergen, 1983; Das et al., 1988; Das et al., 1982; Naglieri & Das, 1988a, 1988b; Snart et al., 1988), as have the relationships between the component processes and specific reading abilities (Cummins & Das, 1977; Das et al., 1982; Kirby & Robinson, 1987; Naglieri & Das, 1987, 1988a, 1988b; Snart et al., 1988). In addition, there is considerable evidence that inadequate reading-skill development is positively influenced when the processes that have been identified through the application of the Planning, Attention, Simultaneous, Successive (PASS) Model

(Das et al., 1979; Naglieri & Das, 1990) are strengthened (Brailsford et al., 1984; Kaufman, 1978; Kirby & Robinson, 1987; Krywaniuk, 1974).

The three-part intervention that formed the core of the present study featured the use of global, bridging, and planning tasks. Global, or content-free, tasks have been used successfully for the remediation of deficient cognitive processes (Butterfield & Belmont, 1977; Feuerstein et al., 1980; Kavale, 1981). Attempts to use the global tasks that were derived from the Planning, Attention, Simultaneous, Successive (PASS) Model (Das et al., 1979; Naglieri & Das, 1990) for the remediation of academic, as well as cognitive, dysfunction have not been entirely successful. However, significant improvements to particular aspects of cognitive processing and academic functioning have been reported (Brailsford et al., 1984; Kaufman, 1978; Krywaniuk, 1974). As a result, the use of global tasks was continued.

Recommendations for a shift from content-free training tasks to content-based tasks have been based on sound pedagogical reasoning (Brown & Campione, 1986). In practice, content-based remedial tasks appear to have been much more useful for generating both improved cognitive functioning and the far-transfer of acquired skills to academic areas than were global tasks (Clay, 1985; Montague & Boz, 1986; Palincsar, 1986; Spencer, !988). For this reason, the use of content-based remedial tasks remained central to the present study. Furthermore, in an effort to increase the effectiveness of the intervention , each of the content-based tasks was paired for delivery with the global task from which it was derived. This technique of bridging from the cognitive domain to the academic domain was very similar to the overall strategy that characterized Spencer's (1988) program of remediation. A major difference, of course, was that the intervention was applied to the area of reading disability rather than spelling disability.

The final component of the current intervention was training in the use of metacognitive strategies, or planning. Metacognitive approaches to the remediation of both general learning difficulty and specific learning disability have become common, and their overall effect appears to be a positive one (Brailsford et al., 1984; Chance, 1986a, 1986b, 1986c, 1986d; Deshler et al., 1981; Mulcahy et al., 1989). Moreover, where metacognitive training has been incorporated into remedial programs that emphasize the use of content-based training tasks, improvements in the cognitive/ academic functioning of learning disabled students has often been dramatic (Borkowski et al., 1989; Brown, 1990; Clay, 1985; Cross & Paris, 1988; Montague & Boz, 1986; Palincsar, 1986; Spencer, 1988). Therefore, as part of the current program of remediation, the use of global and bridging tasks was supported by the use of a separate and more general class of training tasks which had been designed to foster students' abilities to generate, select, apply, evaluate and modify specific learning strategies , depending on the demands that were being faced in particular problem-solving situations.

CHAPTER III

Hypotheses, Rationale, and Definitions

Statement of the Hypotheses

Hypothesis 1: Compared to the children of the control group, the children of the experimental group will demonstrate greater improvement on selected measures of reading comprehension, following training.

Hypothesis 1A: Improvement on a standardized measure of reading comprehension will be greater under the experimental condition than under the control condition.

Hypothesis 1B: Improvement on an informal reading inventory will be greater under the experimental condition than under the control condition. Specifically, children in the experimental group will answer more comprehension questions correctly than will children in the control group,and the instructional reading levels of children in the experimental group will improve significantly over the instructional reading levels of the control children.

Hypothesis 1C: Improvement on a measure of silent reading comprehension, to be derived from a second informal reading inventory, will be greater under the experimental condition than under the control condition.

Hypothesis 2: Compared to the children of the control group, the children of the experimental group will demonstrate greater improvement on selected measures of cognitive processing, following training.

Hypothesis 2A: Improvement on the measures of simultaneous processing will be greater under the experimental condition than under the control condition.

Hypothesis 2B: Improvement on the measures of successive processing will be greater under the experimental condition than under the control condition.

Hypothesis 2C: Improvement on the measures of planning ability will be greater under the experimental condition than under the control condition.

Hypothesis 2D: Improvement on the measures of arousal/ attention will be greater under the experimental condition than under the control condition.

Hypothesis 3: Compared to the children of the control group, the children of the experimental group will demonstrate greater improvement in their evaluations of their own academic competence, following training. Specifically, improvement on a measure of perceived reading/spelling ability will be greater under the experimental condition than under the control condition.

Rationale for the Hypotheses

Cognitive processing. The relationship between cognitive process training and performance on related measures of cognitive processing has been demonstrated in a number of research projects. Significant improvement in successive processing ability has been generated in low-achieving, elementary school students, through the use of remedial programs which have emphasized successive processing strategies (Kaufman, 1978; Krywaniuk, 1974; Spencer, 1988). Similarly, simultaneous processing ability has shown significant improvement following the completion of a remedial program which included the selection and application of simultaneous processing strategies in its regimen (Brailsford, Snart, & Das, 1984; Kaufman,1978). While training spelling-disabled students in the use of successive processing strategies, Spencer (1988) also systematically taught them to engage in planful behaviour as they worked through the tasks. As a result, the students performed significantly better on three of the four measures of planning ability that were included in the study. Therefore, where successive processing, simultaneous processing, and planning were concerned, there was evidence that training in

the use of appropriate strategies would lead, in the present study, to improved scores on the marker tasks for those cognitive variables.

Although it has been acknowledged that an appropriate level of arousal (i.e. neither too much nor too little) is probably necessary for efficient cognitive functioning (Naglieri & Das, 1988a, 1988b), it was decided not to attempt to remediate attentional processes directly in the present study. There were three reasons for this decision. In the first place, a broadly based program of remediation, directed at all four areas of cognitive processing, was rejected in favour of a remedial program that focused more specifically on simultaneous processing and planning, two areas that appear to be especially critical to the development of reading comprehension ability (Cummins & Das, 1977; Das, 1984b; Das et al., 1982; Kirby & Robinson, 1987; Snart et al., 1988; Solan, 1987).

Secondly, empirically based studies in the area of arousal/attention are in an emergent state, at best. To date, effective measures of selective and sustained attention, behavioural correlates of the arousal function (Naglieri, & Das, 1988b; Snart, Das, & Mensink, 1988), have simply not been researched adequately (Das, Mensink, & Janzen, 1990). Without such measures, it has become extremely difficult to demonstrate in an empirical sense: a) that arousal/ attention exists as a separate factor within the Planning, Attention, Simultaneous, Successive (PASS) Model (Das et al, 1979; Naglieri & Das, 1990), and b) that attentional difficulties are susceptible to remediation. Therefore, the direct targeting of attentional processes for remediation was considered to be somewhat premature, at this time.

Finally, there was reason to believe that the successful remediation of the coding and planning functions would, in itself, contribute substantially to improvement in the ability to attend. This belief was based on the theoretical

relationships that are presumed to exist among the four major components of the Planning, Attention, Simultaneous, Successive (PASS) Model (Das et al, 1979; Naglieri & Das, 1990). Das (1984a, 1988) has stated that, while coding, arousal/ attention, and planning most definitely exist as distinct functions, they are also intertwined in the sense that proficiency in any one of the areas can't help but influence performance in the other two. By way of example, he has suggested that, as the ability to encode incoming information improves, planning ability is positively affected, and vice-versa. From this it should follow that improvements in the ability to encode information, either simultaneously or successively, and to plan effectively should lead to improvement in the ability to attend to the task at hand.

Closer consideration of the general nature of the planning and coding strategies should serve to make the relationship between arousal/ attention and the other cognitive functions somewhat more explicit. For example, attempts to foster planful behaviour have involved, among other things, encouraging children: a) to attend to the most relevant aspects of the task; b) to select from a variety of potentially helpful strategies those that appear to be most appropriate; and c) to follow each task through to a successful conclusion. Clearly the first two objectives involve the development of selective attention, while the third would have to contribute to the development of sustained attention. With respect to coding, the improvements in the ability to encode incoming information that have been documented by Krywaniuk (1974), Kaufman (1978), Brailsford et al. (1984), and Spencer (1988) should, almost by definition, lead to a pronounced decrease in the levels of frustration which are customarily experienced by children with learning difficulties. This should also contribute to improvements in sustained attention, as greater competence at processing

information should allow many more reading disabled children to pursue tasks of increasing complexity to completion.

Reading comprehension. The use of content-free tasks for the purpose of strengthening deficient cognitive processes has also led to significantly improved performance on some academic tasks. Krywaniuk (1974) and Kaufman (1978) both emphasized successive processing in their remedial programs and were both able to generate improved levels of word recognition in their treatment groups. Similarly, Brailsford et al. (1984) were able to demonstrate improved [illegible]ional reading levels following participation in a remedial program th[illegible]n successive and simultaneous processing. While working with sp[illegible]abled students, Spencer (1988) was able to provide even clearer e[illegible]ce of the transfer of cognitive processing skills to academic tasks. By pairing content-free training tasks with content-specific tasks and then delivering them in a program that emphasized the efficient use of planful behaviour, Spencer was able to bring about significantly improved performance on both criterion-referenced and standardized tests of spelling ability.

In the case of Spencer's (1988) study, it is likely that the use of content-specific or bridging tasks for the purpose of training deficient cognitive processes contributed to improved performance on academic tasks because of a decrease in transfer distance. That is, the post-training adjustment that had to be made by the children in the processing and completion of their academic tasks was probably diminished as a result of the use of training tasks that were based on and therefore highly relevant to the children's regular academic program. The other contributing factor was, no doubt, the emphasis that was placed on the use of planful behaviour during the completion of both the content-free and the content-specific training tasks.

In view of Spencer's (1988) success with successive processing, planning, and spelling achievement, it seemed reasonable, during the current investigation, to expect a similar pattern of results regardless of the academic area that was targeted for improvement, as long as: a) there was a strong relationship between the cognitive processes that were being trained and the skills that were required to complete the academic tasks; and b) the training tasks were based on the content of the academic area that was being addressed. Therefore, with students who were experiencing serious problems in the area of reading, improved levels of reading comprehension were expected to follow from a remedial program that: a) focused on the successive processing and the simultaneous processing of information; b) employed content-free training tasks which had been paired with related tasks which were also based on specific reading comprehension skills; and c) actively encouraged the development of planful behaviour as well as the development of selective and sustained attention.

Perception of ability. As the children progressed through the series of global and bridging tasks, their cognitive processing abilities should have improved, and the tasks should have become progressively easier to complete. Although the rate of success should have had a positive influence on the children's perception of their ability to deal with the tasks, improvements in this regard were not left to chance. As part of the program to induce and reinforce appropriate planful behaviour and, thereby, to correct possible deficiencies in the children's planning ability, a mediator intervened to help the children organize their strategic behaviour (Das, Snart, & Mulcahy, 1982). This means that the mediator helped the children to become aware of the problem to be solved, to control any premature responses, to select appropriate strategies, and to evaluate the results of their actions (Das, 1984b). In other words, the

children received constant feedback as they moved through the steps toward successful completion of the individual tasks. Therefore, because deliberate attempts were made to make the children aware of the kinds of improvement that were taking place, and because a major portion of the training program was based on activities that are conventionally used to develop reading comprehension skills, it seemed reasonable to expect that there would be significant improvements in the children's perceptions of their own ability to deal with both cognitive processing and academic tasks.

Operational Definitions of the Variables

Simultaneous processing involved the organization of incoming units of information into a quasi-spatial scheme (Das & Varnhagen, 1986). Thus at the perceptual, mnestic, or conceptual levels, each element could have been interpreted in isolation, in relation to any other element or group of elements, or as part of a single whole (Naglieri & Das, 1988a). The essential nature of this form of encoding was, therefore, that any portion of the result was surveyable or accessible to inspection at the time of processing (Das, 1988).

Successive processing involved the organization of incoming units of information into sequences, with the relationships between the various elements being temporal rather than spatial (Snart, Das, & Mensink, 1988). This chain-like arrangement of the elements implies that the individual pieces of information could only be accessed linearly, as any given element in the chain was related only to the element that preceded it and to the one that followed it (Das, & Varnhagen, 1986; Naglieri, & Das, 1988a).

Planning referred to the ability to invoke strategic behaviour in the face of a particular problem or task (Das, Snart, & Mulcahy, 1982; Snart, Das, & Mensink, 1988). Typically this involved the generation and/or selection of an appropriate strategy, the execution of the selected strategy, the evaluation of the

effect of one's own behaviour and possibly the related behaviour of others, and the tendency to act on the basis of one's overall evaluation (Das, 1984a).

Arousal/attention. Arousal was defined as the nonspecific state of alertness that is necessary for the reception and analysis of information and for the proper regulation of mental activity (Naglieri, & Das, 1988b). It is psychologically expressed in the attentional processes which are specifically directed toward objects or ideas (Das, 1988; Naglieri, & Das, 1988b). Attention can be manifested in two forms, either sustained or selective. Sustained attention refered to the maintenance of one's concentration over a prolonged period of time, while selective attention refered to the ability to discriminate relevant from irrelevent stimuli without becoming distracted (Snart, Das, & Mensink, 1988).

Global training tasks were derived from tasks that were used to assess simultaneous and successive processing ability. They were related to the assessment tasks in the sense that they had been constructed to tap the same processing abilities (i.e. either simultaneous or successive). However, they were also different in that there had been alterations in their content and format. This had been done to ensure that performance on the assessment tasks following training would require the near-transfer of acquired skills and not just their maintenance across similar situations. The global tasks were also constructed to be free from academic content. This was done to minimize the influence of any given child's store of knowledge on the successful performance of the training tasks.

Bridging tasks were derived from specific global tasks and were also used to strengthen deficient cognitive functions. They were content-specific in that their content had been adapted from one of the areas (i.e. Reading) in which the children were customarily expected to function during their years in

school. The use of content-specific training tasks in this way was intended to help bring about the far transfer of acquired coding skills to the academic area in which the children were experiencing difficulty.

Reading difficulty was defined as a level of reading comprehension which was two to three and one-half years below the student's current grade level.

Chapter IV

Method and Procedures

Subjects

A total of sixteen subjects participated in the study. Eight were included in the experimental group, and eight served as controls. The subjects were selected according to the following criteria:

1. All subjects had been placed in either Grade 5 or Grade 6 for the 1989/90 school year;

2. All subjects had levels of reading comprehension that were two to three and one-half years below grade level;

3. The word recognition skills of all subjects were at a Grade 3 level or higher.

4. All subjects were at least 9 years 9 months of age, but no older than 12 years 11 months;

5. All subjects had IQ scores that fell within the range of 86 to 115, once the standard error of the instrument had been taken into account; and

6. All subjects were eligible for placement in a resource program for the 1989/90 school year, with placement having been based on the assessed levels of reading comprehension and intellectual functioning.

Once they had been selected, the subjects were randomly assigned to either the experimental condition or the control condition.

Independent Variables

Initially school records and the recommendations of resource personel were used to identify those students who qualified for consideration as subjects, based on their grade level, age, level of intellectual functioning, level of reading comprehension, and level of word recognition. Once the actual subjects had been selected and the specified levels of functioning had been confirmed, the

children were randomly assigned either to the experimental condition or to the control condition. Under the experimental condition, children were included in a training program which consisted of three types of activities. A series of paired global and bridging tasks were used to train simultaneous processing, successive processing, and planning ability. As the children proceeded through these tasks, they were also engaged in sequences of verbal interaction specifically designed to further en age the development of both attentive and planful behaviour.

IQ. Because it seemed reasonable to expect that the students might have problems with expressive vocabulary, IQ was assessed by means of the nonverbal battery of the Canadian Cognitive Abilities Test, Form 3 (Thorndike & Hagen, 1982). This is the Canadian revision of the well-known Cognitive Abilities Test (Thorndike & Hagen, 1978-83) which is considered to be particularly effective for assessing learning ability where psychosocial and/or linguistic problems interfere with academic achievement (Constantino, 1989). The internal consistency reliability coefficient (i.e. Kuder-Richardson Formula 20) for the nonverbal battery is .90. The only estimate of concurrent validity that has been provided is the correlation of .64 with the composite score (i.e. grade equivalent) of the Canadian Test of Basic Skills. This value is considered to be somewhat low but, nevertheless, acceptable (Cummings, 1989).

Where the results of the group cognitive abilities test were too low to be considered valid, the Peabody Picture Vocabulary Test-Revised (Dunn & Dunn, 1981) was administered individually. Although this test of receptive vocabulary is no longer being recommended for use as an IQ test (McCallum, 1985; Wiig, 1985), correlations of .72 with the Stanford-Binet Vocabulary Subtest and .69 with the WISC Vocabulary Subtest (Dunn & Dunn, 1981) suggest that, where alternatives are limited, it might at least serve as an indicator of general

cognitive functioning. With regard to reliability, the split-half coefficients for ten to twelve year olds range from .77 to .86, with the mean values for Forms L and M being .82 and .85 respectively.

Reading ability. Levels of word recognition and reading comprehension were confirmed by means of the Gates-MacGinitie Reading Tests: Canadian Edition, Level D, Form 1 (MacGinitie, Kamons, Kowalski, MacGinitie, & MacKay, 1980). This same test was used to look for improvements in word knowledge and reading comprehension following training. A detailed discussion of the subtests is included under Dependent Variables: Reading comprehension.

Global tasks. Two sets of global or content-free tasks had been used to modify the cognitive functioning of students who were experiencing difficulties with reading comprehension (Brailsford, Snart, & Das, 1984; Das & Conway, tasks under development). Many of these tasks were also used in the present study. One group of seven tasks focused on simultaneous processing. A second group of three tasks emphasized successive processing. These ten tasks are described in Appendix 2.

Bridging tasks. Three separate bridging tasks were derived from each of the global tasks described in Appendix 2. The bridging tasks preserved the focus (i.e. simultaneous or successive processing) and the underlying approach of the global tasks from which they were derived. However, they were constructed to be content-specific (Das, 1984b) as opposed to being content-free. All of the bridging tasks have been described in Appendix 3.

Individual training sessions involved the presentation of one of the global tasks paired with one of the associated bridging tasks. Training proceeded until all of the global tasks had been presented once. Upon completion of the first series of sessions, a second cycle began. At that time each global task was

paired with the second of the three associated bridging tasks. A third cycle of training sessions was implemented similarly.

Planning tasks. As the children progressed through the paired global and bridging tasks, they were encouraged to engage in planful behaviour. Specifically, they were encouraged: a) to paraphrase directions before proceeding with any given task, b) to identify the demands of the task, c) to suggest alternative strategies for satisfying the task demands, d) to select and implement the most appropriate strategy, and e) to evaluate the strategy upon completion of the activity.

Control condition. In the control condition, children participated in the regular resource program, where the focus was on the remediation of their reading difficulties.

Dependent Variables

Selected subtests from the Das-Naglieri: Cognitive Assessment System Experimental Test Battery (Das & Naglieri, 1989) were used to assess four areas of cognitive functioning: simultaneous processing, successive processing, planning, and attention. Reading comprehension was assessed by means of: a) the Gates-MacGinitie Reading Tests (MacGinitie et al., 1980); b) the Evaluation Strategies of the Diagnostic Reading Program (Alberta Education, Student Evaluation Branch, 1986); and c) informal reading inventories which have been developed by Burns and Roe (1985). The Student's Perception of Ability Scale (Boersma & Chapman, 1977) was also used to identify possible improvements in students' perceptions of their own competence in dealing with reading and spelling tasks.

Planning ability was assessed by means of the Visual Search and Planned Connections subtests of the Das-Naglieri: Cognitive Assessment System Experimental Test Battery (Das & Naglieri, 1989). These subtests have

been described in Appendix 1A. The subtests have been found to load on a factor which is separate from the simultaneous and successive factors and which has been called planning (Das, Mensink, & Janzen, 1990). Based on the data that was collected from 140 students in Grades 5 and 6, Das, Mensink and Mishra (1990) have indicated that the relevant internal consistency reliability coefficients (i.e. Cronbach's Alpha) are .70 for Planned Connections, and .58 for Visual Search

Simultaneous processing was assessed by means of three subtests from the Das-Naglieri: Cognitive Assessment System Experimental Test Battery (Das & Naglieri, 1989), namely: Simultaneous Verbal, Figure Memory, and Matrices. These tasks have been described in Appendix 1B. In factor analytic studies, Figure Memory and Matrices have been found to load consistently on a single factor which has been called simultaneous (Das, Kirby, & Jarman, 1979; Naglieri, & Das, 1988a). Results from a recent study involving 160 Grade 6 students (Naglieri, & Das, 1987) have identified internal consistency reliability coefficients (i.e. Cronbach's Alpha) of .72 for Figure Memory, and .83 for Matrices. Simultaneous Verbal is the most recent adaptation of the Tokens task. Although the relevant data is not yet available for Simultaneous Verbal, it is available for Tokens. Tokens has also been found to load on the simultaneous factor and to have an internal consistency reliability coefficient of .89 (Das et al., 1990).

Successive processing. The subtests that were used to measure successive processing ability included Word Series, Sentence Repetition, and Color Ordering from the Das-Naglieri: Cognitive Assessment System Experimental Test Battery (Das & Naglieri, 1989). Descriptions of these tasks have been included in Appendix 1C. It has been demonstrated that Word Series and Color Ordering load consistently on a single factor which has been

labelled successive (Das, & Cummins, 1982; Naglieri, & Das, 1988a). On the basis of data collected from 160 sixth-grade students, internal consistency reliability coefficients (i.e. Cronbach's Alpha) for Word Series and Color Ordering have recently been calculated at .87 and .82 respectively (Naglieri, & Das, 1987). Sentence Repetition has been included in the experimental test battery because it too has been found to load on the successive factor.

Attention was assessed by means of the Expressive Attention subtest and the Receptive Attention subtest of the Das-Naglieri: Cognitive Assessment System Experimental Test Battery (Das & Naglieri, 1989). The Expressive Attention subtest represents an adaptation of a colour naming test which has frequently been used as a test of speed of processing. It has been demonstrated by Das (1984a) that these kinds of tests load on a factor that is distinct from simultaneous, successive, and planning factors. In addition, Das et al.(1990) have found that the Expressive Attention subtest and the Receptive Attention subtest of the Das-Naglieri: Cognitive Assessment System Experimental Test Battery (Das & Naglieri, 1989) both load on the same factor. This factor has been called attention. These two subtests were therefore used to assess level of attention in the present study. Descriptions of the subtests have been included in Appendix 1D. The internal consistency reliability coefficients that have been obtained by Das et al. (1990) from their study of 140 students from grades 5 and 6 are .84 for Receptive Attention (time) and .70 for Expressive Attention.

Reading comprehension was evaluated by means of three different instruments. The Gates-MacGinitie Reading Tests: Canadian Edition, Level D, Forms 1 and 2 (MacGinitie et al., 1980) were used to provide a quantitative estimate of both level of word knowledge and level of reading comprehension. Level D has been designed for use with children who are functioning from

Grade 4.0 to Grade 6.9. The vocabulary subtest which assesses word knowledge consists of 45 items, each of which requires the student to select, from a list of five alternatives, the synonym that correctly matches the target word. Internal consistency reliability coefficients (Kuder-Richardson Formula 20) which correspond to the three grade levels which were under consideration are .87 for Grade 4.2, .90 for Grade 5.2, and .90 for Grade 6.2. The reading comprehension subtest consists of sixteen passages which have been chosen from published sources and which represent the range of materials customarily encountered throughout Grades 4 to 6. There are a total of 43 questions, 55% literal and 45% inferential, each of which is presented with four possible answers. The internal consistency reliability coefficients (Kuder-Richardson Formula 20) for Grades 4.2, 5.2, and 6.2 are .87, .89, and .89 respectively. The Canadian edition is considered to be particularly useful for assessing the reading levels of children who are being educated in Canada because: a) it contains vocabulary and content which is identifiably Canadian; and b) it has been standardized on a population of 46,000 Canadian children.

The evaluation component of the Diagnostic Reading Program (Alberta Education, Student Evaluation Branch, 1986) consists of forty-eight graded reading passages (i.e. mid-Grade 1 to Grade 6) and six evaluation strategies which have been designed to assess important aspects of reading behaviour. These include general proficiency, decoding and fluency, recalling thought-units, comprehension, using closure, and verifying content. The passages have been arranged into four forms (i.e. Forms A, B, C, and D), with each form consisting of two passages per grade level. The vocabulary level and the readability level of the reading passages were established and verified by means of extensive field-testing and a pilot project, all of which took place between June, 1984 and May, 1986 (Alberta Education, 1986). Similar means

were used to establish the reliability and validity of the evaluation strategies between the fall of 1984 and May, 1986 (Alberta Education, 1986). Approximately 7,600 elementary school children in 297 classrooms in the Province of Alberta were involved in each round of field-testing. For this reason, the Diagnostic Reading Program (Alberta Education, Student Evaluation Branch, 1986) is considered to be particularly appropriate for assessing the reading performance of Canadian school children.

In the present study, the Comprehension Questions Strategy was selected to assess the students' levels of oral reading comprehension. At pretest, students' responses to the strategy were used to identify the corresponding instructional reading levels. This measure was then used to verify the equivalence of the experimental and control groups prior to the implementation of the intervention. Following the intervention, there was not sufficient time to recalculate instructional reading levels for all of the students. Therefore, the Comprehension Questions Strategy was modified to provide an oral reading comprehension score. This was accomplished by having the students read two preselected passages, one from Grade 3 and one from Grade four. The number of correct responses to the accompanying questions was then totalled across the two passages for each student, and the resulting composite scores were used to check for significant differences at posttest.

The informal reading inventories of Burns and Roe (1985) include 28 graded word lists (i.e. preprimer to Grade 12, Forms A and B) and 56 graded passages (i.e. preprimer to Grade 12, Forms A, B, C, and D). Each of the graded passages is accompanied by eight or ten comprehension questions. For each passage, the level of difficulty has been controlled by means of an appropriate readability formula. The informal reading inventories yield three possible estimates of reading level (i.e. independent, instructional, and

frustration) which are expressed as grade equivalents. The reading inventories also provide a word recognition score and three comprehension scores (i.e. oral reading comprehension, silent reading comprehension, and average comprehension). These scores are all expressed as percentages of the total number of correct items. For the purposes of the present study, silent reading comprehension was assessed across four grade levels (i.e. Grades 2, 3, 4, and 5). The individual scores were combined to form a reading comprehension composite, and the composite scores were then examined for improvement from pretest to posttest.

Perception of academic competence. The Student's Perception of Ability Scale (Boersma & Chapman, 1977) is a 70 item questionnaire on which students are asked to evaluate their own academic competence in six areas. Only one of the subscales was examined in the present study; that was the Reading/ Spelling subscale. Factor analysis has confirmed that all of the subscales are independent of each other but are strongly related to the full scale score which reflects general perception of ability. With regard to internal consistency, Boersma and Chapman (1977) report values for Cronbach's Alpha of .915 for the full scale and .855 for the Reading/Spelling subscale. Coefficients of test-retest reliability were .834 for the full scale and from .714 to .824 for the subscales. Of all the subscales, the Reading/Spelling subscale was found to be the most stable and internally consistent (Boersma & Chapman, 1977).

Procedures

Timeline. February 12-20, 1990: Selection of sample.

February 21-March 23: Administration of pretest battery.

April 4-June 7: Intervention .

June 11-28: Administration of posttest battery.

Selection of the sample. The criteria for eligibility (i.e. grade level, reading level, age, IQ, and placement in a resource program) were presented to the principals and resource teachers of the co-operating schools. These people used school records, their own experience with under-achieving students, and input from classroom teachers to compile a list of 24 suitable candidates. The standardized reading tests from the pretest battery were then used to verify the reading levels of the candidates. Because recent IQ scores were not available, levels of intellectual functioning were estimated by means of the nonverbal battery of the Canadian Cognitive Abilities Test (Thorndike & Hagen, 1982) and/or the Peabody Picture Vocabulary Test-Revised (Dunn & Dunn, 1981).

Eight students had to be dropped from consideration for one or more of the following reasons: assessed level of reading comprehension at or above grade level (i.e. two students), assessed level of reading comprehension less than two years below grade level (i.e. two students), word recognition skills below Grade 3 level (i.e. two students), severe behaviour problems (i.e. one student), and noncompliance (i.e. one student). The sixteen students who qualified for inclusion in the study were then randomly assigned either to the experimental condition (i.e. n=8) or to the control condition (i.e. n=8).

The pretest battery was administered according to the following schedule:

Days 1 to 10: Selected subtests of the Das-Naglieri: Cognitive Assessment System Experimental Test Battery (Das & Naglieri, 1989).

Days 11 to 15: Evaluation Strategies from the Diagnostic Reading Program (Alberta Education,Student Evaluation Branch, 1986).

Days 16 and 17: Informal Reading Inventory: Form A (Burns & Roe, 1985).

Day 18: Student's Perception of Ability Scale (Boersma & Chapman, 1977).

Remedial training. Each student was seen for a forty-five minute remedial session, every other day. During any given session, the student spent approximately five minutes on a selected global training task and fifteen minutes on the associated bridging task. This procedure was then repeated for a second set of paired training tasks. Five minutes at the end of the session were usually reserved for recapping the activities of the day. At the end of five days, when the students had been exposed to all ten of the global training tasks, the global tasks were paired with new training tasks and the cycle was repeated. This same procedure was followed two more times, resulting in a total of four full cycles of training. The training period extended to a total of 20 sessions, and the training regimen required a total of nine weeks to complete. Toward the end of the second cycle of the intervention, Informal Reading Inventory: Form B (Burns & Roe, 1985) was administered to all participants.

Bridging tasks. In the drafting of the bridging tasks, a concerted effort was made to keep the reading exercises at an appropriate level of difficulty. Where the tasks required the reading of single words or phrases, the EDL Core Vocabularies (Taylor, Frackenpohl, White, Nieroroda, Browning, & Birsner, 1979) were used to ensure, to the greatest extent possible, that the vocabulary did not exceed a Grade 4 level of difficulty. Where the tasks required the reading of sentences or short passages, a similar effort was made to control the vocabulary that had been employed. In addition, the readability of all passages was kept at a level which was appropriate for students in Grade 4 or lower. Because vocabulary level had been controlled so closely, Fry's readability formula was considered to be most appropriate for the purpose.

Control condition. Students in the control condition participated in the regular resource program. For each child, this meant meeting with a teacher's aide, in a group of three to five students, for a thirty to forty-five minute period, three of four times every six-day cycle. Specific task demands varied somewhat from group to group, but, in the main, the children were expected to complete series of paper-pencil activities which were selected from various workbooks and which emphasized vocabulary development, decoding skills, structural analysis skills, comprehension skills, and thinking skills. Direct observation of group activities suggested that the preferred format included reading a short passage or exercise, completing an accompanying written activity, and then correcting the activity with the group. Toward the end of the second cycle of the intervention, Informal Reading Inventory: Form B (Burns & Roe, 1985) was administered to all participants.

The posttest battery was administered according to the following schedule:

Days 1 to 5: Selected subtests of the Das-Naglieri: Cognitive Assessment System Experimental Test Battery (Das & Naglieri, 1989).

Days 6 and 7: Vocabulary and Comprehension subtests of the Gates-MacGinitie Reading Tests: Canadian Edition, Level D, Form 2 (MacGinitie et al., 1980).

Student's Perception of Ability Scale (Boersma & Chapman, 1977).

Days 8 to 10: Evaluation Strategies from the Diagnostic Reading Program (Alberta Education,Student Evaluation Branch, 1986).

Days 11 and 12: Informal Reading Inventory: Form D (Burns & Roe, 1985).

Data Analysis

Part one. The small size of the sample, coupled with the comparatively large number of dependent measures that were necessary to the evaluation of student performance, made it impossible to proceed directly to statistical analysis of the data. Therefore, the first level of data analysis involved a visual inspection of the group differences on all of the identified variables. For the reading comprehension variables, mean differences at pretest and at posttest were calculated and examined. For the cognitive processing and perception of ability variables, differences in the mean gain scores were calculated and examined. In some cases, mean differences favoured the control group. In other cases, they favoured the experimental group but were of negligible magnitude (i.e. In four cases, the mean difference favouring the experimental group represented an improvement of less than five percent over the score at pretest.). Where either of these two conditions appeared, a lack of support for the corresponding research hypotheses was assumed, and they were subsequently dropped from further analysis.

Part two. Some of the mean differences which favoured the experimental group were judged to be sufficiently large to warrant further examination (i.e. In each of four cases, the mean difference represented an improvement of more than eight percent over the score at pretest and/or the total possible score on the measure.). These data were moved to the next level of analysis. For those hypotheses which pertained to reading comprehension, SPSS-X One Way Anova (SPSS-X Inc.,1988) was used to test for the equivalence of the experimental and control groups at pretest. The same program was then used to test for significant treatment effects at posttest. This procedure had to be followed because the pretest and posttest measures were not identical and could not, therefore, be incorporated into a repeated measures design. For the areas of cognitive processing and perception of ability, on the other hand, SPSS-X Anova with repeated measures, a subprogram within SPSS-X Manova

(SPSS-X Inc., 1988), was used to test for significant differences, with Factor A being groups (i.e. Experimental vs. Control) and Factor B being time (i.e. Pretest vs. Posttest).

Part three. Because it can be very difficult to achieve statistical significance when working with small numbers of subjects, particularly where large variances also appear in the data, it was decided to test the hypotheses with a series of nonparametric procedures. A box plot (See Figure 3) provides an interesting and informative way to look at a series of scores on a given variable.

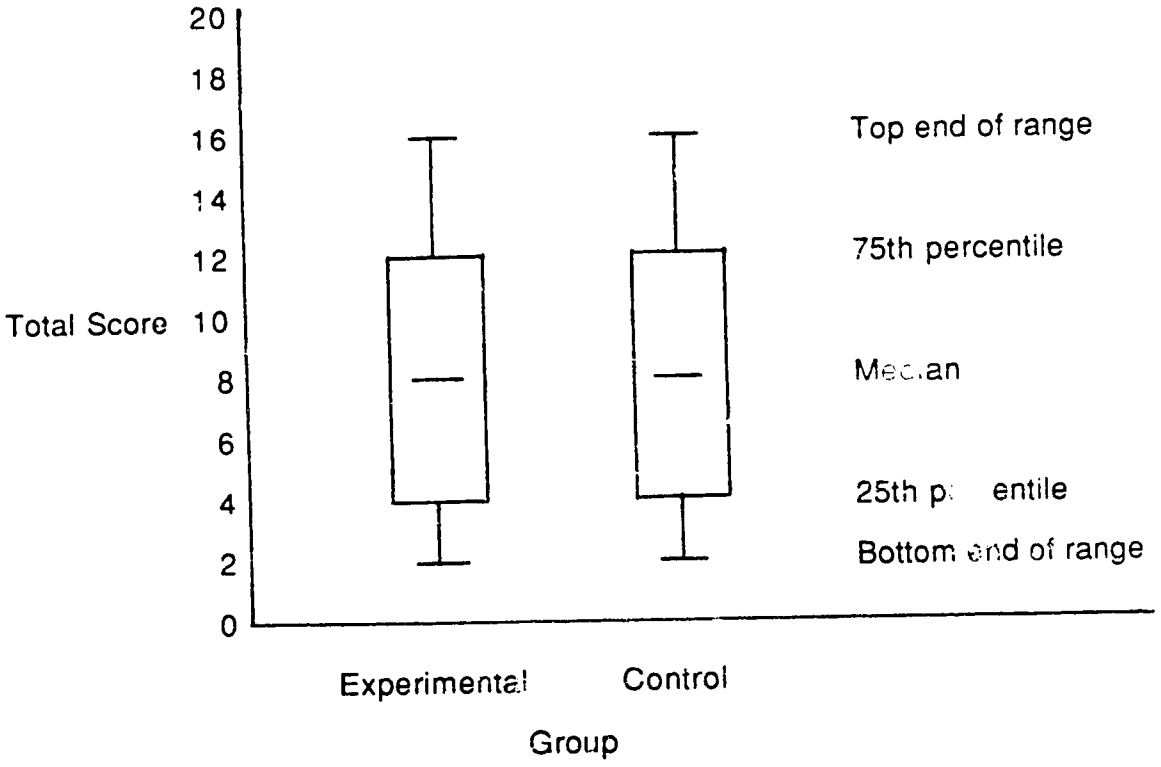

Figure 3. Sample box plots.

It graphically illustrates the median, the interquartile range, which is bounded by the 25th and 75th percentiles, and the extreme scores at the upper and lower ends of the distribution. Improvement following treatment is indicated on a box plot by the movement of both the median and the interquartile range in the predicted direction, and, in certain instances, by the compacting of the box, representing greater

homogeneity of the scores lying within the interquartile range. Comparison of the box plots of a control group and an experimental group at pretest should reveal similar configurations. At posttest, though, the improvement of the experimental group relative to the control group should be apparent in the clear separation of the respective medians and interquartile ranges.

In the current study, Boxplot, a subprogram within SPSS-X Manova (SPSS-X Inc., 1988), was employed to create boxplots for both groups on each of the target variables. Where there appeared to be noticeable separation of the medians and or the interquartile ranges at posttest, but little or no separation at pretest, the corresponding hypotheses were tested by means of the Median Test and the Mann-Whitney U Test, two subprograms of SPSS-X Npar Tests (SPSS-X Inc., 1988). As its name implies, the Median Test assesses whether or not the medians of two groups are significantly different. The Mann-Whitney U Test, on the other hand, assesses whether there have been significant changes in the rank order of a set of scores following treatment. The latter test is regarded as being one of the most powerful of the nonparametric tests and as a useful alternative to parametric analysis (Siegel & Castellan, Jr., 1988).

Chapter V

Results

Introduction

Table 1 presents the mean scores of the experimental and control groups at pretest and posttest, as well as the mean difference scores at pretest and posttest, for the reading comprehension variables. For Vocabulary, Comprehension, and Informal Reading Inventory, equivalent test forms were used. In the case of the Diagnostic Reading Program, a severe time constraint prevented the reassessment of instructional reading level at posttest. Therefore, instructional reading level scores were used to verify the equivalence of the experimental and control groups at pretest, while the related comprehension measure, only, was used to test for treatment effects at posttest.

Table 2 presents the mean pretest scores, the mean posttest scores, and the mean gain scores of the experimental and control groups, for the measures that were used to assess planning, simultaneous processing, successive processing, attention, and perception of ability. In addition, it presents the net gain of the experimental group over the control group on all of the measures. In all cases, the pretest measure and the posttest measure for a given variable were identical.

Hypothesis 1

> Compared to the children of the control group, the children of the experimental group will demonstrate greater improvement on selected measures of reading comprehension, following training.

Table 3 presents the results of a series of one-way analyses of variance that were run on the scores from the comprehension measures at pretest. In all cases, the between-group differences were not significant.

Table 1

Mean Scores and Difference Scores at Pretest and at Posttest for the Reading Comprehension Variables

Variable	Experimental		Control		Difference Score:
	Mean	SD	Mean	SD	Expt.-Cntl.
Vocabulary					
Pretest (/45)	15.00	3.07	15.25	4.10	-0.25
Posttest (/45)	17.00	5.40	16.38	4.17	+0.62
Comprehension					
Pretest (/43)	12.13	2.85	13.88	3.68	-1.75
Posttest (/43)	13.63	3.93	16.38	5.37	-2.75
Diagnostic Reading Program					
Instructional Reading Level (Pretest)	3.88	1.36	3.63	0.74	+0.25
Comprehension (Posttest/20)	11.88	2.48	9.88	2.36	+2.00
Informal Reading Inventory (Burns& Roe)					
Pretest (/38)	17.13	5.14	17.13	2.90	0.00
Posttest (/38)	19.00	5.73	15.25	3.69	+3.75

Note. Except for Instructional Reading Level, total scores possible are included in parentheses in the list of variables. Difference scores with a negative value indicate results which favour the control group. Difference scores with a positive value indicate results which favour the experimental group.

Table 2

Mean Pretest, Mean Posttest, and Mean Gain Scores, Experimental and Control: Cognitive Processing and Perception of Ability

Measure	Experimental Group			Control Group			
	Pretest Score	Posttest Score	Gain (Post-Pre)	Pretest Score	Posttest Score	Gain (Post-Pre)	Net Gain Expt.-Cntl.
Planning							
Visual Search: Total Time	94.88 (23.78)	82.50 (13.82)	-12.38	102.25 (14.64)	90.38 (18.80)	-11.87	+0.51
Planned Connections: Total Time	198.50 (43.68)	172.00 (42.46)	-26.50	193.50 (52.96)	166.63 (51.60)	-26.87	-0.37
Simultaneous							
Simultaneous Verbal: Correct (/26)	14.88 (1.25)	16.88 (2.42)	2.00	14.88 (1.89)	15.63 (1.51)	0.75	+1.25
Figure Memory: Correct (/24)	10.00 (1.41)	11.25 (1.28)	1.25	10.00 (1.41)	11.50 (2.45)	1.50	-0.25

Table 2 (Continued)

Measure	Experimental Group			Control Group			
	Pretest Score	Posttest Score	Gain (Post-Pre)	Pretest Score	Posttest Score	Gain (Post-Pre)	Net Gain Expt.-Cntl.
Matrices: Correct (/31)	11.75 (3.45)	11.50 (3.30)	-0.2	10.38 (2.83)	11.00 (4.21)	0.62	-0.87
Successive							
Word Series: Correct (/26)	8.13 (3.36)	9.13 (2.85)	1.00	9.75 (2.61)	12.13 (2.70)	2.38	-1.38
Sentence Repetition: Correct (/17)	5.50 (2.00)	7.13 (2.36)	1.63	5.13 (1.89)	6.50 (1.41)	1.37	+0.26
Colour Ordering: Correct (/25)	10.88 (2.42)	11.38 (1.85)	0.50	11.75 (2.77)	12.75 (2.66)	1.00	-0.50
Attention							
Stroop Ratio	0.92 (0.25)	1.05 (0.31)	0.13	1.04 (0.30)	0.92 (0.29)	-0.12	-0.25

Table 2 (Continued)

Measure	Experimental Group Pretest Score	Experimental Group Posttest Score	Experimental Group Gain (Post-Pre)	Control Group Pretest Score	Control Group Posttest Score	Control Group Gain (Post-Pre)	Net Gain Expt.-Cntl.
Receptive Attention: Correct (/100)	72.50 (7.27)	78.50 (5.04)	6.00	78.13 (8.81)	81.50 (8.04)	3.37	+2.63
Perception of Ability Reading/ Spelling: Correct (/12)	8.50 (1.69)	9.25 (2.38)	0.75	6.88 (2.48)	6.88 (2.36)	0.00	+0.75

Note. Total scores possible are included in parentheses in the list of variables, except where scores represent time to completion. Standard deviations are included in parentheses below the corresponding mean scores. Net gain scores with a negative value indicate results which favour the control group. Positive scores favour the experimental group.

Table 3

Analyses of Variance: Reading Comprehension Scores at Pretest

Variable	Source	Analysis of Variance				
		Degrees of Freedom	Sum of Squares	Mean Square	F Ratio	F Probability
Gates-MacGinitie: Vocabulary	Between Groups	1	0.250	0.250	0.019	0.892
	Within Groups	14	183.500	13.107		
	Total	15	183.750			
Gates-MacGinitie: Comprehension	Between Groups	1	12.250	12.250	1.130	0.306
	Within Groups	14	151.750	10.839		
	Total	15	164.000			

Table 3 (Continued)

Variable	Source	Analysis of Variance				
		Degrees of Freedom	Sum of Squares	Mean Square	F Ratio	F Probability
Diagnostic Reading Program: Instructional Reading Level	Between Groups	1	0.250	0.250	0.209	0.655
	Within Groups	14	16.750	1.196		
	Total	15	17.000			
Informal Reading Inventory	Between Groups	1	0.000	0.000	0.000	1.000
	Within Groups	14	243.750	17.411		
	Total	15	243.750			

Hypothesis 1A.

> Improvement on a standardized measure of reading comprehension will be greater under the experimental condition than under the control condition.

Results from the vocabulary subtest of the Gates-MacGinitie Reading Tests (MacGinitie et al.,1980) favoured the experimental group (See Table 1.), but the difference in the mean scores at posttest was only 0.62 points. This value represented an improvement of only 4.13 percent over the mean score at pretest. Results from the comprehension subtest favoured the control group. At best, these data offered only marginal support for the hypothesis. Therefore, they were dropped from further analysis.

Hypothesis 1B.

> Improvement on an informal reading inventory will be greater under the experimental condition than under the control condition. . Children in the experimental group....will answer more comprehension questions correctly than will children in the control group.

Results from the comprehension measure which was based on the comprehension questions strategy of the Diagnostic Reading Program (Alberta Education, 1986) favoured the experimental group. (See Table 1.) The mean difference of 2.00 points at posttest represents 10 percent of the possible score. The one-way analysis of variance which was performed on the posttest scores, the results of which have been reported in Table 4, revealed that the between-group difference was not significant. However, it is possible that the result of $p=0.120$ was indicative of a trend toward significance.

Table 4

Analyses of Variance: Selected Reading Comprehension Scores at Posttest

Variable	Source	Analysis of Variance				
		Degrees of Freedom	Sum of Squares	Mean Square	F Ratio	F Probability
Diagnostic Reading Program: Comprehension	Between Groups	1	16.000	16.000	2.740	0.120
	Within Groups	14	81.750	5.839		
	Total	15	97.750			
Informal Reading Inventory	Between Groups	1	56.250	56.250	2.419	0.142
	Within Groups	14	325.500	23.250		
	Total	15	381.750			

Figure 4 shows the box plots of the scores from the comprehension measure that was based on the Diagnostic Reading Program (Alberta Education, 1986). The numerals in parentheses represent the actual values of the extreme scores, the 75th percentile, the median, and the 25th percentile. There did not appear to be a marked difference between the medians of the experimental and control groups. However, because of the skewed nature of the distributions, the small number of subjects, and the large variances which appeared in the data, nonparametric analysis of the data was considered to be in order.

Results of the Median Test (See Table 5.) indicated that the medians of the experimental group and the control group are probably not significantly different, as $p=0.282$. However, results of the Mann-Whitney U Test appeared to support the possibility of a trend toward significance, with $p=0.074$.

Hypothesis 1C.

> Improvement on a measure of silent reading comprehension, to be derived from a second informal reading inventory, will be greater under the experimental condition than under the control condition.

Table 1 clearly shows that the results from the measure which was based on Informal Reading Inventory of Burns and Roe (1985) also favoured the experimental group. The mean difference of 3.75 at posttest represents 9.87 percent of the possible score. The one-way analysis of variance (See Table 4.) revealed that the between-group difference was not significant. It is likely that this result can be attributed, at least in part, to the small number of subjects and to the increased variability that became apparent in the scores of both groups from pretest to posttest. However, it is again possible that the result of $p=0.142$ is indicative of a trend toward significance.

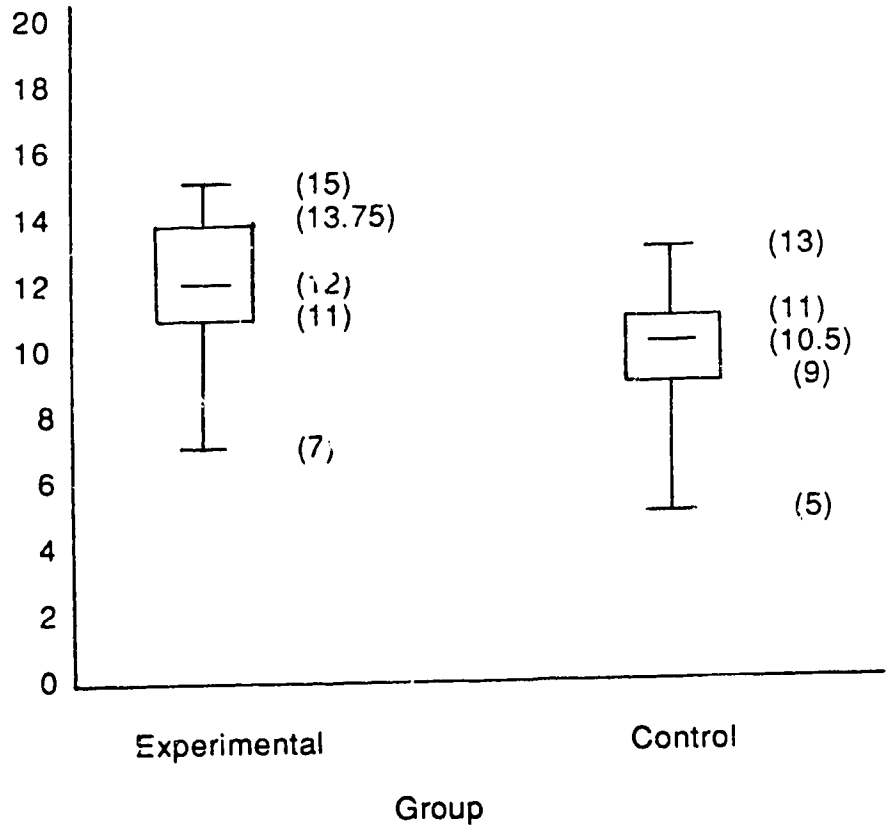

Figure 4. Box plots of the posttest scores from the Diagnostic Reading Program: Comprehension, by group.

Table 5

Nonparametric Analysis of Selected Reading Comprehension Scores at Pretest and at Posttest: Experimental vs. Control

	Median Test		Mann-Whitney U Test	
Measure	Pretest	Posttest	Pretest	Posttest
Diagnostic Reading Program:Comprehension	----	0.282	----	0.074
Informal Reading Inventory	1.000	0.041	0.832	0.057

Note. Numerical values represent the probabilities that the two samples (i.e. Experimental and Control) have been drawn from the same population (Siegel & Castellan, Jr., 1988).

Although the results from the pretest and the posttest, only, have been reported, silent reading comprehension was, in fact, assessed three times over the course of the study. The results of these assessments are illustrated in Figure 5. Form A of Informal Reading Inventory (Burns & Roe, 1985) was used prior to the beginning of the intervention (i.e. at pretest); Form B was used after three weeks of intervention; and Form C was used upon completion of the intervention (i.e. at posttest).

At pretest the means of the two groups were identical (i.e. $\overline{X}E=\overline{X}C=17.1$); after three weeks, the means were separated by 0.7 points (i.e. $\overline{X}E-\overline{X}C=11.3-10.6$); and at posttest the separation was 3.7 points (i.e. $\overline{X}E-\overline{X}C=19.0-15.3$). These data tend to support the possibility of a trend toward a significant between-group difference.

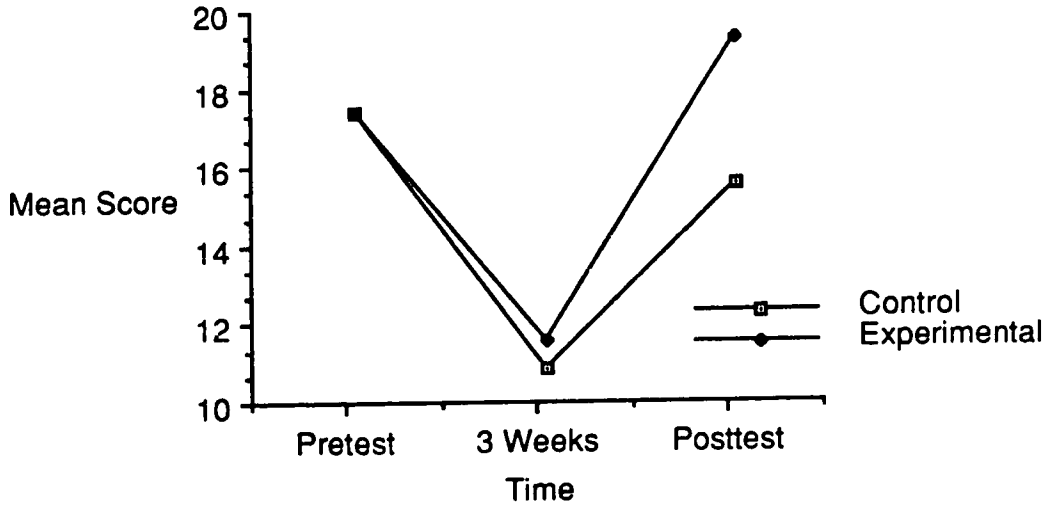

Figure 5. A comparison of the mean scores from Informal Reading Inventory over time, by group.

Figure 6 shows the box plots of the pretest and posttest scores from the measure of silent reading comprehension, with the numerals in parentheses representing the actual values of the extreme scores, the 75th percentile, the median, and the 25th percentile. At posttest, the difference between the medians of the experimental and control groups had increased substantially and become quite similar to the mean difference, while the interquartile ranges had separated noticeably.

Results of the Median Test (See Table 5.) indicated that the experimental group did, in fact, perform significantly better than the control group, with $p=0.041$. Results from the Mann-Whitney U Test, which have also been reported in Table 5, fell just short of confirming the significant difference at the 0.05 level. However, the shortfall was minimal as p equaled 0.057.

Hypothesis 2

> Compared to the children of the control group, the children of the experimental group will demonstrate greater improvement on selected measures of cognitive processing, following training.

The factor loadings which were to be used in the calculation of factor scores were not available for use in this project. Therefore, within the four areas of cognitive processing, the component measures had to be assessed individually.

Hypothesis 2A.

> Improvement on the measures of planning ability will be greater under the experimental condition than under the control condition.

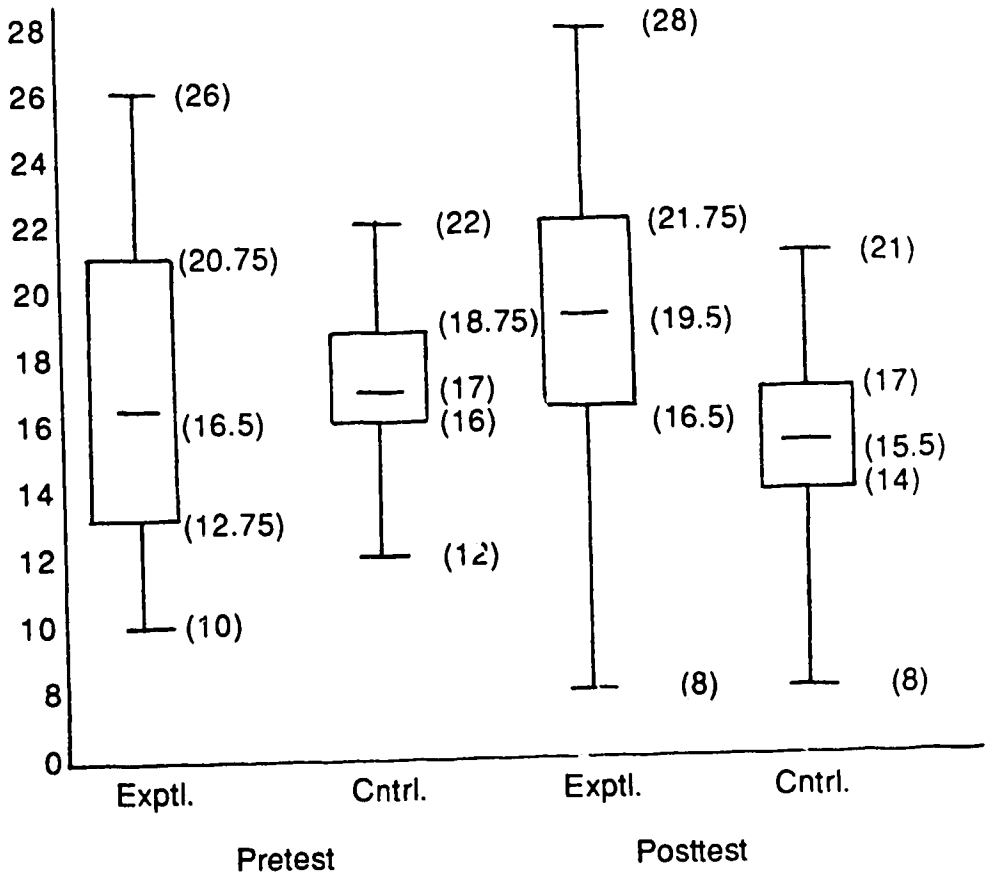

Figure 6. Box plots of the pretest-and posttest scores from Informal Reading Inventory (Burns & Roe, 1985), by group.

The two subtests of the Das-Naglieri: Cognitive Assessment System Experimental Test Battery (Das & Naglieri, 1989) which were used to assess planning ability are listed in Table 2. They were Visual Search and Planned Connections. For both groups, the mean time to completion on each task was calculated at pretest and at posttest. This was followed by the calculation of the mean gain score for each group on each task. The difference between the gain scores of the experimental and control groups was then calculated for each of the tasks and examined for significance. Results from Visual Search favoured the experimental group, while results from Planned Connections favoured the control group. However, from Table 2, it is obvious that the between-group differences were negligible. Therefore, it was concluded that there was a lack of support for the hypothesis, and the results of the two measures were dropped from further analysis.

Hypothesis 2B.

> Improvement on measures of simultaneous processing will be greater under the experimental condition than under the control condition.

Three subtests of the Das-Naglieri: Cognitive Assessment System Experimental Test Battery (Das &Naglieri, 1989) were used to assess simultaneous processing. The subtests, which are listed in Table 2, included Simultaneous Verbal, Figure Memory, and Matrices. The results from Simultaneous Verbal favoured the experimental group, with the net gain of 1.25 points representing 8.4% of the mean score at pretest. An analysis of variance with repeated measures (See Table 6.) revealed that the gain was not significant, as p equaled 0.300. Nonparametric analysis of the medians and the rank order of scores at posttest confirmed the lack of significance. Results from Figure Memory and Matrices favoured the control group, but only marginally.

Tab e 6

Analyses of Variance with Repeated Measures: Selected Scores from the Das-Naglieri: Cognitive Assessment System Experimental Test Battery (Das & Naglieri, 1989) and the Student's Perception of Ability Scale (Boersma & Chapman, 1977)

	Analysis of Variance					
Variable	Sum of Squares	Error Sum of Squares	Mean Square	Error Mean Square	F	Significance of F
CAS:Simultaneous Verbal	3.125	37.750	3.125	2.696	1.159	0.300
Perception of Ability:Reading/ Spelling	1.125	27.750	1.125	1.982	0.568	0.464

As a consequence, it was concluded that there was a lack of support for the hypothesis, and the results of all three measures were dropped from further analysis.

Hypothesis 2C.

> Improvement on the measures of successive processing will be greater under the experimental condition than under the control condition.

The three subtests of the Das-Naglieri: Cognitive Assessment System Experimental Test Battery (Das & Naglieri, 1989) which were used to assess successive processing are listed in Table 2. They were Word Series, Sentence Repetition, and Color Ordering. The results from Sentence Repetition favoured the experimental group, but the margin was small, a net gain of 0.26, representing an improvement of only 4.7% over the mean score at pretest. Results from Word Series and Color Ordering favoured the control group, also by small margins. Therefore, it was concluded that there was a lack of support for the hypothesis, and the results of all three measures were dropped from further analysis.

Hypothesis 2D.

> Improvement on the measures of arousal/attention will be greater under the experimental condition than under the control condition.

The two subtests of the Das-Naglieri: Cognitive Assessment System Experimental Test Battery (Das & Naglieri, 1989) which were used to assess arousal/attention are listed in Table 2. They were Expressive Attention and Receptive Attention. In the former case, the Stroop ratio was used as the relevant measure; in the latter, total number of correct responses was used. Results from Receptive Attention favoured the experimental group, but the net

gain of 2.63 points represented an improvement of only 3.6% over the pretest score. Results from Expressive Attention favoured the control group. As a consequence, it was concluded that there was a lack of support for the hypothesis, and the results of the two measures were dropped from further analysis.

Hypothesis 3.

> Improvement on a measure of perceived reading/spelling ability will be greater under the experimental condition than under the control condition.

On the Reading/Spelling subtest of the Student Perception of Ability Scale (Boersma & Chapman, 1977), the net gain of the experimental group over the control group (See Table 2.) was 0.75 points. This value represents an improvement of 8.8% over the mean score of the experimental group at pretest. However, as indicated in Table 6, the improvement was not significant (i.e.p=0.464). Once again, it is likely that this result can be attributed, at least in part, to the small number of subjects and to the increased variability that became apparent in the scores of the experimental group from pretest to posttest. (See Figure 7.)

Examination of Figure 7 also shows that the median of the experimental group exceeded that of the control group by 2.0 points at pretest and by 3.5 points at posttest. Furthermore, at posttest the apparent advantage of the experimental group was reinforced by the almost complete separation of the interquartile range from that of the control group. Although the results of the Median Test did not reveal the between group difference to be a significant one, (See Table 7.), it did indicate the possibility of a trend in that direction, with p=0.132. Results of the Mann-Whitney U Test appeared to support the trend, as p was found to equal 0.069.

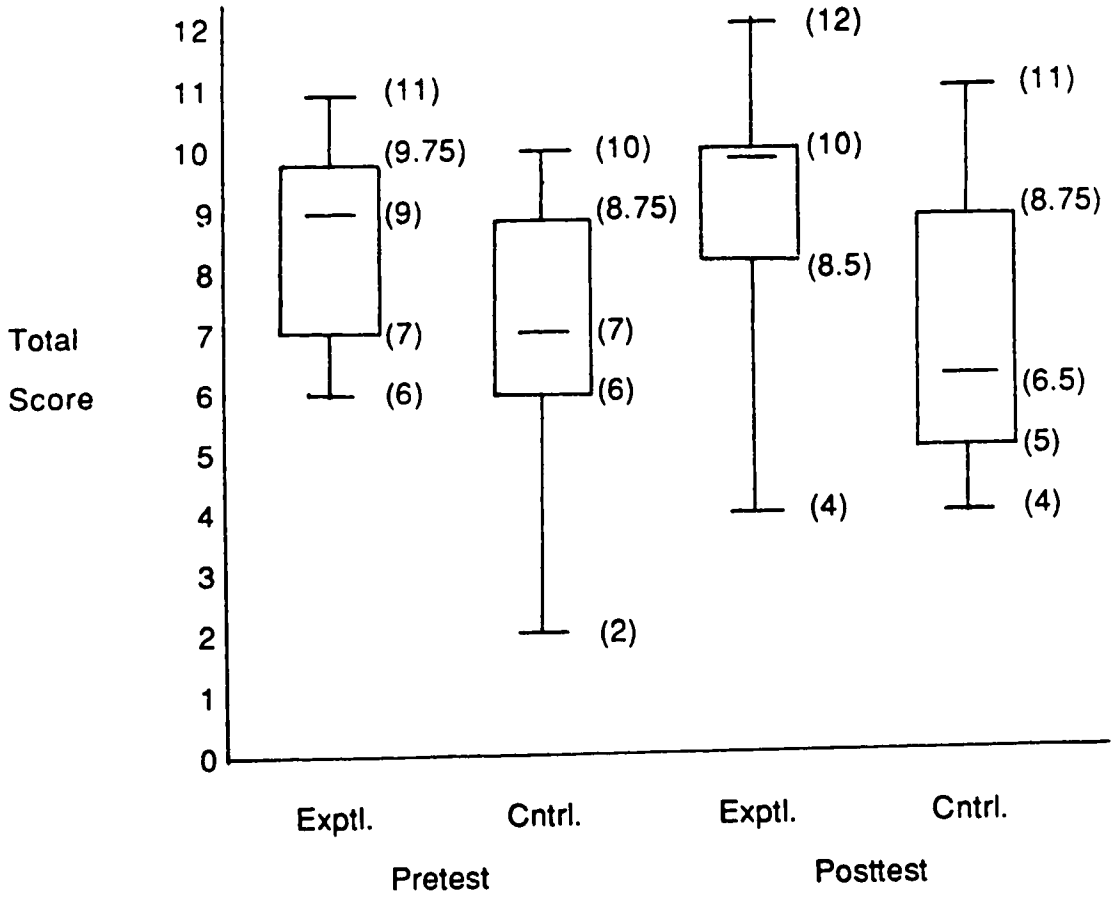

Figure 7. Box plots of the pretest and posttest scores from the reading/spelling subtest of the Student's Perception of Ability Scale (Boersma & Chapman, 1977), by group.

Table 7

Nonparametric Analysis of Reading/Spelling Scores from the Student's Perception of Ability Scale (Boersma & Chapman, 1977): Experimental vs. Control

	Median Test		Mann-Whitney U Test	
Measure	Pretest	Posttest	Pretest	Posttest
Perception of Reading/ SpellingAbility	0.315	0.132	0.149	0.069

Note. Numerical values represent the probabilities that the two samples (i.e. Experimental and Control) have been drawn from the same population (Siegel & Castellan, Jr., 1988).

Evaluation During the Intervention

The bridging tasks that were used during the intervention had been designed to teach the students to apply planning strategies, simultaneous processing strategies, and, to a lesser extent, successive processing strategies to activities that focused primarily on reading comprehension. The tasks had not been designed to evaluate student progress. Immediately prior to the beginning of the intervention, though, it was decided to make minor modifications to as many of the tasks as possible so that they could be used to assess whether or not students were becoming more proficient at reading and comprehending written exercises. The modifications took two forms.

For one group of tasks, the items within each task were arranged to create series of three or more exercises which were more or less equivalent. For example, for the task called Story Segments 1, in which the students were

required to sequence printed passages to form short stories, one three-segment story, one four-segment story, and one five-segment story were completed in each of three separate sessions. This permitted improvement to be monitored across the sessions. Other tasks for which this approach proved to be appropriate included Matrix Words 1 and 2, Passage Identification, Word Pairs 1 and 2, and Tracking.

A second group of tasks could not be re-organized into series of equivalent exercises. The reason was that, while the format of the exercises within a given task remained similar, task demands were deliberately increased from one session to the next. The tasks for which this progressive format were employed included Picture Identification, Pirates' Island/At the Playground, and West Edmonton Mall/Walt Disney World 1. The lack of equivalence did not prevent these tasks from being used in the evaluation. For each of the tasks, students' responses to the more difficult follow-up activities were compared with their responses to the easier activities, the object being to determine whether or not students were able to maintain or to improve their levels of performance in the face of increased task demands.

Of the thirty tasks that had originally been created for the intervention, only twenty were actually used for remediation, owing to the fact that it became necessary to shorten the intervention to make it fit the available time. Of those twenty tasks, eleven proved to be suitable for modification and, together with one of the global tasks, were eventually incorporated into the evaluation. These tasks, used either individually or in combination, made up the eight measures which provided the results that follow.

Matrix Words 1 and 2 have been described in Appendix 3: Tasks to Accompany Matrix Numbers and Matrix Letters. Together with the corresponding global task, they were the only tasks in which successive

processing took precedence over simultaneous processing and planning. In each of three sessions, students were presented with three series of five words. The number of trials that students required to recall all five items in a series, including their correct positions of the items in a matrix, was recorded. The total number of trials required to recall all three series was then calculated. Student performance across the three sessions is illustrated in Figure 8.

A best possible score of 3 was recorded where a student was able to accomplish the task, while using only one trial per five-word series. At Time 1, individual scores within the experimental group ranged from 3 to 10, but only one student managed to achieve a perfect score. At this time, the mean value for the total number of trials required to reach criterion was 5.5. By Time 3, individual scores ranged from 3 to 5; five students achieved perfect scores of 3; and the mean value had dropped to 3.8. In other words, over three sessions, the students became much more proficient at using serial rehearsal and recall, a successive processing strategy.

Picture Identification has been described in Appendix 3: Tasks to Accompany Sentence Verification. The task required students to read a short printed passage, to study a set of photographs, and to select the photograph that best illustrated the contents of the passage. The photographs were thematically similar, making it necessary for students to pay close attention to detail. Students also had to use a simultaneous processing strategy to evaluate the photographs of each set, prior to making a choice. A student's score was the total number of correct matches made before the delivery of any prompts, the condition that was identified as Level A. This score was expressed as a percentage of the total possible score. Student performance across two sessions is illustrated in Figure 9.

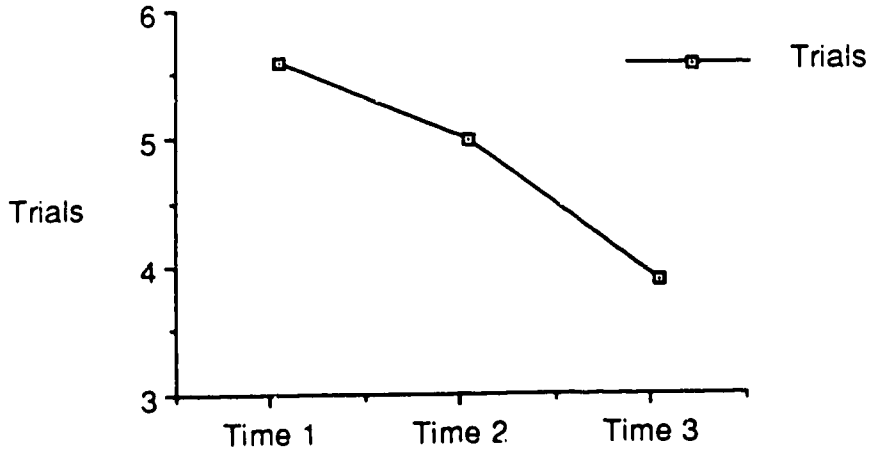

Figure 8. Matrix Words 1 and 2: The mean number of trials required by the experimental group for the correct recall of three five-word series, Time 1 to Time 3.

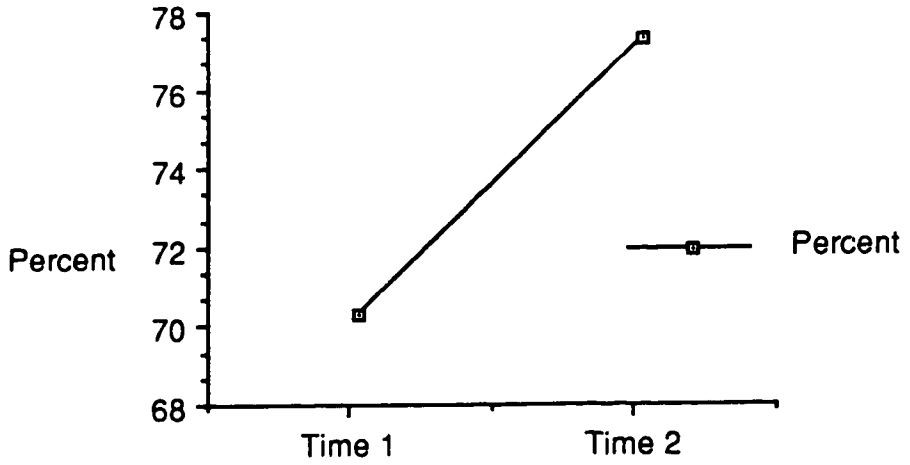

Figure 9. Picture Identification: The mean number of correct answers achieved by the experimental group at Level A (i.e. before the introduction of any prompts), expressed as a percentage of the total possible score.

The mean score for the experimental group increased from 70 to 77 percent from Time 1 to Time 2, a net gain of only seven percentage points. However, Picture Identification was one of the progressive tasks, in which task demands increased from Time 1 to Time 2. At Time 1, most students were given four sets of two photographs, followed by four sets of three photographs. By contrast, at Time 2, students had to study one set of three photographs, six sets of four photographs, and one set of five photographs. Therefore, it can reasonably be argued that the increase of seven percentage points carries considerably more weight than it would have, had the two sets of exercises been equivalent.

Passage Identification has also been described in Appendix 3: Tasks to Accompany Sentence Verification. It was similar in format to Picture Identification, except that students were required to study one photograph, to read a set of printed passages, and then to select the passage that best described the photograph. In each set, all of the passages had the potential to be the correct choice, in that none of the matches was wildly improbable. Therefore, once again, students had to pay close attention to detail and to use simultaneous processing strategies, prior to making a choice. This time, of course, the strategies had to be applied to series of passages, not photographs. In each of three separate sessions, students were given two sets of two passages, two sets of three passages, and two sets of four passages, thus making it possible to compare student performance across sessions. In each session, a student's score was the total number of correct matches made, before the delivery of any prompts, the condition identified as Level A. Student performance over time is illustrated in Figure 10.

From Time 1 to Time 3, the mean score of the experimental group increased by 2.2, as the mean climbed from 3.4 to 5.6. At the same time, the

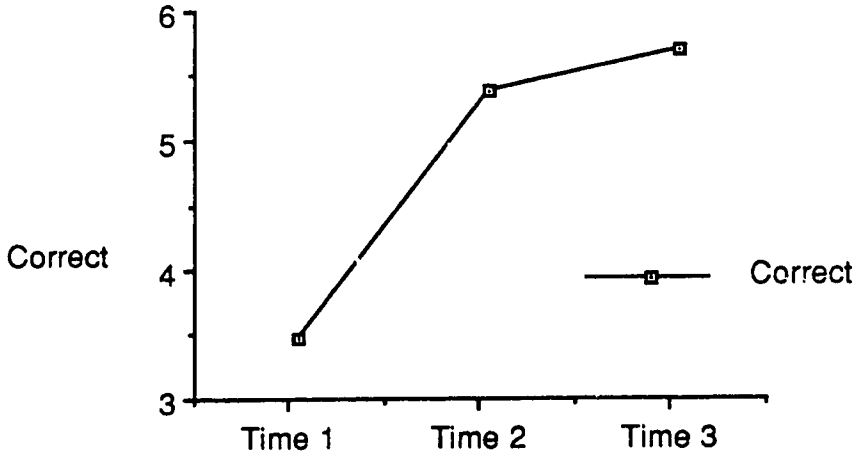

Figure 10. Passage Identification: The mean number of matches correctly made by the experimental group at Level A (i.e. before the introduction of any prompts), Time 1 to Time 3.

number of students who were able to achieve a perfect score of six increased markedly, from one at Time 1 to four at Time 2 and to five at Time 3. Therefore, by the end of the intervention, students were able to process the printed passages much more efficiently than they were in the beginning.

Word Pairs 1 and 2 have been described in Appendix 3: Tasks to Accompany Serial Recall and Associative Pairing. The tasks required students to rehearse and recall series of six and eight words. In this instance, the students were taught how to simplify the task by making use of the associative pairs in each series. In other words, simultaneous processing strategies played a large part in the successful performance of this task. In each of three different sessions, students were presented with two series of six words, followed by two series of eight words. The number of trials that were required to recall all of the items in a series, either serially or associatively, was recorded. The total number of trials required to recall all four series was then calculated. Student performance across the three sessions is illustrated in Figure 11.

The mean value for the total number of trials required to reach criterion at Time 1 was 8.3. This value fell to 6.2 by Time 2 and then rose very slightly to 6.3 at Time 3. This suggests that students were able to apply and maintain the strategy, with considerable success, over the course of the intervention.

Tracking is the only global task that has been included in the evaluation of student performance during the intervention. The reasons are: a) that it was one of the only global tasks whose level of difficulty was comparable to that of the bridging tasks, and b) that it was particularly useful for assessing simultaneous processing and planning ability. Tracking required students to use tracking cards (See Appendix 2, Task 8.) to identify the locations of eleven different numbered houses or eleven different lettered trees on a village map.

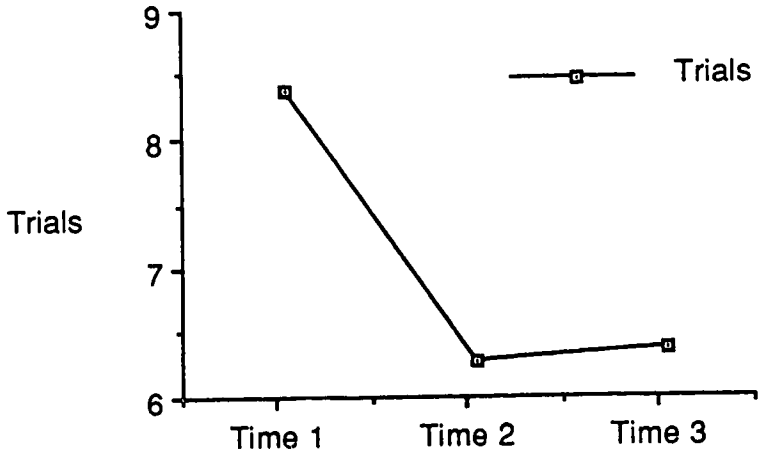

Figure 11. Word Pairs 1 and 2: The mean number of trials required by the experimental group for the correct recall of two six-word series and two eight-word series, Time 1 to Time 3.

Students had to complete two trials per session for four sessions (i.e. two sessions with the houses and two sessions with the trees). The tracking cards were re-arranged at the beginning of each trial, so that individual students were never faced with the same sequence of required responses. The time that it took students to find all eleven locations and the total number of correct responses were recorded for each trial. Times and scores were averaged across trials for each session. Student performance is illustrated in Figure 12 and in Figure 13.

The mean value for the time that was required to complete the Tracking task (i.e. averaged across two trials) was 178 seconds at Time 1. This value fell to 135 seconds at Time 2, 121 seconds at Time 3 and 97 seconds at Time 4. From Figure 11, it can also be seen that mean scores were rising, as the times to completion were falling. As a matter of fact, by Time 4, almost the entire experimental group achieved perfect scores of 11 on both trials of the task. Plainly, student performance improved dramatically across the four sessions.

A third measure of proficiency, the range of the scores, added another dimension to the evaluation. During Trial 1 at Time 1, it became clear that some of the students were using a successive processing strategy, as they moved in a linear fashion from intersection to intersection, often pointing the way with their fingers. The time that it took these students to complete the task exceeded, by far, the time that was required by the other students in the group. The difference in strategic approach can probably be represented by the range, or arithmetic difference between the longest time to completion and the shortest time to completion on any given trial. The range at Time 1,Trial 1 was 182 seconds. Once the students were taught to use a simultaneous processing strategy to simplify the task (i.e. by using the quadrants of the village map in the

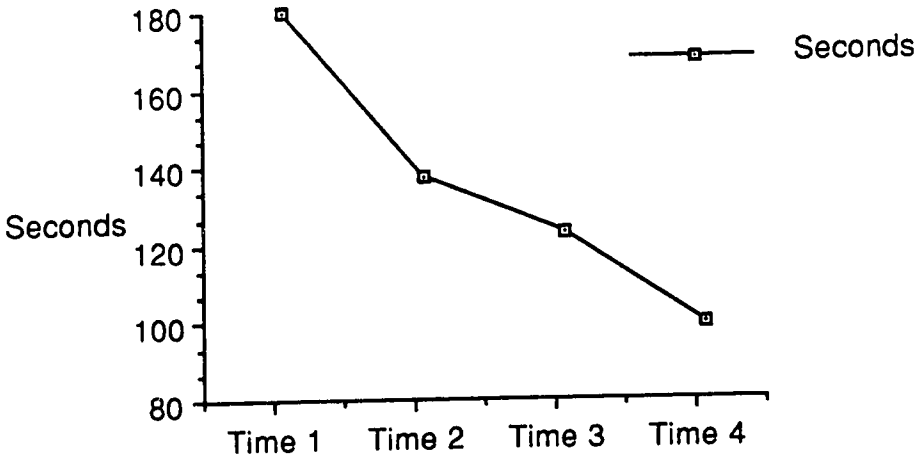

Figure 12. Tracking: The mean number of seconds, averaged across two trials, required by the experimental group to complete the eleven Tracking cards, Time 1 to Time 4.

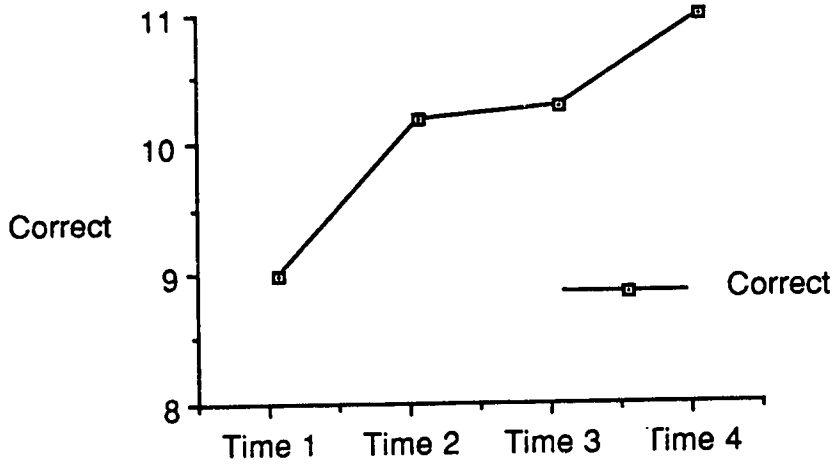

Figure 13. Tracking: The mean number of correct responses, averaged across two trials, achieved by the experimental group, Time 1 to Time 4.

search for the target locations), the values of the range decreased dramatically. On Trial 2 of Time 1, it was 116; on Trial 1 of Time 2, it was 51; and by Trial 2 of Time 4, it has dropped to 35. In other words, as students became more proficient at employing the simultaneous processing and planning strategies, not only did their times drop in value, but the students appeared to become more similar in the way they completed the task.

The rearrangement of the tracking cards at the beginning of each trial and the change from numbered houses to lettered trees at the mid-way point prevented the task from becoming purely a measure of practice effect. However, it cannot be denied that practice effects probably played some part in students' improved levels of functioning. In order to avoid this situation, it would have been necessary to change the configuration of the village map at the beginning of each trial. Despite this problem with the interpretation of the results it still seems likely that the dramatic decrease in the time to completion reflected, to a considerable degree, increased ability to invoke simultaneous processing and planning strategies.

Pirates' Island/At the Playground both required students to read a printed passage and then to use clues from the passage to identify the location of a missing object or person on an accompanying illustration. It is likely that this task primarily tapped simultaneous processing strategies, because it demanded that students extract and manipulate a series of clues in order to come to the desired conclusion. Each story was divided into two parts, with both parts being completed in a single session. For each part, students scored 3 if they were able to complete the exercise before the delivery of any prompts, 2 if they required the first level of prompting, and 1 if they had to move to the second level of prompting. Scores from Part 1 and Part 2 were summed to give a

composite score for each story. Student performance on both stories is illustrated in Figure 14.

The mean composite score for Pirates' Island was 3.4, while the mean value for At the Playground was 5.0. Both scores were out of a possible 6 points. The increase of 1.6 from Time 1 to Time 2 suggests that the students became more proficient at using printed clues to draw conclusions which were only implied in the text. However, it cannot be stated with certainty that the two stories were equivalent in the demands that they placed on the students. The suggestion has been made that, because the subject matter and location of the second story were probably more familiar to the students, at least some of them may have found the second exercise to have been easier than the first. Therefore, any conclusions regarding improved levels of functioning have been made subject to qualification.

Story Segments 1 required students to sequence correctly three, four, or five story segments which had been randomly arranged. During each of three separate sessions, the students were given a three-segment story, a four-segment story, and a five-segment story. For each story, the students were given a score of 3 if they were able to complete the exercise correctly before the delivery of any prompts. They received a score of 2 or 1 if they needed to be moved to the first or second level of prompting, respectively. At the end of the session, scores were summed to yield a task composite. Student performance on the task is illustrated in Figure 15.

The mean composite scores were 6.9 at Time 1, 6.7 at Time 2, and 7.9 at Time 3. The increase of one point from Time 1 to Time 3 appears to represent a very modest gain. However, it must be remembered that the increase of one point in the mean score meant that, on average, students were able to move up one level of prompting (i.e. from the second level to the first, or from the first to

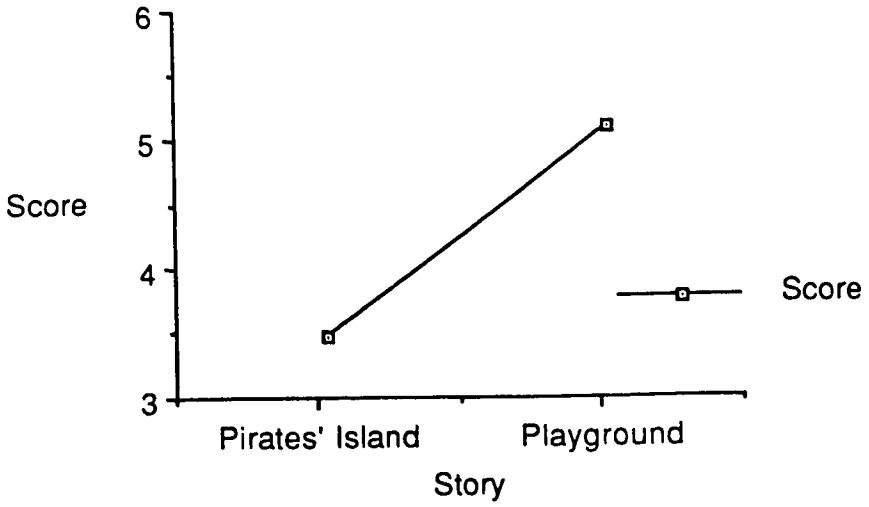

Figure 14. The mean values for the composite scores (i.e. Part 1+Part 2) from Pirates' Island (i.e. Time 1) and At the Playground (i.e. Time 2).

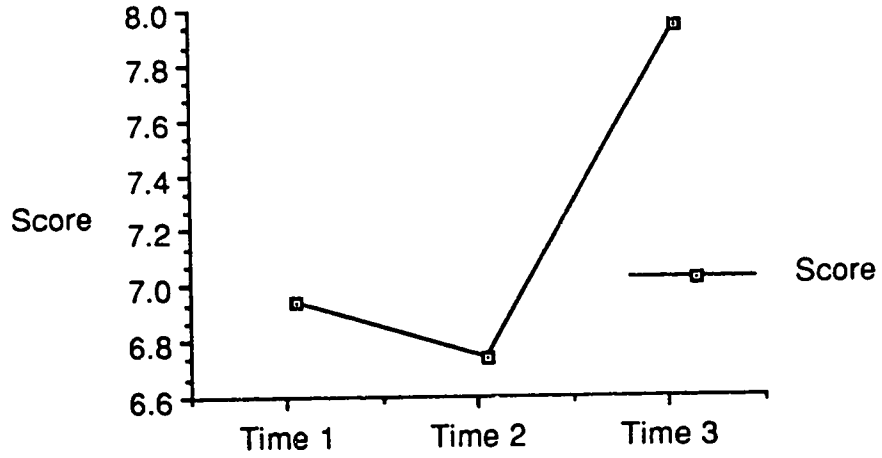

Figure 15. Story Segments 1: The mean values for the composite scores (i.e. Exercise 1+Exercise 2+Exercise 3) achieved by the experimental group, Time 1 to Time 3.

no prompting at all) on at least one story. When the individual scores were examined, improvement in the group became even more obvious. At Time 1, a total of eight perfect scores (i.e. 3 out of 3) were recorded by the experimental group, with six of these scores occurring on three-segment stories and two occurring on four-segment stories. At Time 3, on the other hand, fourteen perfect scores were recorded, of which six occurred on three-segment stories, three occurred on four-segment stories, and five occurred on five-segment stories. In other words, over the course of the intervention, the students became considerably more proficient at handling even the more difficult items, with much less help from the mediator.

Although Story Segments 1 involved sequencing series of storyparts, a successive processing strategy was clearly not sufficient for the task to be completed successfully. Because the position of each segment in the series had to be established relative to the positions of two, three, or four other segments, a simultaneous processing strategy was essential for correct completion. Furthermore, a planning strategy emerged as a necessary ingredient in the task, as those students who remembered to condense the contents of the individual segments prior to re-ordering them were the ones who became most proficient at reconstructing the stories correctly.

West Edmonton Mall/Walt Disney World 1 required students to plan a series of six visits to the mall on one occasion, followed by a series of six visits to the amusement park on another occasion. During each session, students had to read two printed passages that specified two features that were to be visited, two passages that specified three features, and two passages that specified four features. After reading the passage, the students then had to trace the appropriate path on the corresponding floor plan/map. A student's score was the total number of visits that were correctly planned, prior to the

delivery of any prompts, the condition that has been identified as Level A. For each of the sessions, the total possible score was 6. Student performance across the two sessions is illustrated in Figure 16.

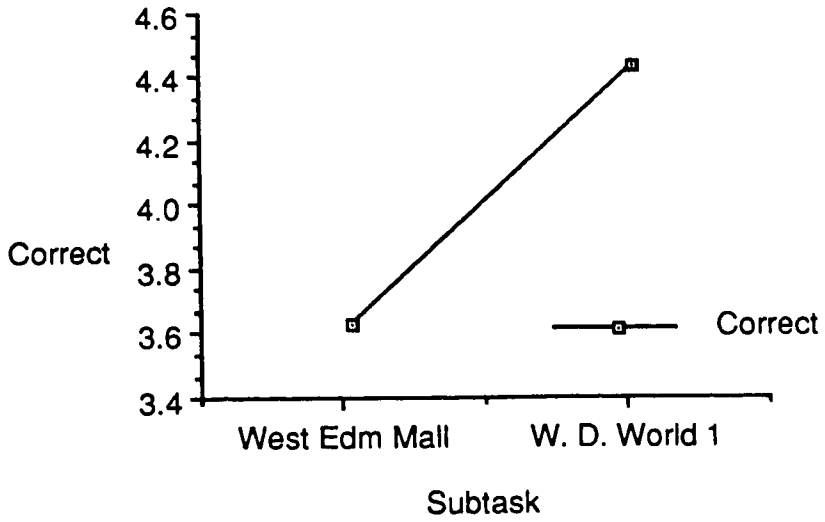

Figure 16. The mean number of correct responses achieved by the experimental group at Level A ((i.e. before the delivery of any prompts), on West Edmonton Mall (i.e. Time 1) and Walt Disney World 1 (i.e. Time 2).

The mean number of correct responses at Level A was 3.6 for West Edmonton Mall and 4.4 for Walt Disney World 1. Despite the size of its absolute value, the increase of 0.8 points represented an improvement of 22 percent over the score at Time 1. Another important factor in the interpretation of the scores is that the two parts of the task were not equivalent. The floorplan of the mall was very regular, and only those items that played a part in the task were included. The map of Walt Disney World, on the other hand, did not have the regular layout of the mall, and it contained many features which functioned as distractors, as they were not germaine to the task. In short, as a task which

required both planning and simultaneous processing strategies, Walt Disney World 1 was probably more difficult than West Edmonton Mall, and it is likely that the gain of 0.8 points is more meaningful than it would have been, had the subtasks been equivalent.

Summary of the Results

With regard to reading comprehension, hypothesized improvements on the standardized tests of vocabulary development and comprehension were not supported by the data. These data revealed, in the former case, a negligible difference in group means at posttest and, in the latter case, a small difference which favoured the control group. Analysis of variance of the results from the test of oral reading comprehension indicated that the group difference which favoured the experimental group was not significant. However, the analysis revealed the possibility of a trend toward significance, with $p=0.120$. Support for the existence of this trend could also be seen in the nonparametric analysis of the data, where p equaled 0.074. Analysis of variance of the results from the test of silent reading comprehension also indicated the possible existence of a trend favouring the experimental group (i.e. $p=0.142$). In this case,the trend in the data was supported by the Median Test which indicated a signific t difference (i.e. $p=0.041$) favouring the experimental group. The Mann-Whitney U Test fell short of confirming the significance of the difference, but only just (i.e. $p=0.057$).

With regard to cognitive processing, none of the hypotheses predicting improvement of the experimental group over the control group in the areas of planning, simultaneous processing, successive processing, and attention were supported by the data. In all cases, there were either negligible differences in the mean gain scores or differences which favoured the control group. In the area of perception of reading/spelling ability, analysis of variance with repeated

measures failed to confirm that the difference favouring the experimental group was significant. However, the possibility of a trend toward significance was suggested by the results of both the Median Test (i.e. p=0.132) and the Mann-Whitney U Test (i.e. p=0.069).

The most important finding to emerge from the evaluation of the intervention was that the improvement in student performance, from Time 1 to Time 2 or Time 3, was consistent across all of the tasks. The levels of improvement showed considerable variation, in that they were dramatic on some tasks but more modest on others. However, the evaluation left no doubt that the students were able to learn to apply planning, simultaneous processing, and, to a certain extent, successive processing strategies to printed texts, so as to make those texts meaningful. For students who had been diagnosed as having serious and pervasive difficulties with reading comprehension, it could be argued that this accomplishment had considerable intrinsic value, and that its importance was not necessarily compromised by the failure to show significant improvement on the standardized measures of reading comprehension and cognitive processing.

Chapter VI

Discussion

Introduction

The results of the present study have raised a number of questions regarding the use of the intervention with this particular group of underachieving students. In the first place, given that significant differences on the standardized measures of reading comprehension and cognitive processing never emerged and that differences on the other measures did not emerge cleanly, what sorts of factors might have been operating to impede the progress of the experimental group, thus preventing the appearance of clearly significant differences?

Secondly, given that the analysis of the responses to the intervention tasks suggests that the students were learning to employ specific strategies to aid their comprehension of printed passages, does the lack of significant differences, particularly on the measures of reading comprehension and cognitive processing, indicate that there was no transfer of knowledge taking place? Alternatively, do the students' successes during the intervention and the evidence of improvement on the measures of oral and silent reading comprehension support the possibility that some form of transfer was, in fact, occurring?

Thirdly, it has been suggested that the Planning, Attention, Simultaneous, Successive (PASS) Model (Das et al., 1979; Naglieri & Das, 1990) may provide the foundation upon which specific programs of remediation might be built. In view of the problems that seemed to emerge from the final assessment, can the results of the present investigation contribute to the evaluation of this function of the PASS Model, particularly where the

remediation of reading comprehension difficulty is an issue? The following pages contain an exploration of these three areas of concern.

Accounting for Nonsignificant Results

It is obvious from the results of the current study that the treatment effects which were generated were subtle ones. A satisfactory explanation for this situation would have to take a number of factors into account. It may be that the remedial tasks were not crafted carefully enough to bring about the desired result. Alternatively, the situation may be more complex, in that the Planning, Attention, Simultaneous, Successive (PASS) Model (Das et al., 1979; Naglieri & Das, 1990) may not have provided an adequate basis for the remediation of comprehension difficulties. It may well be that the remediation of the more complex cognitive processes, like simultaneous processing and planning, require a more complex approach, both for the correction of deficiencies and for the transfer of skills to conventional reading tasks. Before examining these issues in greater detail, however, a number of other factors should be discussed. These are factors which relate more generally to experimental research in applied settings and which present a challenge for statistical analysis.

Factors related to the selection and implementation of the research design. Two factors likely contributed to the difficulty of demonstrating that the mean differences which did appear following treatment were, in fact, statistically significant. One factor was the limitation that had to be placed on the number of subjects who could receive the treatment, principally because of the need for prolonged one-to-one interaction during training. The other was the appearance of large variances in the data of both the experimental and control groups (See Table 1.). The combination of a small number of subjects with large within-group variability obviously placed considerable strain on the

parametric statistical procedures that were used and made significance difficult to achieve.

A second problem with the overall plan of the project may lie with the assessment instruments that were selected to measure the treatment effects. Standardized achievement tests measure the acquisition and application of general skills; hence their utility as indicators of far-transfer. Where a broad range of ability is being assessed, these tests can be very useful. However, with students who are operating in a restricted range, the utility of the tests is questionable (Paris, Cross, & Lipson, 1984). In the current study, the standardized tests that were employed may not have been sensitive enough to detect the improvements in cognitive, metacognitive, and comprehension skills that were suggested by the analysis of the responses to the intervention tasks.

Thirdly, the duration of the intervention may have been too short. Marie Clay (1985) reported that it took daily sessions for an average of fifteen weeks for her Reading Recovery Program to have an effect on her subjects. What must be remembered is that Clay's subjects were readers whose deficiencies had been identified and targeted for remediation within a year of the beginning of reading instruction. In the current study, the difficulties appear to have been considerably more complicated than those that were identified by Clay. In addition to experiencing serious skill deficiencies, the students in question were also burdened with counterproductive habits and attitudes that had become entrenched over the course of their early years in school. Generally, students like these require long-term interventions, if the training of specific skills, metacognitive strategies, and attributions is to be successful (Borkowski et al., 1988). Therefore, fifteen hours of remediation delivered over twenty sessions may not have given the students enough remedial input.

Factors related to the instructional policies and priorities in place in the schools/school division. Minor administrative problems led to a delay in the implementation of the remedial program in both schools. The net effect of this delay was twofold. First, there was insufficient time to bring all of the tasks to the planned conclusion, and, secondly, the final assessment had to be carried out during the last three weeks of school, immediately prior to the beginning of summer vacation. While it could be argued that this latter condition affected both the experimental and control groups equally, it is possible that any negative effects were felt less by the control group, for whom the novelty of involvement was still strong.

A second factor that may have contributed to the failure to achieve significance was the failure of one of the schools to adhere to the selection criteria that were provided at the outset of the project. As a result of this failure, the number of students who were eligible for inclusion in the study dropped from 24 to 16, with eight students in each of the experimental and control groups. The use of a sample that was even smaller than the one that had been anticipated further complicated data analysis and made statistical significance even harder to achieve.

Factors related to socio-economic status. Social and economic factors were probably responsible, at least to some degree, for the problems that several of the students were having with achievement. Some of the factors which were confirmed by school personnel included: standards of living which were well below the poverty line, mothers or fathers who appeared to have left the family unit, casual partners who temporarily or intermittently joined the family unit, siblings who were experiencing severe emotional lability, and family members who were dealing with the effects of substance abuse.

The random assignment of subjects should decrease the likelihood that problems such as those cited above will be disproportionately represented in one of the groups. In the case of the school that supplied only six of the subjects for the study, random assignment appeared to have worked well. In the opinion of the principal of the second school, however, the above problems were more prevalent in the experimental group than in the control group. Obviously, this introduced a factor which might be important to the interpretation of the results, one that may have made it that much more difficult to generate a significant between-group difference.

Factors related to the learning characteristics of the students. Reference has already been made to the fact that the students' difficulties with reading comprehension were serious (i.e. levels of functioning that were two to three and one-half years below grade level), longstanding (i.e. in evidence and a focus for remediation for at least two years), and, by implication, difficult to remediate. One assumption of the current project was that deficiencies in one or more areas of cognitive processing could help to account for the reading difficulties that were being experienced by the students. As it happened, several other contributors came to light over the course of the intervention, many of which were related to the attitudes and strategies that the students brought into the remedial sessions.

At least one of the problem behaviours that was exhibited by students could be explained with reference to the Planning, Attention, Simultaneous, Successive (PASS) Model (Das et al., 1979; Naglieri & Das, 1990). Specifically, several students tended to rely too heavily on the successive or sequential processing of information and not enough on simultaneous processing. They would proceed, in linear fashion, from one piece of information to the next, rather than synthesizing the components, more or less

simultaneously, into a complete and comprehensible whole. Tasks for which this strategy generated particular problems included: Passage Identification, What Am I?, Word Pairs, Pirate's Island, and Story Segments (See Appendix 3.). While the remedial program was designed to take a problem like this into account, such was not necessarily the case with other difficulties that appeared.

As students worked through the remedial tasks, several of them exhibited one or more of the following: problems with expressive vocabulary, which could have been based in a lack of appropriate vocabulary and/or in difficulties with lexical access; a lack of self-confidence and/or low self-esteem; an over-reliance on visual memory to the detriment of auditory memory, or vice-versa; distractibility; impulsivity; problems with visual perception; a rigid adherence to strategies which were plainly inappropriate and sometimes bizarre; and the egocentric interpretation of reading passages. The extent to which these problems also affected the control group, could obviously not be determined without putting those students through the intervention. Therefore, it can't be said that they influenced the between-group differences at posttest. What can be said, however, is that the problems introduced a whole series of confounding factors which likely counteracted the effort to generate treatment effects and which, therefore, made the interpretation of the results that much more difficult.

Evidence of Transfer

The hypothesized distances across which acquired skills and strategies had to transfer have been examined for each of the assessment conditions. These assessment conditions include the assessment of student performance on the remedial tasks, assessment by means of the informal reading inventories, and assessment using standardized reading tests and tests of cognitive functioning.

Remedial tasks. There are two main reasons why the assessment of student performance on the remedial tasks was of particular importance to the study. In the first place, it established that students who had been diagnosed as having serious difficulties with reading comprehension were, in fact, able to learn from printed texts. Secondly, it provided evidence that the students became able to transfer newly acquired skills and strategies from session to session, even though the sessions on any given task were separated by several (i.e. up to fifteen) days. It could be argued, of course, that the use of skills that have been learned in one session to complete exercises that are encountered in subsequent sessions is evidence of maintenance, and not transfer. In the present case, however, a number of factors suggest that it was the near-transfer of skills and strategies that was taking place. These factors include: a) the complex nature of most of the tasks, which precluded the rote application of simple strategies; b) the changes in content from session to session; and c) the increased levels of difficulty that were evident in the case of the 'progressive' tasks. In short, as students proceeded through the intervention, the conditions under which they were expected to complete given tasks changed. These changing conditions likely required not just the reapplication of acquired strategies, but rather the re-evaluation and adaptation of those strategies.

Informal reading inventories. Evidence for the transfer of skills and strategies to the informal reading inventories is less convincing, because conclusive between-group differences never emerged from the statistical analyses of the students' responses. This was not totally unexpected, because, with increased transfer distance, treatment effects become that much harder to generate (Campione & Brown, 1987; Vye et al., 1987). However, the students of the experimental group did demonstrate, at least in absolute terms, greater proficiency in dealing with the informal reading inventories, under both the oral

reading and the silent reading conditions. Furthermore, their advantage appeared to signal the emergence of a trend toward significance in the data, a trend which was supported by the nonparametric analyses of the students' responses. Taken together with even stronger evidence from Brailsford et al. (1984) for the existence of a similar phenomenon, this finding would seem to suggest that the students of the experimental group were in the process of learning to transfer their acquired skills and strategies to the informal reading inventories.

Standardized reading tests. The lack of evidence of transfer to the standardized reading tests can also be explained in terms of transfer distance. During the intervention, students were asked to focus on specific reading skills and metacognitive strategies, whereas the standardized tests approached reading comprehension in a more general way. In short, the discrepancy between what the students were required to do on the bridging tasks and what they had to do during the assessment probably necessitated the far-transfer, or even the very far-transfer of skills and strategies. In addition, the format changed radically from assessment to remediation and back to assessment. During the remediation, the students were involved in one-to-one interactions with the mediator; questions were posed verbally; and the students had time to reflect on the input and to tailor their answers to suit the specific questions. The standardized measures, on the other hand, were administered to the entire group, had strict time limits, and took the form of a multiple choice format. With so many differences between the training materials and the assessment instruments, it should not come as a complete surprise that students with serious comprehension difficulties had trouble with the transfer of knowledge to standardized tasks.

Tests of cognitive processing. Unlike previous studies which have used global tasks as part of the training regimen (e.g. Brailsford et al., 1984; Kaufman, 1978; Krywaniuk, 1974; Spencer et al., 1989), the present study was unable to demonstrate the transfer of skills and strategies to the tests of cognitive functioning. It is possible that this may be explained, at least in part, by a change that was made to the manner in which the global tasks were used. For the most part, the global tasks were too easy for the students who were involved in the study, but the tasks were deliberately retained to serve as models for the more difficult bridging tasks. In most cases, when the students were initially presented with a set of paired tasks, they spent the first five minutes mastering the global task and the next fifteen or twenty minutes applying the same or similar strategies to the bridging task. There was seldom any need to return to the global tasks in subsequent sessions. This was not viewed as a problem, because it was anticipated that the function of the global tasks, the teaching of simultaneous processing and planning, would be taken over by the related bridging tasks. The possibility exists that this change contributed to a problem with transfer.

The bridging tasks were designed to decrease the transfer distance between the remedial tasks and the measures of reading comprehension. This was done by making the tasks content-based, which is to say, more similar to the measures of reading comprehension than were the global tasks. However, as the bridging tasks became more like the measures of reading comprehension, they also became less like the tests of cognitive functioning, which effectively increased the transfer distance between the remedial tasks and the cognitive measures. Whereas the transfer of knowledge from the global tasks to the tests of cognitive functioning, in previous studies, probably had to occur over an intermediate distance, the emphasis on bridging tasks in the

present study likely necessitated the far-transfer of knowledge to the subtests of the Das-Naglieri: Cognitive Assessment System Experimental Test Battery (Das & Naglieri, 1989). The greater effort that was required of the students could account for their generally poor performance on those subtests.

The Utility of the Planning, Attention, Simultaneous, Successive (PASS) Model as a Basis for Remediation

Remedial programs which are based on models of cognitive processing such as the Planning, Attention, Simultaneous, Successive (PASS) Model (Das et al., 1979; Naglieri & Das, 1990) ought to contribute to the realization of two goals. First, they should contribute directly to the improvement of those cognitive functions which have been identified as being in need of remediation. Secondly, they should help to bring about the transfer of the newly acquired skills and strategies to those academic areas that have been adversely affected by the cognitive dysfunction. Within the body of research that has examined practical applications of the PASS Model (Das et al. ,1979; Naglieri & Das, 1990), there are studies in which it has been reported that both of the above goals have, in fact, been realized. The qualification that must be placed on this conclusion, though, is that the results have not been entirely consistent across all areas of cognitive functioning.

Successive processing. Among those studies that have addressed the remediation of cognitive deficiency, within the context of the Planning, Attention, Simultaneous, Successive (PASS) Model (Das et al., 1979; Naglieri & Das, 1990), the highest levels of success have been documented in the area of successive processing. Where students had been diagnosed as having a successive processing deficiency, systematic practice on tasks that required the use of this approach generally resulted in significantly improved functioning on tests of successive processing ability (Brailsford et al. ,1984; Kaufman, 1978;

Krywaniuk, 1974; Spencer et al ., 1989). Furthermore, the improvement in cognitive functioning appeared to generalize to academic tasks that correlated highly with successive processing ability. In particular, this was found to be the case with word recognition (Kaufman, 1978; Krywaniuk, 1974), spelling (Spencer et al., 1989), and mathematical computation (Kaufman, 1978). In contrast to the studies of Krywaniuk, Kaufman, and Spencer et al., success with the remediation of successive processing ability was not achieved in the present study. The most logical explanation for this result would seem to be that, although all four areas of cognitive processing were included in the remedial program, the emphasis in the investigation was on simultaneous processing and planning, not on successive processing.

Simultaneous processing and planning. While it is clear that the Planning, Attention, Simultaneous, Successive (PASS) Model (Das et al., 1979; Naglieri & Das, 1990) provides a useful way to approach the remediation of successive processing deficiencies, the same cannot yet be said for simultaneous processing and planning. It is true: a) that Kaufman's (1978) subjects were able to demonstrate significant improvement on two of three measures that have been found, in factor analytic studies, to load on the simultaneous processing factor; b) that the subjects of Brailsford et al. (1984) were able to do likewise on one of two similar measures; and c) that the subjects of Spencer et al. (1989) were able to show significant improvement on three of four measures of planning ability. However, it is also true: a) that Kaufman's (1978) results emerged from a study in which the remediation of successive processing took precedence over that of simultaneous processing, and that these results might, therefore, represent something of an aberration; b) that the level of success shown by the subjects of Brailsford et al. (1984) was lower than that of Kaufman's study, despite the fact that their program

emphasized the remediation of simultaneous processing deficiencies; and c) that the subjects of both the current study and Conway's (1985) study were unable to demonstrate significant improvement on any of the measures of simultaneous processing and planning ability that were incorporated into the respective remedial programs. In short, evidence from Brailsford et al. (1984), Kaufman (1978), Conway (1985), and the present study suggests that, unlike successive processing deficiencies, both simultaneous processing and planning deficiencies may prove to be somewhat resistant to remediation, and this resistance may appear both in the acquisition of skills and strategies and in their transfer to the related academic domains.

The successful transfer of skills and strategies over time (i.e. from one subtask to a closely related subtask) by the subjects of the present investigation has been documented and identified as a form of near-transfer. Increasing the transfer distance to the informal reading inventories made it more difficult to achieve the transfer of knowledge. However, due to the evidence from the parametric and nonparametric analyses of the data, supported by the results from Brailsford et al. (1984), it became possible to suggest that transfer also appeared on this set of measures. With the use of bridging tasks to decrease transfer distance, it was also hoped that evidence for the transfer of knowledge to the standardized measures of reading comprehension would emerge from the data, but this evidence never materialized. In this sense, the results of the present study paralleled the results that have been found by other researchers. In short, in no study that has looked into the remediation of simultaneous processing and/or planning ability has there been any indication of the far-transfer of knowledge to related standardized tests of achievement, whether reading comprehension (Brailsford et al., 1984; Conway, 1985; Kaufman, 1978) or mathematical problem solving (Kaufman, 1978).

Resistance to remediation. Belmont and Butterfield (1977) have discussed the effectiveness of measures in terms of the directness with which they are able to 'capture' the processes that underlie particular behaviours. The more closely the measures are related, both temporally and logically, to the processes, the more effective they will be as measures. Measures which are temporally distant, in that they occur long after the time at which processing occurs, have their effectiveness compromised. The reason is that the passage of time allows other factors to intrude and to confound interpretation of the data. Similarly, measures which are logically distant permit too many acceptable alternative explanations for the variability in the results. As an illustration of this latter point, Belmont and Butterfield contrast the logical proximity inherent in the use of a tape recorder to monitor audible speech with the logical distance implied in the use of an IQ test to measure quality of thought. For measures to have maximum effectiveness, therefore, it is the position of Belmont and Butterfield (1977) that temporal and logical distance must be minimized.

This view of measurement offers a reasonable explanation for a portion of the results of the present study. The successful performance by the students of the experimental group on the intervention tasks, together with the problems that were encountered by the students on the standardized test of reading comprehension and the test of cognitive functioning, have been discussed at length. Assessment during the intervention occurred concurrently with practice on the remedial tasks, meaning that temporal distance was reduced to zero. Logical distance was also minimized owing to the fact that what was being assessed was what had been taught, namely the application of simultaneous processing and planning strategies within the context of reading comprehension. With the standardized test of reading comprehension and the tests of cognitive functioning, temporal distance was maximized, an

unavoidable consequence of a pretest-postest research design. In addition, logical distance was greatly increased, as too many alternative explanations for students' success or lack of success on the two batteries could be suggested. Therefore, using Belmont and Butterfield's (1977) frame of reference, the general lack of success on the measures at posttest might not imply resistance to remediation, at all; rather it might suggest that inappropriate measures were used to assess the acquisition and transfer of skills and strategies.

Chapter VII

Implications for Future Research

Introduction

This investigation has raised several issues regarding the design and implementation of programs of remediation. A consideration of some of the more important issues may serve as a useful guide to researchers who are involved in this aspect of educational research. The issues which seemed to be particularly relevant to the present study were tied to several different aspects of the investigation. These included: the duration of the intervention, the use of an individual vs. a small-group format, the derivation and use of content-based and content-free remedial tasks, the selection of a research design and an appropriate analytical technique, and, finally, the comparative importance of processes and strategies in the training paradigm. Each of these areas and the related issues will be discussed in the sections which follow.

Duration of the Intervention

When the present investigation was in the planning stages, it was anticipated that the students would be able to participate in thirty forty-five minute remedial sessions. Unfortunately, unavoidable delays during the implementation stage allowed only twenty sessions to be completed. Because of the pervasive and longstanding nature of the academic difficulties that characterized the sample, twenty sessions were regarded as the minimum number that would be required to produce an effect. As it happened, other factors intruded and probably affected the quality of at least some of those sessions.

During the intervention, it became clear that the students were being hindered not only by their academic difficulties, but also by the attitudes that they brought to the sessions. Evidence for these problems with attitude first

came from the amount of time (i.e. up to five sessions) that many of the students seemed to need to adjust to the intervention. Working one-on-one with a comparative stranger, on novel tasks, in an area of the school (i.e. the vice-principal's office) that was not necessarily identified with instructional practice appeared to tax the students and to deflect their attention, at least to some degree, from the process of remediation.

Other evidence for problems with attitude came from comments that were made by students over the course of the intervention. While instances of noncompliance were very few in number, there were many occasions on which students declared their inability to complete given tasks, often before any genuine attempt had been made. This "I-can't-do-it" attitude can best be illustrated by a verbatim quotation from one student who had been asked to complete a routine memory span task. He said,

> "I think it's only fair to warn you. I can't do these. I have no memory."

Problems that accompany a perceived lack of competence are certainly more serious than problems that arise merely as the result of encounters with novel situations. The key point is that both sorts of problems have the potential to confound skill development, and both take time to correct. Therefore, in cases like these, where attributions and self-esteem require as much attention as deficient skills and strategies, long-term remedial programs become a necessity (Borkowski et al., 1989; Paris & Oka, 1989). For the students of the present investigation, forty or even fifty remedial sessions, extending over one-half of the school year, would probably have been a more appropriate intervention.

Individual vs. Small-Group Formats

Unlike Brailsford et al. (1984) or Conway (1985), all of whom delivered the remediation to small groups of students, the present investigation used a more individualized approach. This procedure eliminated the potential for problems with self-consciousness or competitivness and allowed the mediator to focus exclusively on the specific strengths and weaknesses of the participant. However, it also sacrificed certain advantages of the small group format.

The use of groups of two or three compatible students would have allowed many more students to participate in the intervention. This, in turn, might have: a) benefitted students who had to be excluded due to the limited number of available positions, b) eliminated complications to the analysis of the data, and c) allowed hesitant administrators (i.e. especially those subscribing to consultative resource models) to become more amenable to the use of this type of remediation. Most importantly, though, a small-group format might have improved the quality of the interactions within the sessions.

One of the components of the approach that was used involved guiding students toward a relevant piece of information or an appropriate strategy without giving away the correct answer. This introduced two problems. First, where the student was unsure of the correct answer and/or unwilling to volunteer what might have been an incorrect answer, it was possible for the interaction to come to an abrupt halt. Secondly, this approach tended to force the mediator to assume too prominent a position within the interaction. Small group sessions might have solved both problems, first, by allowing the mediator to redirect a student's attention toward the contributions of his or her peers, and, then, by allowing the student to evaluate and modify those contributions, thereby contributing him or herself to the shaping of an appropriate answer.

A third possible advantage of small-group sessions is that they provide a more realistic context within which to develop and refine metacognitive skills. One of the main strengths of Palincsar's (1986) approach to the remediation of comprehension difficulty was that students were not required just to read passages and answer questions. Rather they were expected to operate on the available content by formulating relevant questions about it for the members of the peer group. A modification of this procedure was used in the current investigation, but formulating questions or paraphrasing for the mediator, rather than for a group of peers, tended to be somewhat artificial and, therefore, not as effective.

Content-free and Content-based Tasks

The development of content-based remedial tasks from their content-free precursors represented the next logical step in research into the remediation of cognitive processes and related academic difficulty. Evidence from the intervention of the present investigation suggests that there may be an advantage to reversing this relationship. Depending on the exact nature of the content-free, or global, task, the development of an equivalent content-based, or bridging, task often became very difficult. In some instances, global tasks didn't lend themselves to being converted into academically based tasks . In other cases, although the resulting bridging tasks seemed to be accurate representations of the corresponding global tasks, they were ineffective because they didn't fully develop the skills and strategies that students needed to make sense of text materials. These problems suggested the need to begin the process of remediation with the development of content-based tasks.

Where students are having difficulty comprehending printed texts, it makes sense to begin with the activities that are eliciting the problem. These activities then need to be task analyzed in order to clarify what students need to

know so as to be able to complete them successfully. For example, a reading activity may require the ability to organize information hierarchically. Where this is a problem for students, training activities obviously should give extended practice in this strategy. Once appropriate remedial activities have been devised, a decision may be made to incorporate global tasks into the remediation for one or more of the following reasons: they don't penalize students for a limited knowledge base; they can be created to be more motivating; and they can serve as effective models for the content-based tasks. Where this decision is taken, the global tasks would then be derived from the content-based tasks in the same way that the latter were derived from the former for use in the present investigation. The main advantage of this procedure would be that both the content-free tasks and the content-based tasks would be tied directly to the difficulties that were being experienced with reading comprehension.

Nested Assessments

Like the study of Brailsford et al. (1984), the current investigation has suggested that the informal reading inventories were more useful than the standardized reading measure because of the additional data that they were able to provide. In the present case, though, the utility of the informal reading inventories may even have been surpassed by that of the criterion-referenced measures which were created from the tasks and subtasks of the intervention. The ongoing assessments that were nested within the intervention provided a great deal of interesting information, including considerable evidence that the students were both acquiring skills and strategies and transferring them to subsequent sessions. The problem with this form of assessment was that there was no comparison group against which the progress of the experimental group

could be measured. A longer intervention and a slight modification of the research design could possibly have solved this problem.

Had more time been available, students of the control group could have been required to complete the first and the last sets of exercises within selected tasks or subtasks. This would have been different from the demands that were placed on the students of the experimental group because the control students: a) would not have received any prompting or training as they worked through the exercises (i.e. They would have been restricted to working at Level A.), b) would not have received any feedback as they worked through the sets of exercises, and c) would not have worked through any of the intermediate sets of exercises. Under these conditions, the first and last sets of exercises from the selected remedial tasks could have functioned effectively as pretest and posttest measures.

Research Design and Statistical Analysis

It has been stated that the sample of the present investigation was comparatively small in size. This sample was also made up of students who had been selected because of their lack of achievement, who were operating in a restricted range, and whose data were characterized by high levels of variability. These factors no doubt placed considerable strain on the research design and the statistical procedures that that were selected and implemented.

The problems inherent in using inferential statistics when operating under the above conditions were illustrated by the analysis of the data from the Informal Reading Inventory (Burns & Roe, 1985). At pretest the mean scores of the experimental and control groups were identical, but at posttest the mean score of the experimental group exceeded that of the control group by almost four full points. Under the conditions of small sample size and large within-group variability, parametric analysis of the data showed that the difference was

not significant. Two separate nonparametric procedures, on the other hand, pointed to the strong possibility that the between-group difference was in fact a significant one. Furthermore, similar results appeared from the analyses of the responses to both the Diagnostic Reading Program (Alberta Education, 1986) and the Reading/Spelling subtest of the Students' Perception of Ability Scale (Boersma & Chapman, 1977).

These results raise important questions regarding the selection of research designs and techniques for data analysis. In the first place, given that training studies like the present one often include small numbers of subjects who have serious learning problems , should group designs be considered at all? Single-subject designs would be more difficult to implement because more measures would have to be found or created to provide sufficient baseline and intervention data. However, this approach might be more appropriate in that it might provide much more information regarding the progress of the subjects, both as individuals and as part of a treatment group. Secondly, where the analysis of group data remains as a desirable alternative, despite small numbers of subjects and/or large within-group variances, should parametric analysis be sacrificed in favour of some of the more powerful of the appropriate nonparametric techniques? Certainly, the above examples from the present investigation suggest that valuable information might have been lost had the Median Test and the Mann-Whitney U Test not been employed.

One final point regarding the significance or the lack of significance of specific gains remains to be made. In the case of normally functioning students, small gains may rightfully be dismissed as being not significantly different from a chance result. With students who are experiencing serious levels of academic difficulty, however, the same may not be entirely true. For example, the systematic tracking of a student's progress over time may reveal a series of

small gains, each one of which can be interpreted as a random event, with no statistical significance. Viewed cumulatively, however, such gains may turn out to have practical importance. Speaking to this point, Clay (1979) has said that, in the initial stages of remediation, students typically make very small gains but that the small gains eventually add up to give students the start they need to begin reading on their own. With students like these, what may be most important is not the magnitude of individual gains but rather the consistency with which small gains are displayed.

Processes and Strategies

The premise that underlies the current investigation is that academic difficulty is tied to deficiencies in successive processing, simultaneous processing, and/or planning. The connection has been identified as correlational, and it could possibly be causal. Global tasks have been designed and used to strengthen deficient cognitive processes, one result of which has been the alleviation of certain academic difficulties. Bridging tasks have also been designed and used to strengthen cognitive porcesses, but in ways that carry the process of remediation directly into the content area in which the academic difficulties have become apparent. Planning activities seem to have taken on a slightly different function, in that they have been designed and used to give students practice in the selection and application of strategies. Thus, they have been intended to provide tools by which new or yet-to-be-learned material can be made meaningful.

Spencer et al.'s (1989) paired global and bridging tasks were intended both to strengthen the successive processing of spelling disabled students and to improve their spelling ability. The precise reason why the program worked so effectively is still open to conjecture. However, it is likely that the selection and application of an appropriate strategy played an important role. The successive

strategy that provided the focus for the program was appropriate for at least three different reasons. First, it was simple and, therefore, easily acquired. Secondly, it was logical because the sequential study of graphemes and their related phonemes provides an effective way to learn unfamiliar words. Finally, and possibly most importantly, the strategy could be applied consistently regardless of the word that was being attempted, a factor which may be a major component in the process of transfer.

Palincsar (1986) may have provided her reading disabled students with a similar sort of strategy in her remedial program. Her strategy of formulating a question to capture the essence of a target passage did not focus explicitly on cognitive processes; nor was it easily acquired. However, the strategy was logical and, when applied consistently to subsequent passages, effective. The evidence for this latter point was especially convincing because it appeared in the form of dramatic improvement on a standardized measure of reading ability.

In the current investigation, a few of the strategies that were highlighted were useful for the interpretation and completion of specific tasks or subtasks, but they did not appear to have much utility beyond those tasks. For example, the strategy for rehearsing and recalling series of paired words (See Appendix 3: Tasks to Accompany Serial Recall and Associative Pairing.) was easily acquired and effective; yet it was also task-bound, for it didn't allow the students to do anything other than memorize series of paired words. It is possible that tasks like this one do, in fact, contribute to the development of simultaneous and/or successive processing ability. However, limited opportunities for transfer to other reading activities suggest that it might be advantageous to concentrate on strategies that have broader application.

Most of the strategies in the present study tended to reflect Palincsar's (1986) approach, in that they were more difficult to master, but they provided

many more oportunities for subsequent application. For example, the paraphrasing strategy for Story Segments (See Appendix 3: Tasks to Accompany Picture-Story Sequencing.) gave students practice in extracting the essential content from printed passages. Once the strategy had been mastered, the students were in the position of being able not only to complete the target exercise, with a greater chance for success, but also to apply the strategy on subsequent activities. Observation of students' attempts to complete the remedial tasks, together with results from researchers such as Spencer et al. (1989) and Palincsar (1986), strongly suggest that this latter form of strategy is the one that ought to provide the focus for future programs of remediation, and that this orientation may be particularly appropriate where difficulty with reading comprehensiion is the concern.

Summary

Based on the findings of the current study and of researchers who have been following similar investigations, it seems reasonable to suggest that future research into the remediation of cognitive processes and academic difficulty ought to be guided by a concern for the following points.

1. When implementing remedial programs for students who are experiencing serious difficulties with reading comprehension, long-term rather than short-term interventions should be the preferred alternative. Particularly for academic difficulties that are well entrenched, interventions of forty or fifty sessions, extending over at least one-half of the school year, would probably be reasonable.

2. Where possible, remediation ought to be delivered to small groups of two to four compatible individuals, so as to permit those individuals to contribute actively and to benefit collectively from the efforts of the group.

3. Training tasks should be developed from the sorts of activities that customarily cause difficulties tc emerge. If global or content-free tasks are judged to be of possible benefit to the remedial program, they ought to be derived from those content-based tasks whose function they would support.

4. Assessment ought to occur on a number of levels. First, progress on remedial tasks should be monitored in ways that allow the data to be incorporated into a final evaluation. Secondly, criterion-referenced tests based on the skills and/or strategies that are being developed should be employed over the course of the intervention, as well as at pretest and posttest. Thirdly, where reading comprehension is concerned, informal reading inventories ought to be considered, as they can provide valuable information. Fourthly, where there are indications of substantial progress on the other measures, standarized reading tests might be used to check for far-transfer. At all levels, care should be taken to compare the results of the participants with a group of controls.

5. Group designs need not be the automatic choice for this type of research. With students who are experiencing serious academic difficulties, single-case designs have much to offer. In the event that group performance on particular measures remains as a priority, the nonparametric analysis of the scores, coupled with the use of box plots, could legitimately be considered as an alternative to parametric analysis. It is possible that the latter technique may conceal valuable information, especially when it is used with small groups of underachieving students.

6. Remediation ought to focus on those strategies that are transferable. This means that strategies to be learned should be comparatively easy to acquire, logically related to the desired outcome, and able to be applied consistently across a variety of activities with minimal adaptation.

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Appendix 1: Selected Tasks from the Das-Naglieri:

Cognitive Assessment System Experimental Test Battery

A. Planning

Visual Search

Task description.

Task description and Figure 17 removed

due to copyright restrictions.

Figure 17. Visual Search: Sample task.

Planned Connections

Task description.

Task description and Figure 18 removed

due to copyright restrictions.

Figure 18. Planned Connections: Sample task.

B. Simultaneous Processing

Simultaneous Verbal

Task description.

Task description and Figure 19 removed due to copyright restrictions.

Figure 19. Simultaneous Verbal: Sample task.

Figure Memory

Task description.

Task description and Figure 20 removed due to copyright restrictions.

Figure 20. Figure Memory: Sample task.

Matrices

Task description.

Task description and Figure 21 removed due to copyright restrictions.

Figure 21. Matrices: Sample task.

C. Successive Processing

Word Series

Task description.

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Sample tasks.

Task description and sample tasks removed due to copyright restrictions.

Sentence Repetition

Task description.

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Sample tasks.

Task description and sample tasks removed due to copyright restrictions.

Color Ordering

Task description.

Sample tasks.

Task description and sample tasks removed due to copyright restrictions.

D. Attention

Expressive Attention

Task description.

Task description and Figure 22 removed
due to copyright restrictions.

Figure 22. Expressive Attention: Sample task.

Receptive Attention: Letters

Task description.

Sample task.

Task description and sample task removed
due to copyright restrictions.

Appendix 2: Global Tasks

A deliberate attempt has been made to keep the descriptions of the global tasks as brief and concise as possible. Except for Sentence Verification and Syntax Task, more detailed descriptions of the global tasks can be found in Brailsford (1981). More detailed descriptions of Sentence Verification and Syntax Task are available from the Developmental Disability Centre, University of Alberta, Edmonton, Canada.

Task 1: Matrix Numbers and Letters

These tasks were adapted from Matrix Numbers and Matrix Letters of the Kaufman Assessment Battery for Children (Kaufman & Kaufman, 1983).

Task description. The student was required to memorize a sequence of numbers/letters which had been randomly selected and placed within a five-cell matrix. (See Figure 23.) Each number/letter was used only once per matrix. The student was first shown the entire matrix with all of the numbers/letters in place. He was then shown the series of five matrices in each of which only one of the numbers/letters appeared. The order in which the numbers/letters were presented was invariant and is as follows: top, left, centre, right, and bottom. As the numbers/letters were exposed, the student rehearsed the series by saying the elements aloud (i.e. First 1, then 5, then 8, etc.). The student then attempted to recall the series by writing the elements on a blank matrix. The student began when he could repeat the directions back to the mediator. He continued rehearsing until the series could be recalled exactly as presented, with all of the elements having been accurately identified and correctly placed. If unsuccessful, the student repeated the prescribed steps, beginning with a consideration of the completed matrix. The number of trials to criterion was recorded.

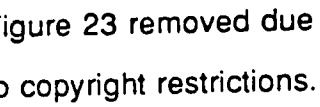

Figure 23. Matrix Numbers:Sample task.

Task 2: Sentence Verification

This task was adapted from Coding, Attention, and Planning (Das & Conway, tasks under development).

Task description. The student was presented with a set of two, three, or four similar pictures. (See Figure 24.) After having listened to a sentence which described only one of the pictures, the student was required to select the one picture that matched the sentence. The student began the activity when she was able to demonstrate an understanding of the task directions. If the student selected the wrong picture, she was required: a) to describe the contents of each of the available pictures; b) to listen to the sentence again; and c) to select the matching picture.

Figure 24 removed due to copyright restrictions.

The spotted frog is jumping.

Figure 24. Sentence Verification:Sample task.

Task 3: Shapes and Objects

This task was adapted from a preschool diagnostic test which was developed by the Russian psychologists, Venger and Kholmovskaya.

Task description. The student was presented with three black, abstract shapes, which had been drawn on coloured paper, and fifteen black and white line drawings of common objects. (See Figure 25.) The drawings were randomly arranged on the table in front of the student who was required to identify the general shape of each of the drawn objects and then to match it with the abstract shape that it most resembled. The student began as soon as he was able to repeat the task directions to the mediator. He proceeded with the sorting task until all of the drawings were matched to their corresponding shapes. The student then provided a rationale for the way he had classified the various drawings. The activity was repeated two more times. The time that the student took to complete the activity was recorded for all three trials. The results were then examined for improvement from Trial 1 to Trial 3. If any of the items were misclassified, the general shape of the object was discussed with the student and the student was then allowed to reclassify the picture.

Figure 25 removed due to copyright restrictions.

Figure 25. Shapes and Objects.

Task 4: Related Memory Sets: Part 2

Task description. The student was presented with sets of three to seven picture cards which showed various kinds of animals. (See Figure 26.) The sets of three and four cards showed animals which were related in some way (e.g. lion, tiger, cheetah). The sets of five, six, and seven cards showed two subsets of related animals (e.g. fox and dog; sawfish, frog, and dolphin). When working with sets of three and four animals, the student was required: a) to study the set of animals; b) to create a title which accurately characterized the way in which the animals were related; c) to rehearse the series by verbalizing, "First ___, then ___, then ___, etc."; and d) to recall the names of the animals exactly as they were presented. When working with sets of five, six, and seven animals, the student was required: a) to study the subsets of related animals; b) to create two titles, one for each subset, which accurately characterized the ways in which the animals of the subsets were related; c) to rehearse the series by verbalizing, "First the two ___.: a ___ and a___; and then the three ___: a ___, a ___, and a ___."; and d) to recall the names of the animals exactly as they were presented.

When the student was able to demonstrate an understanding of the task directions, she began studying, rehearsing, and recalling the various series. If animals were forgotten and/or remembered out of sequence, the student continued to rehearse until she was able to reach criterion. The number of trials to criterion was recorded.

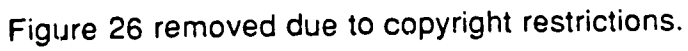

Figure 26. Related Memory Sets: Sample task.

Task 5: Shape Designs

Task description. For this task, the student used cardboard shapes (i.e. circles, squares, rectangles, triangles) which were made available in four colours (i.e. white,red, yellow, blue). (See Figure 27.) The student was given five seconds to study a model which had been constructed by the mediator. The student then replicated the design, using his own set of coloured shapes. The designs had been divided into two sets, based on level of complexity, with the designs of Set A being less complicated than the designs of Set B. In the set as a whole, the designs ranged from simple combinations of three shapes, which were of the same colour, to complex combinations of six shapes which differed in colour.

As soon as the student was able to repeat the task directions back to the mediator, he began studying the models and copying them exactly. If the student was unsuccessful at any point, the model was exposed , and the student was required to verbalize the relationships that were apparent within the pattern. He was then given another opportunity to replicate the design.

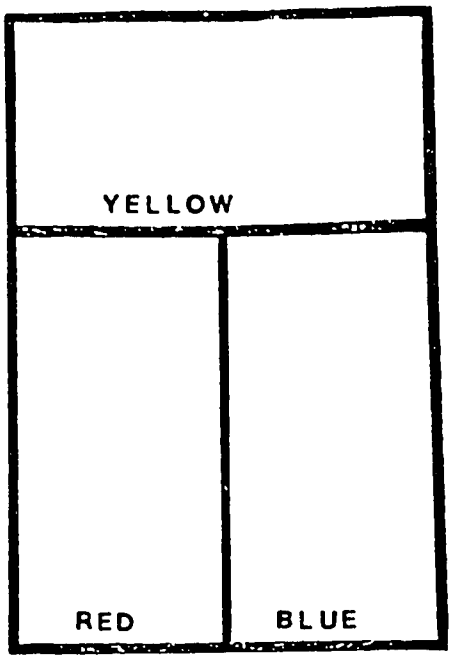

Figure 27. Shape Designs: Sample task.

Task 6: Magic Window

This task was adapted from Magic Window Test of the Kaufman Assessment Battery for Children (Kaufman & Kaufman, 1983).

Task description. The student was required to identify a picture of a common object which was gradually exposed, section by section, as it moved past a narrow slot that had been cut into a cardboard apparatus. (See Figure 28.) The object was constantly surveyable, but only one part of the object was revealed at any one time. The length of the exposure, beginning to end, was approximately five seconds. As soon as the student was able to repeat the directions back to the mediator, she: a) watched the slot as the first half of the object passed by; b) predicted what the object was going to be; c) watched the slot as the last half of the object passed by; and d) identified the mystery object. The pause at the half-way point was used to focus on possible relationships between the observed parts, with the student being encouraged to verbalize her thoughts spontaneously. If the student was unable to identify the object, following the exposure of the second half, the object was exposed again, with the time constraint removed.

Figure 28 removed due to copyright restrictions.

Figure 28. Magic Window: The apparatus.

Task 7: Serial Recall and Associative Pairing of Pictures

Task description. The student was presented with sets of four, six, or eight pictures. (See Figure 29.) The sets of four were made up of two associative pairs (e.g. tree and leaf, chair and desk). The sets of six and eight were made up of three and four associative pairs, respectively. Within each set, the cards were arranged so that one object from each pair was in the first half of the set, while the other object occupied the corresponding position in the second half of the set (e.g. tree, chair, leaf, desk). The student was required: a) to study the first set of pictures; b) to rehearse and recall the objects serially by verbalizing, "First ___, then ___, then ___ , etc."; c) to pair the items in the first series, giving reasons for each pairing; d) to rehearse and recall the objects by associative pair; and e) to rehearse and recall the objects of the remaining series using the method of his choice.

The student began when he was able to demonstrate an understanding of the task directions. If the student forgot the name of an object while recalling, or if the objects were recalled out of sequence, the student was required: a) to review the rehearsal strategy that he was using; and b) to rehearse and recall the series again. The student continued until he was able to reach criterion. The number of trials to criterion was recorded.

Figure 29 removed due to copyright restrictions.

Figure 29. Serial Recall and Associative Pairing: Sample task.

Task 8: Tracking

This task was adapted from a preschool diagnostic test which was developed by the Russian psychologists, Venger and Kholmovskaya.

Task description. The 55 cm by 70 cm map of a 'village' was hung on the wall at the student's eye-level. (See Figure 30.) The student was presented with a series of eleven tracking cards, each one of which illustrated a journey from the starting point (i.e. the tuft of grass at the bottom of the map) to a different, numbered house. While imagining that she was a driver who was delivering parcels for a courier service, the student was told to identify, as quickly as possible, the houses to which she had to make deliveries. The student was then required: a) to summarize the task directions; b) to complete the first task as an example; c) to identify the numbered houses on the remaining ten cards as quickly as possible; and d) to record the answers in the appropriate spaces on the answer sheet. The total number of minutes and seconds, from the time the student started looking at the second card until she wrote down the final answer, was recorded.

If the student made any errors, she was required to redo those cards, while verbalizing the procedures that she was using to identify the target houses. If the student did not make any errors, she was asked to redo any three of the cards, while verbalizing. This time was used to discuss the strategies that were being employed and to decide on ways that the deliveries could have been completed more rapidly. The order of the cards was changed and the task was completed once more. The times-to-completion were then compared across trials.

Tracking: Part 2 required the student to find her way to particular lettered trees where she was supposed to meet a friend. The procedures that were to be used by the student were identical to those of Tracking: Part 1.

Note. The change of targets, from houses to trees, and the change in the order of the cards before each trial ensured that the students were never required to complete the task, in exactly the same way, a second time.

Figure 30 removed due to
copyright restrictions.

'Village' map.

Tracking cards.

Figure 30. Tracking: Sample task.

Task 9: Picture Story Sequencing

This task was adapted from Picture Story Arrangement of the Kaufman Assessment Battery for Children (Kaufman & Kaufman, 1983).

Task description. The student was presented with a set of four to ten randomly ordered pictures. (See Figure 31.) His task was to place the pictures into an ordered sequence, such that a meaninigful story was told. Once the student had demonstrated familiarity with the task directions, he was required: a) to study the randomly ordered pictures; b) to rearrange the pictures so that they told a sensible story; c) to verbalize the story, using the pictures as a guide; d) to provide a suitable title for the story; and e) to suggest a suitable beginning and/or ending for the story, with an appropriate rationale. If the student sequenced the pictures incorrectly, he was provided with the initial picture in the sequence. The student then proceeded with the remainder of the task requirements.

Figure 31 removed due to copyright restrictions.

Figure 31. Picture Story Sequencing: Sample task.

Task 10: Community Puzzle

This task has been adapted from Community Picture Puzzle II, published by Developmental Learning Materials.

Task description. The student was provided with a floorplan of a shopping mall (See Appendix 3: Figure 36.) or a map of an amusement park. (See Appendix 3: Figure 37.) She was also given a point of departure and a destination. She was then asked to find the shortest route between the two points. If the student did not follow the most direct route, she was told that there was a shorter one yet, and she was asked to try again, verbalizing her journey as she went.

Appendix 3: Bridging Tasks

Tasks to Accompany Matrix Numbers and Matrix Letters

Matrix Words 1

Task description. The student was required to rehearse and recall series of words using the procedures that were learned during Matrix Numbers and Matrix Letters (See Figure 32.). There were five series of words. Each series consisted of five words which had been arranged in a five-cell matrix, with one word in each cell. All of the words had been classified at a Grade 3 level of reading difficulty. Four of the words were related; one was not.

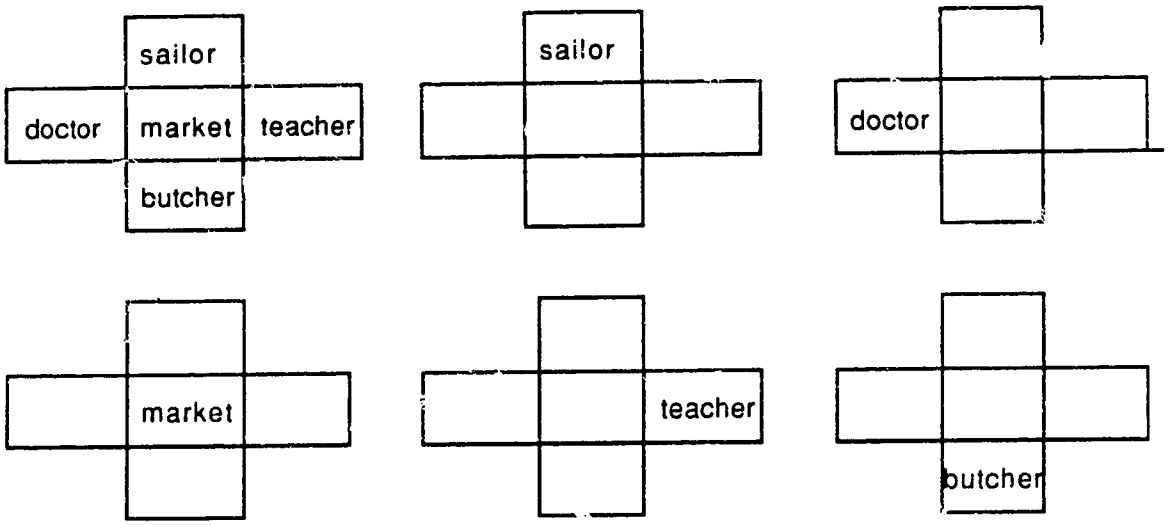

Figure 32. Matrix Words 1: Sample activity.

At the end of each presentation, the student: a) recalled or wrote the words in the correct order; b) identified the four related words; and c) explained why the fifth word did not belong to the same group.

Directions. Preliminary. "Look at the five words which have been placed in the matrix. Point to each word one after the other. Say each word as you point to it."

Level A: 1."Look at the cards which show you the words, one at a time. Read the words to yourself, beginning with the first card and continuing to the last card. You can read them more than once if you wish. When you are ready, write the words, in order, on the blank matrix. Now, before you begin, tell me, in your own words, what you're supposed to do."

If the student is able to recall all of the words and to position them correctly within the matrix, he proceeds to Part 2. If the student makes errors of recall and or transposition, he is told how many errors were made and the nature of those errors. The specific errors are then discussed, and the student is asked to suggest why the errors occurred and how they might be avoided on subsequent trials. The student then proceeds to Level B.

2. "Use the completed matrix to answer the following questions: a) Four of the words are related or alike in some way. Which four words are related? b)Which word does not belong to the group? c) Why doesn't it belong? How is it different?"

Level B: "Look again at the cards which show you the words, one at a time. As you look at the cards, point to the words with your finger, and say them out loud like this, 'First ___, then ___, then ___, etc.'. Continue until you have said all of the words. You can rehearse the words more than once, if you like."

When the student has finished rehearsing the words, the mediator continues.

"Write the words in order on the blank matrix. Be sure to place each word in the correct space."

As soon as the student is able to recall all of the words and to position them correctly within the matrix, he proceeds to the discussion of the accompanying questions. (See Level A: Part 2.) If the student is unable

to remember all five words, or if the words are remembered/ written out of sequence, the steps (i.e. within Level B) are repeated. The procedure is continued until the student is able to remember all five words and to position them correctly within the matrix. The number of trials to criterion is recorded. Following the discussion of the accompanying questions, the student proceeds to the next item.

Sample activities.

1. a) sailor b) doctor c) market d) teacher e) butcher

2. a) Thursday b) Monday c) Sunday d) Friday e) Holiday

Matrix Words 2

Task description was identical to the task description for Matrix Words 1, except that the last three series contained words that had been classified at a Grade 4 level of reading difficulty.

Directions were identical to the directions for Matrix Words 1.

Sample activities.

1. a) spoon b) plate c) knife d) blanket e) pitcher

2. a) palace b) queen c) jewels d) knight e) robber

Tasks to Accompany Sentence Verification

Picture Identification

Task description. The student was presented with a set of photographs. There were two to five photographs in the set. In any given set, the photographs were thematically similar. Each set of photographs was accompanied by a printed passage which was thirty-five to forty-five words in length. The passage described what was happening in only one of the photographs. The student's task was to read the printed passage, to study the accompanying set of photographs, and to select the photograph that best illustrated the contents of the passage. The student began with the two-photograph sets, worked through the three and four-photograph sets, and finished with the five-photograph set.

Directions. Level A: "In this activity, you will be given a set of two, three, four, or five photographs and a short printed passage. It will be your job to study the set of photographs, to read the printed passage, and to select the photograph that best illustrates, or goes with, the contents of the passage. Only one of the photographs goes with the passage. If you have trouble with any of the words in the passage, tell me, and I'll help you. Now, before you begin, tell me, in your own words, what you're supposed to do."

Once the directions have been correctly paraphrased, the set of pictures is placed on the table directly in front of the student. The printed passage is placed on the table as well, between the set of pictures and the student. If the student is able to select the correct photograph, she is required to justify the selection by referring to the key phrases that match the contents of the photograph. The student then proceeds to the next item. If the student is unable to choose one of the pictures, or if she chooses incorrectly, the student is asked to explain the reasons for her error and to suggest a more effective strategy for matching the printed

passage to the correct photograph. Following a brief discussion, the student proceeds to Level B.

Level B: "Take a closer look at the set of photographs. Notice the ways in which the photographs differ from each other."

After 10 or 15 seconds, the mediator continues.

"Now read the passage again, out loud to me. As you read it, try to identify the important words or phrases that are going to help you choose the correct picture."

As the student rereads the passage, she should be helped to identify the salient features that are going to contribute to the identification of the correct picture. If the student is still unable to identify the correct picture after rereading the passage, she proceeds to Level C.

Level C: The student studies the photographs, as the mediator reads the passage to her. As the passage is being read, the salient features which were identified previously are emphasized. It may be necessary to read the passage more than once, but the number of readings should not exceed the number of photographs. With the successful completion of the first item, the mediator continues.

"For each of the following exercises, the procedure will be exactly the same. You will have to read the printed passage, identify all or most of the important clues, study the pictures carefully, and choose the picture that goes with the little story."

The student begins with the two-picture sets, and proceeds to the three-picture sets, the four-picture sets, and the five-picture set.

List of photographs and sample reading activities.

1. a) Helicopter in the air; b) Helicopter on the ground.

Bill and Sam had spent hours working on their model. Now their helicopter was sailing over the crowd. It was on its way to the finish line.

5. a) Rocket on a launch pad; b) Ignition; c) Lift-off.

The rocket's engines roared. A cloud of white smoke covered the launch pad. In a few moments, the rocket and its crew would be streaking toward Mars.

Passage Identification 1

Task description. The student was presented with a photograph and a set of printed passages. There were either two, three, or four passages in a set. Only one of the passages accurately described the contents of the photograph. The student's task was to study the photograph, to read each of the printed passages in the set, and to select the passage that best matched the photograph. The student started with the two-passage sets, proceeded to the three-passage sets, and finished with the four-passage sets.

Directions. Level A: "Here is a picture and a set of printed passages."

The photograph is placed on the table. The set of printed passages is then placed below the photograph, between the photograph and the student.

"Study the picture. Then read each passage carefully. When you have finished, choose the passage that seems to be describing what is happening in the picture. If you have trouble with any of the words in the passages, tell me, and I'll help you. Now, before you begin, tell me, in your own words, what you're supposed to do."

Once the student has correctly selected one of the passages, she is required to justify the selection by referring to the key features of the photograph that match the contents of the passage. The student then proceeds to the next item. If the student has difficulty selecting the correct passage, she is asked to explain the reasons for the difficulty and to suggest a more effective strategy for matching the photograph to the correct passage. The student then proceeds to Level B.

Level B: "Look at the picture again. Describe in your own words what is happening in the picture."

As the salient features are mentioned by the student, they should be emphasized by the mediator. When the student has finished, she should be required to summarize the key features.

"Now read each of the passages again. This time read them out loud to me."

As each passage is read, it should be considered in relation to the summary of the salient features that was arrived at previously. The student should decide, in each case, whether or not the contents accurately describe what is going on in the picture. A final decision should be made when all of the passages have been considered. If the student is still unable to identify the correct passage, she proceeds with Level C.

Level C. The student studies the photograph and summarizes the salient features that were identified previously. The student then listens as the mediator reads each passage aloud. At the end of each passage, the student decides whether or not it describes the contents of the photograph. When the correct passage is identified, the student proceeds to the next item.

Summary: "For each of the following exercises, the procedure will be exactly the same. You will have to study the picture, identify the most important features of the picture, carefully read all of the printed passages, and choose the passage that best describes what is going on in the picture."

The student begins with the two-passage sets, proceeds to the three-passage sets, and finishes with the four-passage sets.

List of photographs and sample reading activities.

1. Mail-lady.

a) Jessie is playing 'Soldier' again. She puts on her uniform and marches around the house.

b) Jessie wants to be a postman. She is delivering the mail to her friends.

6. Horse-drawn cart.

a)The whole family was going to downtown to visit the new shopping mall. Jill said,"If we don't start soon, traffic will get too heavy, and we'll arrive too late to do any shopping."

b) Today was Christmas Eve. The family put on their best clothes and travelled to the village to celebrate with their friends and neighbours.

c) Father and the children had to go to the pasture to get more hay. Without food the cows would stop giving milk.

Passage Identification 2

Task description for Passage Identification 2 was very similar to the task description for Passage Identification 1. The only difference was that, in Passage Identification 2, additional emphasis was placed on the interpretation

of mood and feelings. This was in contrast to Passage Identification 1 where the focus is on the interpretation of the more physical aspects of the scene.

Directions for Passage Identification 2 were identical to the directions for Passage Identification 1.

List of photographs and sample reading activities.

1. Doe and her fawn.

a) The deer walked calmly onto the road. She knew that the drivers would allow her and her baby to cross safely.

b) The deer trembled as she waited fearfully at the side of the road. She knew there was danger here, for both herself and her newborn baby.

2. Badminton player.

a) Mary was so angry that she decided to complain. She had lost the match, but the other girl had not played fairly.

b) Mary felt awful. She had played very well. One careless mistake, though, had allowed the other girl to win.

c) Mary was the happiest person in the world. She could hardly wait to tell her father how well she had played.

Tasks to Accompany Shapes and Objects

Related Phrases

Task description. The student was presented with sets of seven, ten, or thirteen phrases, subsets of which could be classified on the basis of thematic similarity. The seven-item set contained two subsets of three phrases plus a distractor. The ten-item set contained three subsets of three phrases plus a distractor. The thirteen-item sets contained either three subsets of four phrases or four subsets of three phrases plus a distractor. The student was also presented with the appropriate number of labels which identified the categories that were under consideration. For each set of phrases the student was required: a) to read the phrases; b) to classify the items into the specified groups; and c) to identify the distractor. The student began with the two-group set; proceeded to the three-group sets, and finished with the four-group set.

Directions. Level A: "In this activity you will be given a set of labels which identify two, three, or four categories or groups. You will also be given a set of phrases which have been printed on cards. Most of the phrases can be divided up and assigned to one or another of the available groups. One of the phrases does not belong in any category; it stands completely alone. Your job is: a) to read the labels and the phrases silently to yourself; b) to classify the phrases by placing each one into its proper group; and c) to identify the phrase that doesn't seem to belong to any group. If you have trouble with any of the words, tell me, and I'll help you. Before you begin, tell me, in your own words, what you're supposed to do."

If the student is able to classify all of the phrases correctly, he is required to explain why the phrases were classified as they were. The student then proceeds to the next item. If the student is unable to classify all of the phrases correctly, he is told how many phrases in each group have

been incorrectly classified and is asked to suggest a more effective strategy for classifying the phrases. The student then proceeds to Level B.

Level B: The student is required: a) to read aloud all of the labels, together with the phrases that have been associated with each one; b) to evaluate each phrase relative to the associated label; c) to reclassify phrases which appear to have been incorrectly classified; and d) to provide a rationale for each reclassification. If the student persists in making errors, he proceeds to Level C.

Level C: All of the phrases which were misclassified are removed from their groups and arranged in front of the student. Each phrase is then considered relative to all of the available categories/labels, in turn. The activity continues until all of the phrases are correctly classified. The student then proceeds to the next item.

Sample activities.

1.a) Categories: Preparing food, angry reaction.

b) Items: Baking cookies, slamming a door, boiling vegetables, singing songs, roasting a chicken, kicking a chair, throwing a plate.

2.a) Categories: Talking someone into something, doing artwork, using force.

b) Items: To coax a child, to paint a picture, to draw a design, to attack the enemy, to bounce a ball, to fight a battle, to urge a group, to persuade a friend, to make war on a country, to colour the background.

Related Sentences

Task description for Related Sentences was very similar to the task description for Related Phrases. The difference was that sets of seven, ten, and

thirteen sentences were used in place of the sets of phrases. In addition, all of the subsets contained only three items each.

Directions for Related Sentences were very similar to the directions for Related Phrases. The only necessary modification was the substitution of the word "sentences" for the word "phrases" throughout.

Sample activity.

1.a) Categories: Working for a living, things you'd like to avoid.

b) Items: (i) Dave was looking at the most disgusting supper he had ever seen. (ii) The farmer ploughed his land in the fall. (iii) The teacher was reading a book to the class. (iv) Her awful neighbour was coming to complain again. (v) The tailor finished sewing the suit before lunch. (vi) The thought of going on stage made Sam's stomach hurt. (vii) The dress was very elegant but also very expensive.

Tasks to Accompany Related Memory Sets: Part 2

Word Sets 1

Task description. The student was presented with sets of three, four, and five words. The three and four-word sets were made up of related words. The five-word sets were made up of two subsets of related words. Working with one set of words at a time, the student: a) scanned the set of words; b) identified how the words were related; c) suggested a suitable working title for each set or subset of related words; and d) memorized the set or subsets. The student began with the three-word sets, proceeded to the four-word sets, and finished with the five-word sets.

Directions. Preliminary: "Here is a set of word cards. Read each word out loud as I put the card on the table."

If the student is not familiar with any of the words, correct pronunciation and meaning should be discussed before proceeding to the next word.

Level A: "In this activity, your job will be: a) to rehearse the words by saying them silently to yourself; and b) to recall the words exactly as they were presented to you. Now, before you begin, tell me, in your own words, what you're supposed to do."

If the student is able to recall all of the words correctly, she is asked to supply a short title which will describe how the words of the particular set or subset are related. The student then proceeds to the next item. If the student makes errors of recall and/or transposition, she is told how many errors were made and the nature of those errors. Specific errors are then discussed, and the student is asked to suggest why the errors occurred and how they might be avoided on subsequent trials. The student then proceeds to Level B.

Level B: 1.(For three and four-word sets.) "Look carefully at the set of words. All of the words are related in some way. That is, they all have something in common. Try to think of a short title which will describe how the words are related. Don't worry if you have trouble. I'll help you."

2.(For five-word sets.) "Look carefully at the set of words. The words in each of the subsets are all related in some way. Try to think of a short title which will describe how the words of each subset are related. You will have to think of two separate titles."

The appropriateness of the titles should be discussed as they are presented. When suitable titles have been agreed upon, the mediator continues.

"Memorize the set of words in the same order in which it is presented to you. As you review the words, think of how the words of the set (or subset) are related. Say each word aloud. Then turn the card face-down on the table.

When the student has finished reviewing the words, the mediator continues.

"Now say the words in the same order in which they were presented."

If the student is unsuccessful, the exercise is repeated. The student continues to rehearse until she can repeat all of the words in their correct order. The number of trials to criterion is recorded for each set.

Sample activities. 1. Doctor, nurse, hospital.

2. Evening, morning, afternoon, night.

3. (Pine, palm) + (bacon, beef, sausage).

Word Sets 2

Task description. The student was presented with sets of four, five, or six words. The words in each set were all related in some way. The sets of five and six words were each divided into two subsets. The words of a subset were

more closely related to each other than they were to the words of the companion subset. The existence of a relationship within the set as a whole, as well as within each of the component subsets, introduced a factor which was not present in Word Sets 1. Successful performance should, therefore, have required a higher level of comprehension ability than was the case previously.

Working with one set of words at a time, the student: a) scanned the set of words; b) identified the relationships that characterized the two subsets (i.e. where it was appropriate to do so) and suggested a working title for each; c) identified the relationship that characterized the group as a whole and suggested a suitable working title; and d) memorized the set of words. The student began with the four-word sets, proceeded to the five-word sets, and finished with the six-word sets.

Directions. Preliminary: "Here is a set of word cards. Read each word out loud as I put the card on the table."

Correct pronunciation and meaning should be discussed where necessary

Level A: "In this activity, your job will be: a) to review the words by saying them silently to yourself; and b) to recall the words exactly as they were presented to you. Before you begin, tell me, in your own words, what you're supposed to do."

If the student is able to recall all of the words correctly, she is asked to identify the relationships that characterize the two subsets (i.e. where it is appropriate to do so) and the group as a whole. The student is asked to supply suitable working titles for the words at each level (i.e. sets and subsets). The student then proceeds to the next item. If the student makes errors of recall and/or transposition, she is told how many errors were made and the nature of those errors. Specific errors are discussed,

and the student is asked to suggest why the errors occurred and how they might be avoided on subsequent trials. The student then proceeds to Level B.

Level B: 1.(For four-word sets.) "All of these words have something in common. Try to think of a short title which will describe how the words are related."

2.(For five and six-word sets.) "All of these words have something in common, but they are divided into subsets for a reason. Examine the set of words very carefully, and try to answer these questions: (i) What do the words of the first subset have in common? (ii) What do the words of the second subset have in common? (iii) How are the words of the first subset different from the words of the second subset? (iv) How are the words in the set as a whole related to each other?

Now try to think of three titles for the set of words. One should describe how the words of the first subset are related. Another should describe how the words of the second subset are related. The last should describe how the words of the set as a whole are related."

The titles should be discussed until it is clear that the student has a grasp on an appropriate classification scheme. When suitable titles have been agreed upon, the mediator continues.

"Memorize the set of words in the same order in which it is presented to you. As you review the words, think about how the words of the set (or subset) are related. Say each word aloud. Then turn the card face-down on the table."

When the student has finished reviewing the words, the mediator continues.

"Now say the words in the same order in which they were presented."

If the student is unsuccessful, the exercise is repeated. The student continues to rehearse the word list until she can repeat all of the words in their correct order. The number of trials to criterion is recorded for each set.

Sample activities. 1. Gobble, grunt, honk, squawk.

2. (Costume, uniform) + (pants, shirt, apron).

3. (Pencil, ruler, crayon) + (arithmetic, spelling, language).

Tasks to Accompany Shape Designs

Figure Arrangement 1

Task description. The student read a sentence describing how two or three farm animals were arranged in relation to each other. The student visualized the scene, with the animals positioned appropriately. With the card turned face down, the student then arranged plastic figures to correspond with the scene as it was described in print.

Directions. Preliminary. "Here are three plastic farm animals. I'm going to say a number of words or phrases, one at a time. These expressions are used to describe how objects are arranged when they're together. When I say a word or phrase, I want you to use two or more of the farm animals to demonstrate what the word or phrase means. The expressions are: a) beside, b) in front of, c) behind, d) to one side of, e) ahead of, f) between, g) in back of, h) next to, i) below, j) above, k) under, l) on top of".

When the student is able to demonstrate an understanding of all of the above expressions, he proceeds to Level A.

Level A: "Here is a sentence which describes a scene involving two or three farm animals. Your job is: a) to read the sentence silently to yourself; b) to choose the animals that are mentioned in the sentence; and c) to arrange the animals so that they match the description on the card. You can read the sentence more than once if you like. If you have trouble with any of the words, tell me, and I'll help you. Now, before you begin, tell me, in your own words, what you're supposed to do."

If the student is successful, he/she proceeds to the next item. If the student is unable to recreate the scene as it is described on the card, he is asked to identify the reason(s) for his difficulty and to suggest a

strategy for bringing the task to a successful conclusion. The student then proceeds to Level B.

Level B: "Read the sentence out loud to me. As you are reading it, try to imagine the scene in your head, with the animals standing just as they are described in the sentence."

When the student has finished reading the sentence, the mediator continues.

"Without looking at the card, describe for me the scene in your head. *(The mediator pauses to allow the student to respond.)* Now try once more to arrange the animals so that they match the description on the card."

If the student is still unable to complete the activity successfully, possible reasons for the failure are discussed. The student then proceeds to Level C.

Level C: "Listen to me as I read the sentence. When I've finished, I'm going to ask you some questions. Think carefully before you answer."

After the student has listened to the sentence being read, the following questions are used as a focus for discussion:

a) Which animal is mentioned first in the sentence? Let's think of that animal as being the central or most important animal in the scene.

b) Which animal(s) is(are) present in the scene with the central animal?

c) Where is the central animal standing compared to the other animal(s)?"

Following the discussion, the mediator continues.

"Now read the sentence aloud one more time. Then use the plastic figures to show me how the animals should be standing."

Sample activities. 1.The cow is beside the horse.

2.The goat is between the chicken and the rooster.

3.The dog is next to the colt and behind the horse.

Figure Arrangement 2

Task description. This task was similar to Figure Arrangement 1, except that: a) four or five animals were used instead of only two or three; and b) the use of a frame which was three compartments across by three compartments high allowed the student to place figures above and below each other.

Directions. Level A: "This activity is like Figure Arrangement 1, except that you are going to be arranging the animals inside of the frame as well as on the table-top. For example, you might be directed to place the lamb under the sheep. Here is a sentence which describes a scene involving four or five farm animals. Your job is : a) to read the sentence to yourself; b) to choose the animals that are mentioned in the sentence; and c) to arrange the animals so that they match the description on the card. You can read the sentence more than once if you like. If you have trouble with any of the words, tell me, and I'll help you. Now, before you begin, tell me, in your own words, what you're supposed to do."

If the student is successful, he proceeds to the next item. If the student is unable to recreate the scene as it is described on the card, he is asked to identify the reason(s) for his difficulty and to suggest a strategy for bringing the task to a successful conclusion. The student then proceeds to Level B.

Level B: "Read the sentence out loud to me. As you are reading it, try to imagine the scene in your head, with the animals standing just as they are in the sentence.

When the student has finished reading, the mediator continues.

"Without looking at the card, describe for me the scene in your head."

The mediator pauses to allow the student to respond.

"Now try once more to arrange the animals so that they match the description on the card."

If the student is still unable to complete the activity successfully, possible reasons for the difficulty are discussed. Then the student proceeds to Level C.

Level C: The student: a) listens to the sentence as it is read to him; b) identifies the first figure as the central figure; c) identifies, with the mediator's help, how each of the other figures is positioned relative to the central figure; and d) rereads the sentence and positions all of the figures appropriately.

Sample activities. 1. The rooster is above the dog and between the calf and the pig.

2. The horse is on top of the cow, beside the pig, and behind the chicken.

Figure Arrangement 3

Task description. The student read a short story which described how four or five animals or other characters assumed specific positions relative to each other as they went about their business. The student then used plastic figures or mounted pictures to indicate the positions that were occupied by the various characters at the end of the story.

Directions. Level A: "This is a story about a number of different animals. Your job is: a) to read it silently to yourself; b) to choose the figures which correspond to the characters which appear in the story; and c) to arrange the figures so that they show where the different characters are standing at the end of the story. You can read the story more than once if you like. If you have trouble with any of the words, tell me, and I'll help you. Now, before you begin, tell me, in your own words, what you're supposed to do."

If the student is successful, he proceeds to the next item. If the student is unable to recreate the final scene of the story, he is asked to identify the reason(s) for his difficulty and to suggest a strategy for bringing the task to a successful conclusion. The student then proceeds to Level B.

Level B: "Read the story out loud to me. As you read it, try to imagine where each of the characters is standing and/or where it is moving to.

When the student has finished reading, the card is turned face down, and the mediator continues.

"Tell me in your own words what happened in the story, and describe for me the final scene that you have pictured in your head. Then arrange the figures to show where the different characters were standing at the end of the story."

If the student is still unable to complete the activity successfully, possible reasons for the failure are discussed, and the student proceeds to Level C.

Level C: The student a) listens to the story as it is read to him; b) identifies the central figure; c) identifies, with the mediator's help, how each of the other figures is positioned , relative to the central figure and/or to each other, at the end of the story; d) rereads the story aloud; and e) positions all of the figures appropriately.

Sample activity. The frog and the toad sat side by side on the large flat rock. In a little while it would be time for them to join the evening concert. For now, they were enjoying the last rays of the setting sun. A centipede raced across the stony beach. He was being chased by a small snake. By next year, the snake would be large enough to chase the frog and the toad. This year, though, he could only chase insects. The lizard lay on the log, watching the other creatures. It had been a beautiful day. In a few minutes, she would bury herself in the mud to keep warm.

Tasks to Accompany Magic Window

What Am I?

Task description. The student was presented with five clues to the identity of a mystery object. Each clue: a) took the form of a single sentence (or,in a few cases, two short sentences) which had been written in the first person, b) gave the student a new piece of information, and c) was concealed as the next clue in the series was revealed. The student's task was to synthesize the information that was contained in the series of clues and to identify the mystery object. The student was encouraged to guess the identity of the object with the presentation of each clue. However, she was also permitted to alter the hypothesis with the delivery of each new piece of information. The student's preferred response to each of the clues in the series was recorded.

Directions. Level A: "Your job during this activity will be to use a series of clues to identify a mystery object. This is the procedure that we are going to use. I'll show you the first clue which you will read silently to yourself. You can read it more than once if you like. When you have finished reading the clue, you'll turn the card face-down on the table in front of you. At that point, you'll be allowed to guess the object's identity. After you have made a guess, I'll show you the next clue. As we proceed, you may change your guess as often as you like. We'll continue until I've shown you all five clues. At that point you'll be required to make your final guess. Now, before we begin, tell me in your own words what you're supposed to do."

If the student is able to identify the mystery object following the presentation of the fifth clue, she proceeds to the next item in the activity. If the student is not successful, she is asked to identify the reason(s) for her difficulty and to suggest a strategy for bringing the task to a successful conclusion. The student then proceeds to Level B.

Level B: "We're going to go through the clues again. This time, as I put each card in front of you, I want you to read it out loud to me."

When the student has finished reading the card, the mediator continues. "Look at the clue again, and try to pick out one or two words which will help you to remember what the clue is about."

Some discussion regarding the suitability of various words may be necessary. When the student has selected one or two words, the mediator continues.

"Try to keep those words in your memory. Turn the card face-down on the table, and I'll give you the next clue."

The same procedure is followed with each clue. In addition, as new key words are identified, preceding key words are reviewed. Following presentation of the fifth clue, all of the key words are reviewed, and the student is required to make a final guess. If the student is still not successful, she proceeds to Level C.

Level C: This time the student listens as each clue is read to her. Once a clue has been read, it is left exposed on the table in front of the student. When all five of the clues have been read, the student is permitted to review each of them in turn prior to making a final guess as to the identity of the mystery object.

Sample reading activities:

1. I eat insects or seeds but usually not both.

My home is a nest which I build myself.

My young hatch from eggs which I lay in my nest.

My body and wings are covered by feathers.

When winter comes, I like to fly south to a warmer country.

2. I eat many things, but I like insects most of all.

My young are born live.

Except for my wings, my body is covered by fur.

I spend the day hanging upside-down in dark places.

I use a form of radar to catch food and to avoid objects that could hurt me.

3. I can grow to a length of eleven metres.

When swimming, I can pick up the scent of blood from several kilometres away.

I eat only meat which I tear off in chunks and swallow whole.

Some divers have called me 'White Death'.

If you see me coming with my jaws open, get out of the way fast.

4. Long ago, I used to travel around all of the Earth's oceans.

Today you can find me resting on the ocean's floor.

Many sea creatures use me for a home. I guess that means that I'm not completely useless.

One day I may be scooped up and placed in a museum.

At times I'm bothered by people who are looking for treasure.

W-5

Task description. The student was presented with a question that began with who, what, when, where, or why. The student was then given a series of four or five clues which made it possible for her to answer the question. Taken together, the clues formed a little story. There were two sentences per clue. One of the sentences provided the student with new and relevant information. In most cases, the other sentence elaborated on the content of the first but did not provide information that was particularly relevant to the task. As each new clue was revealed, the preceding clue was concealed. The student's task was to synthesize the information that was contained in the series of clues and to

use it to answer the original question. The student was encouraged to guess at the answer with the presentation of each new clue. She was permitted to alter the hypothesis with the delivery of each new piece of information. The student's preferred response to each of the clues in the series was recorded.

Directions. Level A: "Your job during this activity will be to use a series of clues to answer a question beginning with who, what, when, where, or why. This is the procedure that we're going to use. First I'll read the question to you. Then I'll show you the first clue which you will read silently to yourself. You will be able to read it more than once if you like. When you have finished reading the clue, you'll turn the card face-down on the table in front of you. At that point, you'll be allowed to try to answer the question which you were asked. After you have made a guess, I'll show you the next clue. As we proceed, you can change your answer as often as you like. We'll continue until I've shown you all of the clues. Then you'll be required to make your final guess. Now, before we begin, tell me in your own words what you're supposed to do."

If the student is able to answer the question correctly, following presentation of the final clue, she proceeds to the next item. If the student is not successful, she is asked to identify the reason(s) for her difficulty and to suggest a strategy for bringing the task to a successful conclusion. The student then proceeds to Level B.

Level B: The student rereads the clues aloud to the mediator. When the student has finished reading a card, she is required (and helped if necessary) to select a word or phrase which contains the essence of the clue under consideration. Once a suitable word or phrase has been selected, the card is turned face-down on the table, and the remaining clues are similarly presented. With the identification of each new key word or phrase, preceding key words and phrases are reviewed.

Following presentation of the final clue, all key words or phrases are reviewed, and the student is required to suggest a final answer. If the student is still not successful, she proceeds to Level C.

Level C: The student listens as each clue is read to her. Once the clue has been read, the student is asked to restate the clue in her own words; the key word or phrase is again identified; and the card is moved to one side (but left exposed) to make way for the next clue. When all of the cards have been read, the student is permitted to review each of them in turn prior to suggesting a final answer to the initial question.

Sample reading activities.

2. Question: Where or when is all of this activity taking place? What evidence do you have to support your idea?

a) Joey kicked the ball into the net. It was the first goal he had scored all year.

b) B.J. sat quietly by the fence. He just didn't feel like playing soccer or baseball today.

c) Sue and Janet were standing near the doors. They were sharing the candy that Sue's grandmother had given her.

d) The other girls had just stopped skipping. They were waiting for the bell and looking at a magazine that belonged to one of their friends.

4. Question: Why is Brad behaving the way he is? How can you be certain of this?

a) Usually Brad liked to go shopping with his mother. Today, though, he would have liked to have stayed at home.

b) They bought a package of pencils and four brightly coloured pens. Brad didn't really care what colour the pens were.

c) Brad's mom also bought some erasers that were shaped like racing cars. She thought that they would cheer Brad up, but they didn't.

d) Next they got some glue, a dozen notebooks, and a huge box of crayons. Brad didn't even look to see how many were in the box.

e) While his mother paid the clerk, Brad went to sit in the car. He was hoping that tomorrow would never come.

Tasks to Accompany Serial Recall and Associative Pairing

Word Pairs 1

Task description. On a given trial, the student was presented with a set of four or six words. Each of the four-word sets was made up of two word-pairs, while the six-word sets were made up of three word-pairs. In all cases, the paired words were related semantically (e.g. broom and mop; orange and peach; cub and pup). The sets were arranged so that one of the paired words was placed in the first half of a set, while the second word of the pair occupied the corresponding position in the second half of the set (e.g. 1.broom, 2.fork, 1.mop, 2.knife). The student's task was to rehearse and recall each set of words. This could be done by rehearsing and recalling the words serially, in the exact order in which they were presented. Alternatively, the student could group the words by associative pair and rehearse/recall them in the same way. In the latter case, however, the positioning of the paired words, relative to each other, had to be the same as it was in the original series.

Directions. Preliminary: "Here is a set of word cards. Read each word out loud as I put the card on the table."

The cards are placed on the table moving from the student's left to his right. If the student is not familiar with any of the words, correct pronunciation and meaning should be discussed before proceeding to the next word. When all of the words in the set have been previewed, the cards are collected in the same order in which they were presented.

Level A: "You will be shown the set of word cards again. You will be allowed a short time to review them, using a method of your choice. At the end of that time, the cards will be collected. Then you'll be asked to recall the words in the order in which you reviewed them. Now, before we begin, tell me, in your own words, what you're supposed to do."

If the student is able to recall all of the words correctly, he is asked to explain the method that was used to review the word list. If the student has rehearsed/recalled the words serially, the presence of the word pairs is pointed out. If the student has used associative pairs during rehearsal, the advantages over serial rehearsal are discussed. The student then proceeds to the next item. If the student makes errors of recall and/or transposition, he is told how many errors were made and the nature of those errors. Specific errors are then discussed, and the student is asked to suggest why the errors occurred and how they might be avoided on subsequent trials. The student then proceeds to Level B.

Level B: 1."This time, as the cards are placed on the table, point to each one and say the word aloud, like this: 'First ___, then ___, then ___, etc.'. When all of the cards are on the table, you will have a short time (i.e. three or four seconds per word) to review the words. At the end of that time the cards will again be collected. You will then be asked to recall the series of words in the order in which they were presented to you."

Following the attempt to recall the words serially, the student moves immediately to Part 2 of Level B. This is done even if the student has been able to recall all of the words correctly.

2. "You're going to be shown the set of word cards one more time. This time, look for words that seem to go together. Be ready to give a reason why those words could be paired."

In the subsequent discussion, all of the word-pairs in the set should be identified.

"Now review the words again. Pay special attention to the words that are paired and to the word that comes first in each pair. That is how you'll be asked to recall the set of words."

At the end of the alotted time, the cards are gathered up, and the student is asked to recall the words in pairs. The task is repeated until the student is able to recall all of the word-pairs in the set.

"For each of the following sets of words, the procedure will be exactly the same. First you will be asked to identify all of the words in the set. Then you will have to point to each card, say the word, practice the series, and recall all of the words. You can practice and recall the words in the same order in which they were presented to you, or you can practice and recall them as word-pairs. The decision is yours."

The student works through the remaining four-word sets, and then proceeds to the exercises employing six-word sets. In each case, the exercise is repeated until the student is able to recall all of the words in the appropriate order. The number of trials to criterion is recorded for each set.

Sample activities. 1. Broom, fork, mop, knife.

2. Bracelet, motor, necklace, engine.

3. Battle, storm, copper, war, blizzard, nickel.

4. Donkey, butcher, cart, mule, sailor, carriage.

Word Pairs 2

Task description. for Word Pairs 2 was very similar to the task description for Word Pairs 1. The difference was that six and eight-word sets, consisting of three and four word-pairs respectively, were used instead of the four and six-word sets.

Directions. for Word Pairs 2 and Word Pairs 1.were identical.

Sample activities. 1. Prince, castle, diamond, queen, palace, ruby.

2. Grain, tool, fish, flower, wheat, hammer, trout, rose.

3. Insect, soldier, goat, Indian, swarm, army, herd, tribe.

Tasks to Accompany Tracking

Pirates' Island

Task description. The student was given a printed exercise and an accompanying illustration. (See Figure 33.) The printed exercise consisted of two or three separate segments. Each segment: a) was printed on a separate index card; b) was approximately 100 words in length; c) contained from two to five clues to the location of a topographical feature, building, object, person, etc. which had not been specified on the illustration; and d) was followed by a number of questions which related directly to the passage.

The student first studied the illustration and then read the printed exercise, one segment at a time. At the end of each segment, the student used the printed clues to identify the location ot the object, etc. on the illustration.

Directions. Preliminary. "This (i.e. Figure 33) is a picture of an island. Why do you think that it's called Pirate's Island? Look carefully at the picture. Is there anything about it which you find confusing or which you do not understand?"

Stop to consider any elements which the student does not understand. Before identifying specific features for the student, ask he o speculate on what they might be. When the student has finished with the illustration, move it to one side, taking care to leave it fully exposed for the duration of the activity. Then give her the first segment of the printed exercise.

Level A: "Read this passage silently to yourself. If you have trouble with any of the words, let me know, and I'll help you. When you have finished, tell me."

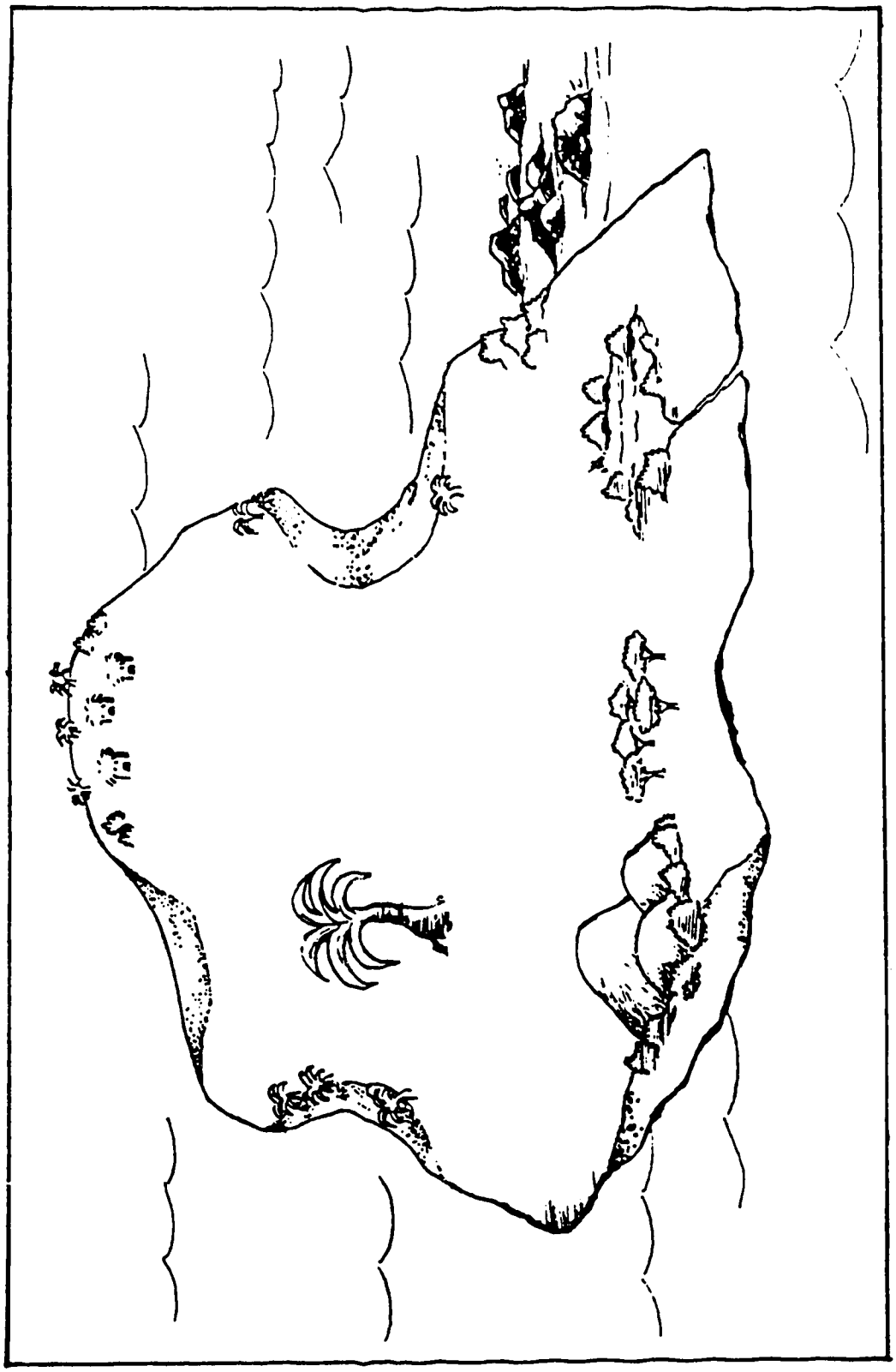

Figure 33. Pirates' Island

When the student has finished reading the passage, the mediator continues.

"Use the picture to answer these questions."

The questions corresponding to Level A are read, one at a time, to the student. If the student is able to answer them correctly, she proceeds to the next segment. If the student is unable to answer correctly, she proceeds to Level B.

Level B: "Read the passage again, out loud, to me. This time try to imagine that you are the pirate captain. Try to see the situation through his eyes."

When the student has finished reading, the mediator continues.

"Now use the picture to answer the following questions."

The questions corresponding to Level B are read to the student. Following each question, the student is allowed a reasonable amount of time to construct a suitable answer. If the student is unable to answer all of the questions correctly, she proceeds to Level C.

Level C: "Look at the picture and listen to me while I read the story. Listen carefully, because I'm going to ask you to tell it back to me when I've finished."

When the mediator has finished reading and the student has finished paraphrasing what she has heard, the mediator continues.

"Let's both use the picture to answer the questions."

The questions corresponding to Level C are read to the student. Sufficient time is allowed for the construction of suitable answers. If the student is still unable to answer all of the questions correctly, the mediator 'works through' the passage with the student, identifying all of the relevant clues along the way. The student is not allowed to proceed

to the next segment until all of the questions have been answered satisfactorily.

Sample reading exercise and questions. 1. "Watch out for the rocks!" shouted the captain. The pirates pulled once more on their oars. Then they jumped into the shallow water and dragged the boat up onto the beach. The captain climbed out too. Standing with his back to the water, he looked to his right at the grass-roofed huts. There didn't seem to be anyone else around. The pirates shaded their eyes from the sun. They stared at the giant palm tree far in the distance. Complaining loudly, they picked up their shovels and set off toward it. Half way to the tree, the men halted and began digging a hole for the treasure chest.

Level A: Point to the place where you would dig to find the pirates' treasure. Why would you dig there?

Level B: (i) Put an 'X' where the pirates pulled their boat up on shore. How do you know that's where they landed?

(ii) In what direction did the pirates set off, after picking up their shovels? How can you be sure?

(iii) Point to the place where you would dig to find the pirates treasure. Why would you dig there?

Level C: (i) Put your finger on the thing or things that caused the captain to shout a warning to his men.

(ii) Put an 'X' where the pirates pulled their boat up on shore. How do you know that's where they landed?

(iii) Circle the object that the pirates were staring at as they stood on the beach.

(iv) In what direction did the pirates set off, after picking up their shovels? How can you be sure?

(v) Point to the place where you would dig to find the pirate's treasure. Why would you dig there?

At the Playground

Task description was identical to the task description for Pirates' Island, except that Figure 34 was cited instead of Figure 33.

Directions were identical to the directions for Pirates' Island, except that Figure 34 is given to the student instead of Figure 33. In addition, the central characters with whom the student was asked to identify through the course of the story were different.

Sample reading exercise and questions. 1. Jason could see the whole playground from his hiding place. He could even see the swimming pool on the other side of the climbing structure. He had to hang on very tightly, though. If he fell, he could get hurt. His bicycle was close by, leaning against the caretaker's shed. That way he could watch over it while he waited. Jason was waiting for Pete and Tommy. They always left their bikes beside the boy's washroom. Then they ran for the swings. This time, when Pete and Tommy passed by, Jason was going to jump down and scare their socks off. This was going to be really funny.

Level A: Put an 'X' on Jason's hiding place. How can you be certain that he's hiding there?

Level B: (i) Put one finger on the place where Pete and Tommy will leave their bikes. Put another finger on the piece of playground equipment to which they will run. Where will Jason probably surprise them?

(ii) Of what is Jason afraid? Why?

(iii) Put an 'X' on Jason's hiding place. How can you be certain that he's hiding there?

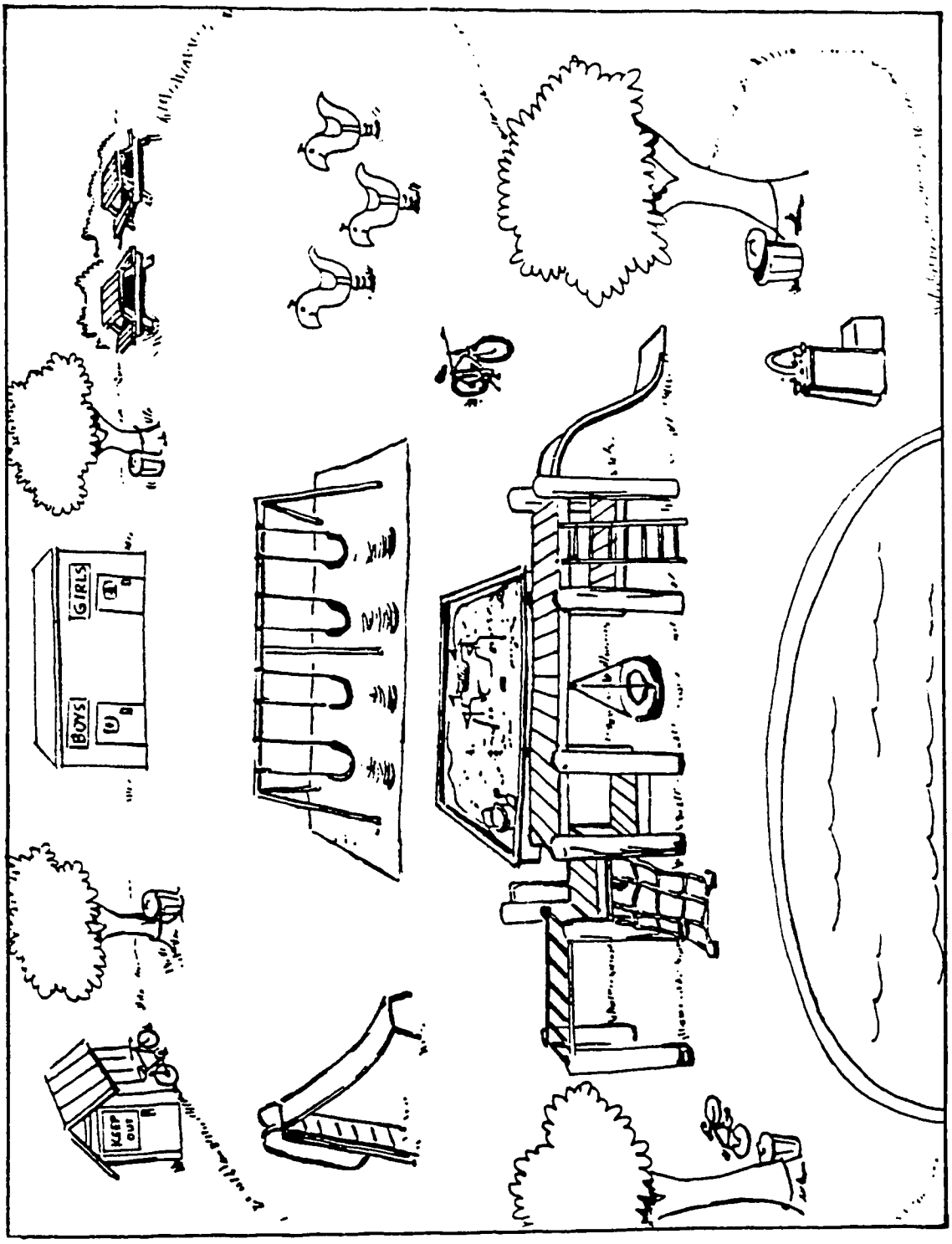

Figure 34. At the Playground.

Level C: (i) Put a circle around Jason's bicycle. Why did he park it there?

(ii) Put one finger on the place where Pete and Tommy will leave their bikes. Put another finger on the piece of playground equipment to which they will run. Where will Jason probably surprise them?

(iii) How can Jason see the swimming pool if it's on the other side of the climbing structure?

(iv) Of what is Jason afraid? Why?

(v) Put an 'X ' on Jason's hiding place. How can you be certain that he's hiding there?

Tasks to Accompany Picture-Story Sequencing

Picture Ordering

Task description. The student was given a printed passage. Once the passage had been read, it was removed from sight. The student was then given a series of four to six drawings (See Figure 35.) which illustrated selected events from the passage but which were not in the correct order. The student was required to sequence the drawings so that they corresponded to the events of the story. Once the student had sequenced the drawings correctly, he was required: a) to summarize the events of the story using the pictures as a guide, and b) to provide the story with a suitable title.

Directions. Level A: "You will be asked to read a short story. After you have finished reading the story, it will be taken away, and you will be given a series of drawings. The drawings illustrate what is happening in the story, but they are not in the correct order. It will be your job to rearrange the drawings so that they follow the same order as the events in the story. If you have trouble with any of the words in the story, tell me, and I'll help you. Now, before you begin, tell me, in your own words, what you're supposed to do."

The 5 by 8 index card on which the first passage has been printed is placed before the student. When the student has finished reading the story, the index card is removed or turned face down on the table. The drawings are then placed before the student, in the prescribed order, moving from the student's left to his right. If the student is able to sequence the drawings correctly, he is asked to summarize the events of the story, using the drawings as a guide, and to think of an appropriate title for the story. If the student makes an error in sequencing the drawings, he is told that at least one of the drawings is not in the correct order. The student is also asked to speculate on where the difficulty

might be. The drawings are then collected, the printed passage is placed face up before the student, and he proceeds to Level B.

Level B: "Read the story again. This time, read it out loud to me."

When the student has finished reading the story, the mediator continues as follows.

"Without looking at the card on the table, tell me what happened in the story. Use your own words, and try not to leave out any of the important events."

If the student leaves out important components, he is prompted with questions such as: 'What happened after/before that?, etc.' Events about which the student is not sure should be verified by referring to the printed passage. When all of the events have been recalled, the index card is turned face down on the table, and the drawings are placed before the student in the prescribed order. The mediator continues as follows.

"Now rearrange the drawings so that they follow the same order as the events of the story."

If the student is successful, he is required to provide a summary and a title. If the student is not successful, the printed passage is turned face up on the table, and the student proceeds to Level C.

Level C: "The order of the drawings is still not quite right. Read the story aloud one more time."

When the student has finished reading the story, the mediator continues, as follows.

"This (i.e. pointing to the appropriate drawing) is the first drawing of the sequence. Rearrange the remaining drawings so that they follow the same order as the events of the story."

If the student is successful, he is required to provide a summary and a title. If the student is not successful, he is given additional prompts, as

the positions of other drawings in the sequence are identified. The order in which the positions are identified is as follows: first, last, second, next-to-last, third, and third-from-last. When the correct sequence has been established, the student summarizes the events of the story and provides a suitable title.

Sample activity.

Amy's father promised to pay her five dollars if she washed the car. She collected up the bucket, the brush, the soap, and the garden hose and struggled to the road. Amy washed, wiped, and polished. She even vacuumed the seats and the floor inside. In no time, the car looked almost new. Father was very pleased. Now the question is: 'Who's going to wash Amy?'.

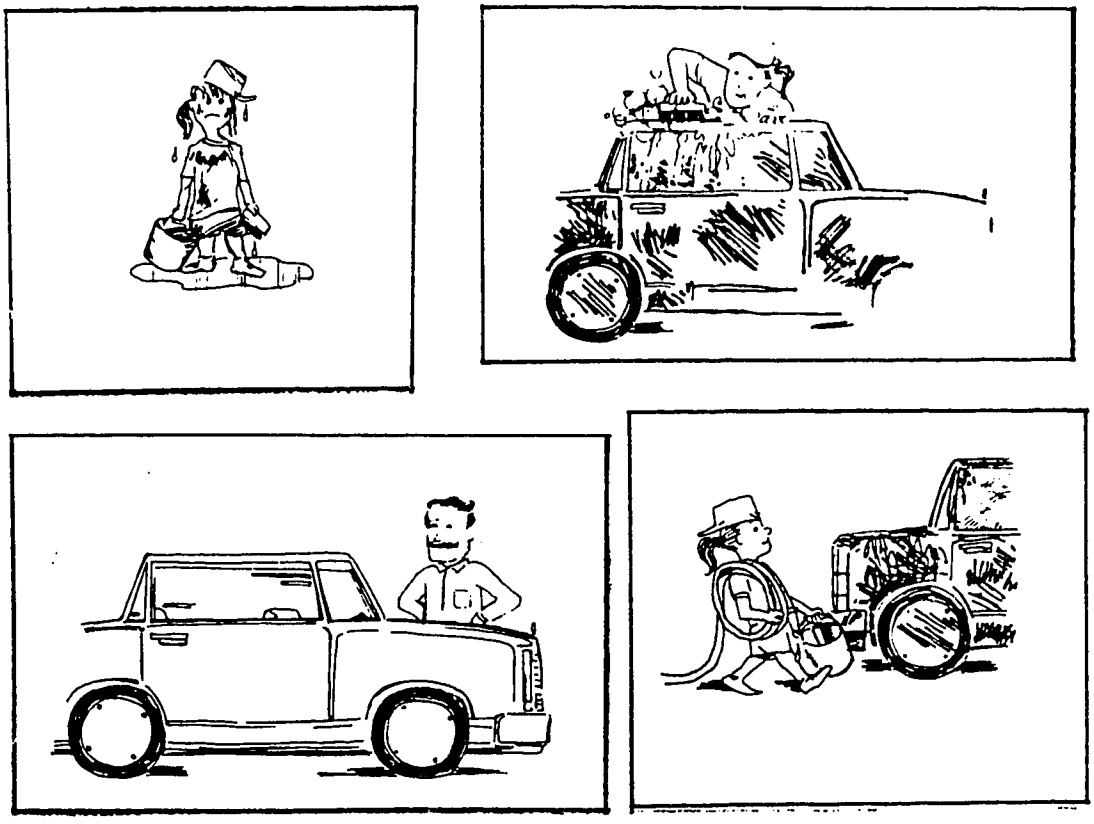

Figure 35. Amy's Car Wash.

Story Segments 1

Task description. The student was given a printed passage which had been divided into a number of segments. The segments were of similar size and were arranged so as not to be sequential. The student's task was to re-arrange the segments into their correct sequence, thereby creating a story that made sense. The student began with three-segment passages and finished with six-segment passages. When all of the segments had been correctly sequenced, the student summarized the story in his own words and provided the story with a suitable title.

Directions. Level A: "You will be given a short story which has been broken into three or more pieces. The pieces are all mixed up, which means that the story will not make any sense. You will be asked to read all of the pieces silently to yourself and then to re-arrange them so that they form a little story that does make sense. If you have trouble with any of the words, tell me, and I'll help you. Now, before you begin, tell me, in your own words, what you're supposed to do."

The first series of story segments is then placed on the table in front of the student, moving from the student's left to his right. If the student is able to sequence the segments correctly, the index cards are collected. The student is then required to summarize the events of the story and to provide an appropriate title for the story. If the student makes an error in sequencing the segments, he is told that at least one of the segments is not in the right position. The student is also asked to identify where the difficulty might be. The segments are then returned to their initial arrangement, and the student proceeds to Level B.

Level B: "Read the story again, using the following procedure. Read the first piece aloud to me. Then, without looking down at the cards, tell me, in your

own words, what you have read. Do the same thing for the second piece and for all of the remaining pieces. Then rearrange the pieces to form a story that makes sense."

If the student is successful, the cards are collected, and the student is required to provide a summary and a title . If the student is not successful, he is told that the order is still not quite right, and the segments are returned to their initial arrangement. The student then proceeds to Level C.

Level C: "Read the pieces aloud one more time."

When the student has finished reading the segments, the mediator continues as follows.

"This (i.e. pointing to the appropriate segment) is the first piece of the story. Move it over to one side (i.e. pointing to the left side). Now rearrange the remaining pieces so that all of the pieces will form a story that makes sense when they are read together."

If the student is successful, he is required to provide a summary and a title. If the student is not successful, he is given additional prompts, as the positions of the other segments in the sequence are identified. The order in which the positions are identified is as follows: first, last, second, next-to-last, third, third-from-last. When the correct sequence has been established, the cards are collected. The student then summarizes the events of the story and provides a suitable title.

Sample activities (with answer key).

1.a).The ball sailed high over the fielder's head. It bounced over the park fence and across the road. Billy took off as though he had been shot out of a cannon. (2)

b) Billy held on to the bat for dear life. He stared at the other team's pitcher. The butterflies in his stomach refused to settle down. (1)

c) Billy's team-mates lined up to give him 'high fives'. "It's funny," thought Billy. "I don't even remember hitting the ball." (3)

2.a) They were allowed to buy two treats, but they had to be quick. Both of them chose popcorn and a drink. (3)

b) Mother told them to stand by the door while she bought their tickets. They were so excited that they could hardly stand still. (1)

c) A man took their tickets as they walked through the door. He smiled and said that he hoped they enjoyed the show. (2)

d) They sat in the middle of the row that was third from the front. Mother was afraid that they were sitting too close. (4)

Tasks to Accompany Community Puzzle

West Edmonton Mall

Task description. The student was presented with a floorplan of West Edmonton Mall (See Figure 36.) on which several key features had been identified. The student was allowed some time to familiarize herself with the locations of the various key features. She was then given a series of printed passages, one at a time, each of which specified a point of departure and from one to five key features which were to be visited by the student. The features were listed randomly within the passages, and each passage also contained a constraint (e.g. time) under which the student was required to operate. The student's task was to: a) read each passage as it was presented to her; b) identify the point of departure and the key features which were to be incorporated into the visit; and c) use the floorplan to trace a path which began at the designated point of departure, incorporated all of the specified features, and satisfied the constraint that was contained in the text. The student began with the passage that specified two key features (i.e. including the point of departure) and finished with the passage that specified six features.

Directions. Preliminary. "This is the floorplan for West Edmonton Mall. As you can see, a number of special features have been identified on it. Let's look at those special features a little more closely."

The student's attention is directed to each of the special features in turn. When all of the features have been identified, the student proceeds to Level A.

Level A: "The printed passage on this card describes a make-believe visit to West Edmonton Mall. Your job will be: a) to read the printed passage silently

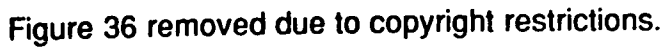

Figure 36. West Edmonton Mall.

to yourself; and b) to trace the path, which is described on the card, on the floorplan which is in front of you. In most cases, there is also a small problem which will complicate your make-believe visit to the Mall, so read each story carefully. If you have trouble with any of the words, tell me, and I'll help you. Now, before you begin, tell me in your own words what you're supposed to do."

When the student is able to summarize the task requirements, she proceeds to the first task. If the student is able to complete the activity successfully, which includes being able to provide an appropriate rationale for her actions, she proceeds to the next passage in the series. If the student is not successful, she is told that there is a problem with the route that was selected, and she is asked to suggest what the problem might be. The student then proceeds to Level B. .

Level B: "Read the story again. This time read it out loud to me. As you read it, try to imagine each of the places as it is mentioned.

When the student has finished reading the passage, the mediator continues.

"What was your starting point and which places did you visit on your make-believe trip through the Mall? Touch each of the places that was mentioned in the story. You can look back at the card if you think that it will help you."

Once the student has identified the point of departure and the special features which were mentioned in the passage, she is required to trace the appropriate path through the Mall. If the student is still unable to complete the activity successfully, she proceeds to Level C.

Level C: "Listen to me while I read the story aloud. As I mention the starting point and each of the places to which it is necessary to go, I want you to place one of the markers (i.e. provided by the mediator) on the appropriate spot on the floorplan."

When all of the features have been marked by the student, she is then required: a) to identify the constraint that is operating in the passage, and b) to trace the appropriate path through the Mall. The student then proceeds to the next passage in the series.

Sample reading activities.

1. You and your aunt have arrived on the transit bus. She wants to play Bingo while you go to the Waterpark. Unfortunately, she can't find her way by herself. What route are you going to have to follow through the Mall?

2. Your father has driven you to door number eight. You have come to the Mall to go on the submarine and the roller coaster. You also want to go on the waterslides. You know that the waterslides are probably going to tire you out. Therefore, you're going to try hard to save your strength. Trace the path that you intend to take through the Mall.

Walt Disney World 1

Task description for Walt Disney World 1 was very similar to the task description for West Edmonton Mall. The differences were: a) that a map of the Magic Kingdom in Walt Disney World (See Figure 37.) was substituted for the floorplan of West Edmonton Mall; b) that the words 'map' and 'Magic Kingdom' were substituted for the words 'floorplan' and 'West Edmonton Mall, respectively; c) that the number of special features, including the point of departure, which were identified in the printed passages varied from two to four; and d) that, unlike the printed passages from West Edmonton Mall which had all been written using the second person, three of the passages in Walt Disney World 1 had been written in the third person.

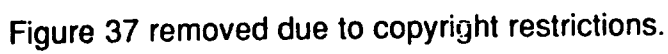

Figure 37. Magic Kingdom.

Directions. Except for the differences noted above, the directions for Walt Disney World 1 were also very similar to the directions for West Edmonton Mall.

Sample reading activities. 1. Billy got off the Big Thunder Mountain Railroad. He ran to 20,000 Leagues Under the Sea. He didn't waste a single step. What route did Billy follow?

2. You and your little cousin are walking along Main Street, U.S.A. You want to visit the Haunted House. Your cousin wants to go to the Mad Tea Party and to Dumbo, the Flying Elephant. If you walk too far, your cousin will become tired. Then you'll have to go home early. What route should you take?

Walt Disney World 2.

Task description for Walt Disney World 2 was very similar to the task description for Walt Disney World 1. The only differences were: a) that the number of special features which were identified in the printed passages varied from three to five; b) that all of the passages had been written in the third person; and c) that, in order to complete each of the activities, the student was required to make an inference regarding the identity and/or location of one of the special features.

Directions for Walt Disney World 2 were identical to the directions for Walt Disney World 1.

Sample reading activities.

1. As Josh was leaving Dumbo, the Flying Elephant, he fell and cut his knee. He started to run to take the canoe to Tom Sawyer's Island. Then he saw the blood. Josh was afraid that he would have to go home to get cleaned up and bandaged. Luckily, Josh had a bright idea. Trace the route that you think Josh followed.

4. Father met Tom and Sara as they ran down the steps from Star Jets. "Okay, where to now?" he asked.

"It's a Small World," said Sara. "And the Riverboat," added Tom.

"Oh no!" groaned Father. "That means we'll have to walk all the way across the Magic Kingdom! Again!"

"No we won't, said Sara. "I have a plan. We can do both of those things, and we'll hardly have to do any walking at all."

What was Sara's plan?