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A Comparison of Learning Disabled and Normal Children on a Selective Attention Task While Using a Verbal Rehearsal Strategy

Stephen A. Mullenberg

A COMPARISON OF LEARNING DISABLED AND NORMAL CHILDREN ON A SELECTIVE ATTENTION TASK WHILE USING A VERBAL REHEARSAL STRATEGY

An Abstract of a Thesis

Submitted

In Partial Fulfillment

of the Requirements for the Degree

Specialist in Education

Stephen A. Mullenberg

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ABSTRACT

The present study involved using an information processing approach for the purpose of understanding and remediating attention problems in the learning disabled students. Specifically, the intent of the present study was to assess the process of selective attention as measured through Hagen's (1967) central-incidental paradigm.

The present study compared performance of learning disabled and normal students while using either a verbal rehearsal strategy (Dawson, Hallahan, Reeve, & Ball, 1980) or no rehearsal strategy on Hagen's (1967) task of selective attention.

Fifty Iowa public school students, 24 LD and 26 normals, from fifth through ninth grade, participated in the study. LD students for this study were teacher-nominated using a four-point criterion describing problem behaviors of attention. Furthermore, the LD and normal students had to meet an average IQ criterion. Hagen's (1967) selective attention task was administered individually to each student either using a strategy of verbal rehearsal (Dawson et al., 1980) or no rehearsal strategy.

Scores on central recall, incidental recall, selective attention efficiency were analyzed using t-tests. The individual serial recall positions and grouped serial recall positions were analyzed using a two-way analysis of variance.

The results of the study indicated statistically significant findings for central recall. Specifically, learning disabled students using a verbal rehearsal strategy demonstrated higher central recall

scores than learning disabled students using no rehearsal strategy. Furthermore, normal students had greater central recall under a nonrehearsal condition than learning disabled students under a nonrehearsal condition. There were no statistically significant findings on incidental recall or selective attention efficiency. The findings of some individual serial recall positions and grouped serial recall positions demonstrated statistical significance. Specifically, rehearsal improved performance at the middle and recency serial recall positions for LD students while decreasing performance at the primacy positions. Further, normal students performed better at the primacy and recency serial recall positions than the LD students. The rehearsal strategy hindered performance for the normal students at the primacy positions and helped performance at the recency positions.

The major conclusions of the present study were as follows:

1. Verbal rehearsal was an effective strategy to remediate attention problems in learning disabled students as indicated by the major measure of central recall on Hagen's selective attention task.

2. Normal students during standard administration of Hagen's selective attention task recalled more central information when compared to learning disabled students.

3. Normal students performed better than learning disabled students at both the primacy and recency positions on Hagen's selective attention task.

4. Both learning disabled and normal students improved performance at the recency positions while using a verbal rehearsal strategy on Hagen's selective attention task.

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This Study by: **Stephen A. Mullenberg**

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has been approved as meeting the thesis requirement for the

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I am going to be unorthodox for a moment; I want to mention that this effort would not be possible if it were not for me. Give thanks and be proud for this is the man the Lord has made.

LIST OF TABLES

CHAPTER I

INTRODUCTION

Over the past 10 to 15 years the theoretical limelight in educational psychology has shifted to cognitive or information processing explanations regarding learning problems. Information processing has been defined by Bruner as, " . . . the way in which individuals achieve, retain, and transform knowledge" (Hall, 1980, p.80).

Information processing grew out of work with computers and their use to analyze data. An analogy was generated between computer operations and human thinking patterns with the intent to better understand human thinking. Essentially, the information processing theory examines man and " . . . his purposes and plans as he seeks, does, and creates things, manipulates objects and information to attain his ends" (Reitman, 1965, p.2).

Within the information processing perspective, attention is a basic process thought to be of significance in the human system. Attention may be viewed as a process of stimulus selection or as a selective perception process (Parrill-Burnstein, 1981). The selectivity of attention is considered the technical aspect or operational component of attention (Ross, 1976). These theories about attention have been used to try to explain learning problems among school-aged children. It is in this selection process that some children falter when it comes to processing information.

The ability for children to know when and how to apply selection strategies for attending to the most important part of a task is necessary for school achievement. This process of selection is defined as selective attention (Hallahan & Bryan, 1981). Specifically, selective attention is one's ability to attend to the important, relevant or pertinent components of a task rather than the unimportant, irrelevant, or features not pertinent to the task. This process is a developmental skill that appears to be learned by children at a variable rate (Hallahan & Bryan, 1981).

Generally speaking, most students develop this selective attention skill fully by age 12 to 13, furthermore, at this age there is a dramatic increase in selectivity (Hallahan & Reeve, 1980). Some major contributions regarding knowledge on selective attention development and assessment arise from John W. Hagen's research (Hallahan & Bryan, 1981). Hagen used a selective attention task which purports to measure a child's ability to select the relevant information from a task and recall this information when asked; this process is termed central recall. Further, the task also measures a child's ability to remember the irrelevant material of a task; this is termed incidental recall. The first part of Hagen's central-incidental task (CI task) involves having the child watch as a series of seven cards are presented, each containing line drawings of a familiar animal and household object. When queried, the child tries to remember where the animals are placed in the seven card series (central recall). The second part of the task has the child match the

pictures of the animal and the corresponding household object as they were viewed together during the first part of the task (incidental recall). Past research with Hagen's task has shown that children classified as learning disabled (LD) have less central recall when compared to normal children on Hagen's CI task, while not differing on incidental recall (Hallahan & Bryan, 1981).

Ross (1976) hypothesized that learning disabled children seem to experience a developmental lag in the ability to attend selectively. Evidence from research has demonstrated that LD children lag 2-3 years behind their normal peers in selective attention (Hallahan & Reeve, 1980). Much of this research is based on experimental paradigms, such as Hagen's, that purport to assess the process of selective attention.

One explanation offered for this deficit in selective attention development is that the LD child performs poorly due to difficulties in applying strategies to attend and remember relevant stimulus materials (Hallahan & Bryan, 1981). Specifically, there is evidence to suggest that the child fails to use verbal rehearsal as a strategy to maintain selective attention and enhance recall (Hallahan & Reeve, 1980). However, it has been demonstrated that the LD child can improve performance on tasks of selective attention when using a strategy of verbal rehearsal (Hallahan & Bryan, 1981; Dawson, Hallahan, Reeve, & Ball, 1980). Flavell (1970) has stated that the LD children do not seem to produce strategies (verbal rehearsal) spontaneously, but can be induced to produce verbal rehearsal strategies and thus selectively attend. Reese (1962) stated that LD

children have a problem of poor performance via selectivity because of a mediational deficiency in verbal mediators used; the mediators do not mediate (Dawson unpublished, 1978; Hallahan & Bryan, 1981).

The idea to use verbal mediators to modify behavior is not new to psychology. The Russian researchers Luria and Yudovich (1959) suggested with their research that people use language to organize stimuli to better understand the world. Hence, a person uses words to categorize perceptions and regulate behavior. Research has shown that there is a normal development in children to use spontaneous verbal mediation to assist memory performance, and this mediational process tends to improve with age in normal children (Druker & Hagen, 1969).

As previously mentioned, the children conceptualized as learning disabled appear to have trouble developing and using verbal mediation during selective attention tasks. Furthermore when looking at a serial-recall curve of responses on Hagen's task, LD children demonstrate a recency effect and lack of a primacy effect (Dawson, Hallahan, Reeve, & Ball, 1980). The focus of the present study was to use the concept of verbal mediation to improve performance of LD children on a selective attention task. The present study will partially replicate a study by Dawson et al. (1980). Dawson et al. (1980) demonstrated that the use of verbal rehearsal improved performance of LD children attending to central information on Hagen's selective attention task (CI task).

The Dawson et al. (1980) study investigated the relative effectiveness of two methods for improving selective attention in

learning disabled children. This study sampled a total of 100 learning disabled boys, 48 (8 1/2-10 1/2 years) and 52 (10 1/2-12 1/2 years). There were four conditions for both age groups: (a) standard administration of Hagen's task; (b) rehearsal condition; (c) a reinforcement condition; (d) a combined rehearsal-reinforcement condition. The experimental conditions of this study used a reinforcement condition in which correct responses on Hagen's task were rewarded and a rehearsal condition in which subjects were taught a verbal rehearsal strategy. Of importance to the present study is the rehearsal condition, for the strategy employed by Dawson et al. (1980) will be used in the present study.

Statement of the Problem

This study replicated, with some modifications, the Dawson et al. study (Dawson unpublished, 1978, 1980). Specifically, performance of normal and LD children on Hagen's selective attention task were compared under two conditions: verbal rehearsal or no rehearsal.

The present study differed from the Dawson et al. (1980) study in that 80 students were asked to participate, 40 learning disabled and 40 normals, with each group having students assigned to either standard administration or rehearsal condition (identical to the rehearsal condition in Dawson's et al. (1980) study). There was neither a reinforcement nor combined rehearsal-reinforcement condition in this study. Furthermore, the age factor of Dawson's et al. (1980) study was not a variable in this study, hence the students chosen were

from grades fifth through ninth (Mean age = 13.5 years; Range = 11.75-15.0 years). The current study also used an informal interview with teachers to identify LD students with attention problems. Furthermore, those students chosen had to fit the range of one standard deviation unit either side of the mean on a standardized intelligence test in order to be included in the sample. These restrictions were completed to clearly delineate a more homogenous LD sample as suggested by Bryan and Bryan (1981).

The following hypotheses were examined:

1. Learning disabled students using a verbal rehearsal strategy will demonstrate higher central scores than learning disabled students not using a rehearsal strategy.

2. Normal students using a verbal rehearsal strategy will demonstrate lower central scores than normal students not using a rehearsal strategy.

3. Normal students not using a rehearsal strategy will demonstrate higher central scores than learning disabled students not using a rehearsal strategy.

4. Learning disabled students using a verbal rehearsal strategy will demonstrate lower incidental scores than learning disabled students not using a rehearsal strategy.

5. Normal students using a verbal rehearsal strategy will demonstrate higher incidental scores than normal students not using a rehearsal strategy.

6. Normal students not using a rehearsal strategy will demonstrate lower incidental scores than learning disabled students not using a rehearsal strategy.

7. Learning disabled students using a verbal rehearsal strategy will demonstrate higher selective attention efficiency scores than learning disabled students not using a rehearsal stratetgy.

8. Normal students not using a verbal rehearsal strategy will demonstrate higher selective attention efficiency scores than normal students using a rehearsal strategy.

9. Normal students not using a verbal rehearsal strategy will demonstrate higher selective attention efficiency scores than learning disabled students not using a rehearsal strategy.

10. Learning disabled students using a verbal rehearsal strategy will demonstrate higher primacy recall scores than learning disabled students not using a rehearsal strategy.

11. Normal students using a verbal rehearsal strategy will demonstrate lower primacy recall scores than normal students not using a rehearsal strategy.

12. Learning disabled students using a verbal rehearsal strategy will demonstrate higher recency recall scores than learning disabled students not using a rehearsal strategy.

13. Normal students using a verbal rehearsal strategy will demonstrate lower recency recall scores than normal students not using a rehearsal strategy.

14. Learning disabled students using a verbal rehearsal strategy will demonstrate higher middle recall scores than learning disabled students not using a rehearsal strategy.

15. Normal students using a verbal rehearsal strategy will demonstrate lower middle recall scores than normal students not using a rehearsal strategy.

Limitations of the Study

There were limitations in random selection imposed by practical constraints. The LD group will be identified before selection by attentional criteria. The groups sampled were from a limited geographical locale, hence limiting the generalization of the results.

Significance of the Study

This study will enhance the results of Dawson's and others 1980 study by providing a normal group to serve as control for comparisons; further Dawson indicated that this study would be a necessary area of further research (Dawson unpublished, 1978).

This study is designed to contribute to the knowledge regarding factors pertaining to and influencing theories on learning disabilities. Specifically, this study will help provide evidence regarding the developmental lag hypothesis of selective attention in the LD child.

Additionally, the study may provide an impetus for developing remedial strategies using mediational techniques, especially verbal rehearsal to improve selectivity and result in better task performance.

Definitions of Terms

Learning Disabled (LD): Students were operationally defined, for sample selection, as LD if placed in a special classroom for learning disabled in the public schools.

Selective Attention: The ability to recall relevant information to the task opposed to recalling irrelevant information.

Verbal Rehearsal: The audible labeling, rehearsing and chunking of relevant information (Dawson unpublished, 1978; Dawson et al., 1980).

Central Recall: The relevant information was the animals on the Hagen task that the child should attend to; also the score of first correct responses in remembering the position of the animal in the card series.

Incidental Recall: The irrelevant information was the household objects in the Hagen task that the child should not be attending to; also the score on the second part of the task for the correct number of matched pairs of household objects with animals.

Selective Attention Efficiency: A measure of the proportion of correct central responses minus the proportion of correct incidental responses, %C-%I (Hallahan, 1975).

Serial-recall: The proportion of correct responses at each of the seven positions on Hagen's selective attention task.

Primacy Effect: The indication of a greater proportion of correct central responses at the earlier serial-recall positions on Hagen's selective attention task.

Recency Effect: The indication of a greater proportion of correct central responses at the last serial-recall positions on Hagen's selective attention task.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

The literature reviewed in this chapter is organized into three sections. Section one reviewed the literature regarding the development of selective attention in normal children. With a foundation in the normal development of selective attention, section two summarized the literature concerning the development of selective attention in learning disabled children. The last section, section three, looked at information processing theories and mediational strategies for improving selective attention.

Selective Attention Development in Normal Children

This first section of the literature review examined selective attention development in normal children beginning with the research initiated by John W. Hagen (1967). Following this discussion, other authors contributing to the development of selective attention in normal children will be reviewed. The last component of this first section examined variables potentially influencing the validity of the experimental task used in this study.

The preeminent researcher in the area of selective attention would likely be John W. Hagen, and, as a result, his research has served to define the development of selective attention. One of the initial developmental studies of selective attention (Maccoby & Hagen, 1965) looked at how normal children approached task complexity (defined by the level of distraction) and the development at various

age levels of a selective strategy to choose relevant and irrelevant information. The results of Maccoby and Hagen (1965) indicated that as normal children progressed through the grades (first, third, fifth, and seventh) they recalled more and more of the relevant information as they got older. Furthermore, at the different grade levels there was a small decreasing trend in recalling irrelevant or incidental information. Specifically as the children got older (fifth and seventh grades) they performed less well on recalling incidental information when compared to younger children. The finding in regards to distraction level (distraction defined as the active participation by students in recognizing a piano base note among high notes) showed all children recalled less central information, under this condition, with no change in recall of incidental information. The authors Hagen and Maccoby (1965) discussed their findings in relation to Broadbent's (1958) information processing theory. This theory explained information processing as a process of giving-up (reciprocity) central information in order to process incidental information and vice versa. However, the results of the above study did not support the reciprocity of central and incidental information because children under the distraction condition did not show an increase (no change was noted) in recall of incidental information when central information decreased. Additional findings can be taken from the correlations between central and incidental recall. A reciprocity (giving-up) between central and incidental recall resulted with

negative correlations between central and incidental recall scores; however, there were no negative correlations indicated in this study.

Hagen (1967) continued with developmental research on selective attention and normal children by observing the performance of first, third, fifth and seventh grade students on a selective attention task. The task used in this study was the same as that used in the present investigation. Hagen's (1967) study focused on selective attention performance in relation to age, visual distraction (one versus two pictures per stimulus card) and audio distraction (base piano note played randomly). The results showed age to be a significant factor in performance; central recall increased with age but incidental recall was not an age-significant factor. The results of visual distraction showed a decrease in performance on central recall at all age levels. In considering visual distraction and incidental recall, the seventh grade students recalled less than any age group. Under the audio distraction condition, there was a significant effect on recall of central information and no effect on incidental recall.

Following Broadbent's (1958) processing reciprocity theory, there was no evidence from comparative analysis to indicate reciprocity took place in Hagen's 1967 study. However, the correlational analysis by grade on central and incidental recall resulted in positive correlations with the exception of negative correlations for seventh graders. These correlations supported the notion of reciprocity in older children (seventh grade), i.e. the students gave-up the processing of incidental information to focus on processing of central

information. To conclude, Hagen (1967) showed selective attention increased with age, and incidental recall was unchanged for younger students but decreased for older students. The correlational analysis provided partial support to the theory of reciprocity.

Numerous other studies have provided further support for the increase of central recall while incidental recall of information remained constant across age groups or declined in older children (Druker & Hagen, 1973; Hallahan & Kauffman, 1973; Wheeler & Dusek, 1973). However, two studies have shown some varied results in relation to selective attention development. Hagen and Sabo (1967) expanded the upper age range of past studies (Hagen & Maccoby, 1965; Hagen, 1967) to include ninth graders. Their results supported the notion that selective attention increased with age. However, they differed in part from past studies in that incidental recall remained the same until seventh grade where it took a dramatic drop but then increased at ninth grade. The researchers Hagen and Sabo (1967) contended that the total processing capacity increased at an older age level (ninth grade), hence more total processing occurred with incidental as well as with central information.

A second study by Hale, Miller and Stevenson (1968) focused on incidental learning and its development from a naturalistic environment rather than from Hagen's experimental paradigm. This study used a short film as the stimulus material then followed this with a questioning procedure to obtain verbal and visual recall of incidental content. There was an increase of incidental scores

through elementary grades but a drop occurred at seventh grade. However, this curvilinear relationship was indicative of only the verbal categories and not the visual categories. The task used both verbal and visual content while Hagen (1967) used only visual stimuli except for the auditory distractor with his task. This contrast suggests that these developmental inconsistencies of incidental learning were due to the variations in experimental tasks and content rather than any differences in students' selective attention.

An additional study (Hallahan, Kauffman, & Ball, 1974) extended the literature on the development of incidental processing. This study found significant differences between students in first, fifth, and seventh grades on incidental recall, with a significant decline in incidental learning observed at fifth grade when compared to seventh graders. These results revealed a significant decline at the fifth grade level on incidental recall; this differed with the decline seen at the seventh grade level of previous studies. Hence, the developmental picture of incidental recall which showed no differences across grades one through five may need to be modified pending further study.

To summarize, the majority of the research literature on the development of selective attention has pointed toward a fairly constant performance on incidental recall tasks across elementary grades (younger ages) with a slight decrease occurring in early adolescence. The central processing of task relevant information has followed a gradual developmental increase with age. The portrayal of

the development of selective attention among normal children provides as context for the development of selective attention among the learning disabled.

Technical Aspects of Hagen's Task

Historically, the selective attention task used by Hagen (1967) and a modified version used in the present study, originated from a short-term memory experiment by Atkinson, Hansen, and Bernbach (1964). The task has served as a method to explain Broadbent's (1958) theory of processing trade-off (reciprocity). In the application of this task, the central and incidental recall scores from a student can be evaluated to infer the quantity of selective processing. A number of researchers have attempted to improve processing trade-off or recall by varying the task or subjective factors in order to influence scores. The perceptual components of the task have been evaluated by various researchers, and a review of the research follows.

Perceptual components of the task have been evaluated by looking at the stimulus pictures and their perceptual integration. Druker and Hagen (1969) attempted to facilitate perceptual discrimination and improve central recall by comparing spatially separated pictures with spatially contiguous pictures (standard administration). Further, they tested alternating top/bottom positions (standard administration) with non-alternating arrangements. Neither of these alterations changed the developmental results nor resulted in improved selective attention. In another modification, color was added to the stimulus

pictures (Sabo & Hagen, 1973), the results of this modification showed no effect on performance.

In other attempts to improve selectivity via task modification, Hagen (1967) took away the incidental pictures to improve scores. All children improved their scores but this increase was constant across age levels. Hallahan, Kauffman and Ball (1974) attenuated stimulus visibility of the incidental pictures but the results again showed selective attention was not improved. Hagen and Frisch (Hagen & Hale, 1973) compared the standard procedure (same pairing of pictures across trials) with pairings of different incidental and central pictures across trials; further, they compared the presention of identical incidental pictures with various central pictures on a given trial. The results showed no difference in performance across all three conditions. Evidently, various feature modifications of the incidental stimulus were not factors significantly influencing performance.

In respect to the number of trials administered, Baker (Hagen & Hale, 1973) found that children tended to train themselves over trials to select the correct material, at least older children (12 years). Baker compared 8 to 16 trials; by trial 16 children picked up the incidental better, especially with different age levels. Therefore, the number of trials within an experiment might be a consideration.

The subjective factor of intellectual development, as measured by intelligence tests, did seem to influence performance on Hagen's task (Druker & Hagen, 1969; Hagen, Meacham, & Mesibov, 1970; Hagen &

Huntsman, 1971; Hagen 1972). Generally, central scores correlated with IQ and incidental scores correlated inconsistently low or showed no relation to IQ.

The majority of studies have shown no occurrence of sex differences on Hagen's task (Maccoby & Hagen, 1965; Hagen, 1967; McCarver, 1972; Hale & Piper, 1973); however, Wheeler and Dusek (1973) found girls to have greater central recall than boys.

To conclude, performance on the Hagen CI task has not shown major fluctuations due to task modifications or subject variables. Furthermore, the task has proved to be a stable measure with no relation to gender or perceivability of the stimulus materials, although IQ was a covariate.

Selective Attention in the Learning Disabled

The second section of the review of literature looks at selective attention development among learning disabled (LD) children. The first area covered looks at the problems that LD children tend to exhibit in attention development and the leading theoretical explanations for these problems. Ross (1976) has contended that the LD children lag in the normal development of selective attention. The research providing support for this developmental lag explanation is reviewed. The last section details the methods and findings of the Dawson et al. (1980) study which the present study is partially replicating.

The problem of attention deficits among the learning disabled has been consistently noted in practice and theory (Hallahan & Reeve,

1975). Most special educators involved with the learning disabled have expressed that these students have problems attending to school curriculum. Hallahan and Reeve (1975) expressed the attentional problems noted by LD children in statement, "Attentional problems are probably cited more often by teachers and parents than any other category of problems (except academic failure itself) as a behavioral symptom of learning disabilities" (p.146). It seems apparent that from an applied perspective, the poor selectivity of attending behaviors is a very real problem for many LD students.

The popularity of studying selective attention deficiencies from a theoretical perspective was perhaps best explained by Ross (1976). Ross' basic hypothesis was that the ability to apply and sustain selective attention is developed more slowly in the learning disabled than in normal children (Ross, 1976). Thus, the learning disabled have a delayed development, or a developmental lag, in the capacity to sustain selective attention. Ross suggested further that improved selective attention was the result of increased inhibition of attending to irrelevant information. The hypothesized inhibition of irrelevant processing followed the implications of Broadbent's (1958) theory in regards to the limited capacity of a human processor and the reciprocity of relevant and irrelevant processing. As a consequence, the giving-up of irrelevant processing provided the individual an opportunity to process more of the relevant information of the task.

The developmental lag hypothesis has been a prominent expression in many research articles covering selective attention in LD children.

While this theoretical perspective has empirical support, the reciprocity of processes has mixed and limited research and theoretical support. Literature regarding a developmental lag and other related hypotheses will now be reviewed.

A study by Hallahan, Kauffman and Ball (1973) compared low and high achieving sixth graders of normal intelligence on Hagen's central-incidental task of selective attention. Low achieving students were defined as those one year below in reading and math in achievement on a standardized achievement test while high achieving were those students at or above grade level in the two subject areas. The authors hypothesized that low achievers would have more difficulty than the high achievers on the CI task. The results indicated a significant difference between low and high achievers on central scores but showed no significant difference on incidental scores. The difference on central recall between groups indicated that low achievers lag in selectively attending to the relevant information. Correlational analysis between central and incidental scores indicated that the high achievers manifested a strong negative correlation (r = -.71) and the low achievers a moderate positive correlation (r = +.53). Hallahan et al. (1973) concluded that these correlations provided support for the reciprocity in the processing of relevant and irrelevant information.

Results similar to Hallahan et al. (1973) were found by Tarver, Hallahan, Kauffman and Ball (1976) in a two-part study using Hagen's CI task with learning disabled boys (normals were used only at the

youngest age level). The development of selective attention was examined at three age levels (8 1/2, 10, & 13 1/2 years). Central recall scores at the three age levels demonstrated a progressive increase of selective attention with an age increase. Incidental recall scores for the youngest age group were not significantly different between the learning disabled and normals in the first part of the study. Further, in the second part of the study involving the two older age levels, the LD students showed no significant differences on incidental recall. The incidental component of selective attention did not differ between learning disabled and normal students and improved with an increase in age. However, the combined LD groups demonstrated central and incidental processing increases, hence no apparent giving-up of incidental information to process central information took place. The correlational analysis at the youngest age between scores on central and incidental recall demonstrated a reciprocity of processing in the normals but not with the LD children. The normals had a low negative correlation (r = -.28) and the LD had a low positive correlation (r = +.36); therefore, the normal group showed that as central processing increased, a slight decrease occurred for incidental processing. However, when data was combined for all age groups, reciprocity and more efficient selective attention processing could be seen in the learning disabled children as age increased. This was revealed with correlational analysis of central and incidental scores at the three age levels; the correlations were +.36 for the youngest, +.27 for the intermediate

group, and -.16 for the oldest group. According to the correlational analysis combined from parts one and two of the study, there seemed to be some contradiction over whether normal students tended to reciprocate processes more so than LD students.

Specifically, the two groups, LD and normals of part one of the study, did not differ on selective attention efficiency, an indicator of reciprocity. The LD group had a central and incidental processing increase; hence no apparent giving-up of incidental information to process central information took place. The perspective of learning disabled having a developmental lag in the trade-off of incidental processing for central processing was partially demonstrated by the inverse correlations of this study, however, not all of the analysis supported this contention.

The results of the Tarver et al. (1976) study were expanded upon by Tarver, Hallahan, Cohen, and Kauffman (1977). This study assessed incidental recall of information and its decline at an older age level (15 1/2 years). While utilizing Hagen's CI task and analyzing data from Tarver et al. (1976), a significant difference of incidental scores across the four age levels was found. Furthermore, when analyzing the simple effects, the 8 1/2 and 13 1/2 year-old groups recalled significantly more incidental information than the 15 1/2 year-old group, and the 10 year-old age group approached significance in the same direction. Therefore, the hypothesis for decline in incidental recall with age was supported.

The measure of selective attention efficiency demonstrated an increase in selective attention with age, as the 15 1/2 year-old group had the greatest difference of the proportion of correct central and incidental information recalled. Selective attention was shown here to increase with age, but reciprocity between central and incidental processing was not supported. Essentially, there was no reciprocity since central and incidental measures varied in the same direction.

The correlational analysis of Tarver et al. (1977) also failed to support the theory of reciprocal processing. The initial study tended toward reciprocity with development (correlations of +.36:+.27:-.16), but the later study had the oldest age group with a correlation of +.32 between central and incidental scores indicating a weak nonreciprocal relationship rather than a reciprocal relationship. The data from Tarver et al. (1976) and Tarver et al. (1977) demonstrated a development of selective attention with age when assessing central and incidental scores of the CI task. However, neither study is consistent with Broadbent's concept (1958) on reciprocal processing.

Pelham and Ross (1977) used a slight modification of Hagen's CI task with children having diagnosed reading problems. The participants were first, third, and fifth graders referred for reading problems and achieving a low score on a standardized reading test. Hagen's task was modified by exposing all the stimulus cards at once rather than the usual individual presentation for the central recall measure, while the standard matching procedure was utilized to assess incidental recall. Results from this study indicated a higher score

on incidental recall and a lower score on central recall when poor readers were compared to a normal control group. The direct implication of this inverse relationship of central and incidental scores with poor readers was processing reciprocity.

Correlations obtained by Pelham and Ross (1977) between central and incidental scores were higher for poor readers at all age levels; with a trend of moderate positive to weak negative for poor readers (+.45:-.33:-.21) and weak positive to weak negative for controls (+.25:-.31:-.32). The Pelham and Ross' (1977) findings showed that poor readers (learning disabled readers) processed incidental information similar to normal children. Furthermore, poor readers tended to score higher on incidental processing and lower on central processing at younger ages while by fifth grade, poor readers tended to process more centrally and less incidentally. Even though the developmental pattern showed similarity, the learning disabled lagged developmentally and tended to score at a level equivalent to normal children two years younger.

The last study to be examined with regards to Broadbent's reciprocity concept and the development of selective attention in LD children was the study upon which this investigation is based (Dawson unpublished, 1978; Dawson, Hallahan, Reeve, & Ball, 1980). This study focused on the effect of age on selective attention performance and the variability of performance under a reinforcement condition, under an induced verbal rehearsal strategy, plus a combination of both rehearsal and reinforcement. Participants were boys aged 9 1/2 and 11

1/2. Age was shown to be a significant factor in the development of selective attention with older students recalling more central information; however, there was no difference between age groups in the recall of incidental information. Thus, there appeared to be a developmental trend in selective attention among the learning disabled similar to that of normals on selective attention. Since no signficant effect was found for processing of incidental information, it seemed the LD children had an increased processing capacity with age, but still seemed to lack the inhibitory mechanisms required for selective attending and a subsequent decrease in incidental processing (Ross, 1976). This study did not support Broadbent's reciprocal processing hypothesis (1958) since there was no decrease in incidental recall as central recall increased between the two age groups. An alternative hypothesis was that the total processing capacity increased without resulting in a decrease in the level of incidental processing, thus providing a greater capacity to transform the relevant information.

In summary, the learning disabled tended to develop processing strategies of selective attention in the same qualitative manner as normal children. The studies reviewed supported Ross' hypothesis (1976) regarding the developmental lag of learning disabled children in the ability to sustain selective attention. Broadbent's (1958) theory regarding processing reciprocity was not entirely supported but was given partial credence by correlational analysis of central and incidental recall scores.

Another finding of the Dawson et al. (1980) study was that verbal rehearsal had a significant influence on selective attention performance with the learning disabled. Specifically, verbal rehearsal increased recall of central information and decreased recall of incidental information. The effect of verbal rehearsal on Hagen's CI task of selective attention will be reviewed in section three.

Information Processing and Verbal Mediation

The third section of this chapter reviews information processing and verbal mediation from a theoretical standpoint. The information processing models of attention and memory will be summarized in order to explain why LD children have problems with selective attention. Following the review of theoretical models of memory and attention, the empirical support for these models will be examined.

Within the realm of information processing theories, there are many areas of processing which overlap within the total human processor. Two important areas in selective attention are memory and attention. Memory can be considered a necessary prerequisite to selective attention, although it is not nearly sufficient. Hagen's CI task has been used to determine if memory influenced selective attention performance directly (Hagen & Sabo, 1967). It was found that remembering a specific component of the task over another did not differentiate performance among normal groups. In other words, the memory performance was not a factor when considering selective attention through Hagen's CI task.

The relationship of memory and attention in selective attention can be analyzed by examining their interrelated theoretical ideas. In a review of information processing theories, Hall (1980) examined the content and similarities of three theorists as they explained information processing in exceptional children. In expressing the similarities among the theoretical models, Hall (1980) emphasized the following: most models portray an occurrence of some initial processing of information at the sensory levels; if information is processed beyond the sensory levels, a short-term storage structure holds that which is to be remembered. Most information processing models explained processing by the structural components (sensory mechanism, short-term storage, long-term storage, etc.) and subject-controlled components (categorizing, organizing or rehearsing information). Due to structural limitations in processing, most models follow Broadbent's notion (1958) of the limited capacity of a processing system. Furthermore, the difference between individual processors (LD and normal) may be generally viewed as a factor of subject-controlled transformations of incoming information (processing) and not a result of the structural features of the processor (Reid & Hresko, 1981). While sensory processing and short-term storage are important structural considerations of information processing models, the subject-controlled features are the main focus when analyzing the processing of learning disabled children.

Broadbent's (1958) model emphasized the limiting capacity of a processing system due to a filter mechanism operating just beyond the

sensory level. However, the filter mechanism was not thought to operate at the sensory level, but only after a memory system was involved. Hence that which has been stored in memory can be selectively passed (via selective attention) through the filter mechanism; thereafter, additional processing can occur.

Following a different approach than Broadbent (1958), Shiffrin's model emphasized a different relationship between memory and attention (Shiffrin & Schneider, 1977; Hall, 1980; Reid & Hresko, 1981). This model was greatly influenced by memory processes. Furthermore, Hall (1980) also examined Atkinson's and Shiffrin's model of human memory and explained that there was no structural component delineated for attention in the processing system; rather, the attentional component was contained within a short-term storage structure. For Shiffrin (Shiffrin & Schneider, 1977), attention was subsumed under the subject-controlled processes and therefore attention was seen as an orchestrator of processing within the memory structure. If one analyzed LD difficulties under this particular model, they would assume adequate and healthy structures of memory and attention therein and focus on the variable subject-controlled components directing attention inappropriately.

While Shiffrin's model focused on memory structures involved in the information process, Brown's model (Hall, 1980) focused on knowing how to apply memory during the processing of information. This developmental model looked at three areas: (a) memory knowledge bases; (b) subjective application of memory knowledge; (c) and the

repertoire of memory strategies. The last two areas, application and strategies for memory processing, have been noted to present problems for LD children (Hallahan & Bryan, 1981). These two problem areas have acquired the terminology of mediational deficiency, for lack of available strategies (Reese, 1962) and production deficiency, for failure to apply the strategies when necessary (Flavell, 1970). The thinking behind a mediational problem is that the mediators used do not always serve their mediational purpose by mediating (Reese, 1962). Specifically, human speech serves as a regulator of external behavior by using the words as a signal for perceiving and acting. Furthermore, the use of speech in development follows a normal transition (Luria & Yudovich, 1959; Luria, 1961); and, perhaps some individuals have an abnormal or slow development in the use of speech as a behavioral mediator. Has this been true of LD students? Probably the best response to this question would follow Flavell's (1970) empirically substantiated production deficiency hypothesis rather than Reese's (1962) mediational deficiency hypothesis. The idea that a child does not spontaneously produce verbal mediators when necessary, even, in some situations, when the relevant words (mediators) are known and used, may be a more feasible explanation than Reese's (1962) idea on inadequately functioning mediators.

Hall's (1980) review of Broadbent (1958), Shiffrin (Shiffrin & Schneider, 1977), and Brown (1980) provides a context for understanding information processing. This foundation will provide a structure to explore the specific hypotheses of Flavell (1970) and

Ross (1976) as potential explanations of processing problems in selective attention for the learning disabled child.

The method often used with Hagen's CI task to assess memory and selective attention from an information processing perspective is the serial-learning curve (serial-recall or serial-position). A serial-position curve for Hagen's task involves plotting percentages of correct responses to each of the seven stimulus positions combined across the total number of trials. The serial-position curve is a straight line graph which portrays how attention is inferred from the order in which items are remembered on central task performance of Hagen's CI task (Parrill-Burnstein, 1981). Furthermore, the serial-recall curve has been used to explain the effects of rehearsal. The recall of stimulus items presented early in a series has been referred to as primacy effect and these items are remembered via active rehearsal (Ellis, 1970). The strategy of active rehearsal can be explained as the verbal repetition of names or labels of the items to be recalled. Moreover, those items recalled which were presented in the last stimulus positions are collectively called recency recall and are due to a echo trace effect in the memory process (Parrill-Burnstein, 1981).

While using a different experimental task than that used by Hagen (1967), Kendler (1963) looked at the development of attention and memory processes in children as conceptualized through reversal shift experiments. Kendler (1963) used reversal shift experiments to look at the flexibility of conceptual thinking in children. Reversal shift

was referred to as how an individual shifts focus from one stimulus concept to another stimulus concept with the possibility of competing perceptions between stimuli arising from the two concepts. The mediator, according to Kendler (1963), was defined as a perceptual or verbal response to a relevant dimenson of the stimulus situation; this response then resulted in a desired overt response. Studies using reversal shift methods have shown mediational development to occur in less than 50% of three and four year olds while 50% or more mediate by five to seven years of age. Hence, children learn at an early age to use mediators naturally. After this time, the mediational development increases progressively with age. Consequently, the tendency exists for younger children who do not use mediators to nevertheless have the ability to naturally produce mediators spontaneously.

A development of spontaneous verbal mediation has been revealed by studies employing serial-learning curves. The effect of using stimulus labels as mediators has been one area evaluated by researchers. Two researchers, Hagen and Kingsley (1968), focused on verbal labels and their effects on short-term memory. This research involved a task similar to Hagen's paradigm with a younger group (five year olds) than Hagen's (1967) initial study. One of the two groups of five year olds were to use labels and label each animal card by naming the animal as it was presented as well as naming the animal on the probe card when presented. The results showed that the verbal label did not seem to serve as an effective mediator for primacy positions on the serial-recall curve. However, when results of

Hagen's task were compared between the two 5 year-old groups on recency positions, labeling was better than not labeling. These authors continued their procedures to evaluate developmental effects of mediating labels with students from first, second, third, and fifth grades. Hagen's serial-recall procedure resulted in some significant developmental differences between grades. As age or grade increased, memory performance on the task increased; overt labels did tend to facilitate performance for first through third grades, but not for fifth graders. Labels improved performance for all groups in relation to the later portion of the serial-position curve, a recency effect. Due to the finding that labels hindered correct performance of the fifth graders at the earliest stimulus positions (an adverse mediatonal effect), the mediating effect of labels at the primacy serial positions needs further empirical clarification.

In another study using verbal mediation, Wheeler and Dusek (1973) demonstrated that verbal labelers scored higher on recall of central information in all grades (kindergarten, third, and fifth) than nonlabelers. Further, the labeling of the stimulus feature in Hagen's task tended to decrease incidental recall at all grade levels. This finding is not consistent with the previously mentioned results.

The effects of verbal labels as effective mediators to guide correct responding has not been established with empirical consistency. With this in mind, a different avenue of research has focused on use of rehearsal rather than labeling as a mediator. Rehearsal as a mediator is generally seen as an act of verbally

repeating names of stimulus features or words serving as cues of the stimulus material in order to improve later recall. Flavell, Beach and Chinsky (1966) explored the effects of rehearsal as a verbal mediator by using direct observations of lip movement along with self-reporting of rehearsal data by the student. The authors found a developmental trend in that kindergartners were less likely than second or fifth graders to use rehearsal in a serial-recall task. A similar study by Druker and Hagen (1969) tried to gather mediational information on how fourth, sixth, and eighth graders approached Hagen's experimental task. The older students tended to rehearse task-relevant names (the animal names) and did not rehearse irrelevant names (names of household objects). These data suggested a developmental trend with respect to verbal rehearsal.

The natural development of spontaneous rehearsal is summarized by Belmont and Butterfield (1971). Their method of assessment was highly inferential by way of measuring subject-controlled pause time between stimulus presentations. Their data demonstrated that, when used, spontaneous rehearsal greatly improved recall on a serial-learning task. In addition, they found that most adults showed both a primacy and recency effect on serial-recall tasks while children only exhibited recency recall until about eight years old, when they began to show evidence of primacy recall. Though subjects of the Belmont and Butterfield (1971) experiments were retardates and normals rather than learning disabled, they concluded that the development of rehearsal was uniform and not qualitatively different among

exceptional populations. In another report, the development of spontaneous rehearsal was similar in groups of young normal children and older retardates (Butterfield & Belmont, 1972). It seemed that both groups had trouble inputting material into memory, but with rehearsal, both groups showed improvement.

Kingsley and Hagen (1969) reported that a primacy effect resulted as active rehearsal and age increased simultaneously, although a young child could show a primacy effect if induced to rehearse. The recency effect was not modified by age nor by overt labels, and was likely the result of an visual or verbal echo (image) traced into short-term memory (Ellis, 1970).

Kingsley and Hagen (1969) compared combinations of labeling (overt versus covert) and rehearsal (induced versus spontaneous) with five year olds to determine the effect on a selective attention task. They used stimulus figures in which one could either attach or not attach a label. At this age, the method of utilizing both overt labels and induced rehearsal showed the best performance at both the primacy and recency positions of the serial-learning curve among all the conditions.

The development of verbal rehearsal as a mediational strategy has been demonstrated to naturally occur with age. Ellis (1970) emphasized that the primacy effect graphed on serial-learning curves was the result of a natural rehearsal procedure. Hence, the natural development of rehearsal strategies would likely result in improved recall at the primacy positions of a serial-learning task. This leads

to the question of whether labels have the same primacy effect as rehearsal.

The induced rehearsal effect with young children was evidenced in a study using first graders who were identified as rehearsers (observed lip movements) or nonrehearsers (Kenny, Cannizzo, & Flavell, 1967). Recall on a serial-recall task similar to Hagen's was better for rehearsers than those who did not rehearse. However, when nonrehearsers were induced to rehearse, they recalled as well as spontaneous rehearsers. Hagen, Meacham and Mesibov (1970) looked at middle to upper childhood, ages 9-14, and tested the effects of labeling on serial-position curves using Hagen's task. In the nonlabeling group the primacy performance was greater at all age levels, however the recency performance was higher for the labeling group at all ages. Further, when college students were tested with regards to the effect of labels on central recall as plotted on the serial-learning curve, labels resulted in a decreased performance at this age. This decrement was evidenced by a lower correct percentage in the primacy positions.

When comparing normals and retardates on the effects produced by labeling, Hagen, Streeter and Raker (1974) reported that there were similarities in serial-curves of both groups when labels served as mediators. Labeling tended to improve performance at the recency positions for retardates (age 10) and for cognitively matched normals. Within the same study these authors examined the role of rehearsal and prompting for improved recall in retardates. The three conditions

analyzed were: (a) rehearsal with prompt upon rehearsal error; (b) rehearsal only; (c) rehearsal with a prompt at primacy positions. Results showed that prompting tended to facilitate recall at the primacy positions more than rehearsal alone for retardates. The effects of prompting (reminding subjects to rehearse if forgotten) were explored further with normal children by Hagen, Hargrave and Ross (1973). Using Hagen's task with normal children ages five and seven, rehearsal with prompting facilitated recall more than rehearsal alone for both age groups; however, the effect was more evident for the five year old group. These results suggested the necessity of including a prompt in the experimental procedures for a more effective use of the mediational strategy of rehearsal, and this procedure was performed in the present study.

More recent research has provided further evidence regarding the effects of mediation (verbal rehearsal) on selective attention. Tarver, Hallahan, Kauffman and Ball (1976) examined LD children (aged 8 1/2) to see if they were deficient in verbal rehearsal strategies, as indicated by primacy recall. Further, they examined the effects of an induced rehearsal treatment on selective attention. Comparisons on scores taken from Hagen's task with normal children revealed that there was a primacy effect evident for normals but not for the learning disabled. The LD group scored highest at the recency position of all the serial positions. The second part of this study studied induced rehearsal with two age groups of LD children (ages 10 & 13 1/2). The induced rehearsal condition required the child to

label, chunk (group for rehearsal) and rehearse names of the stimulus items. The results of the second part of this study revealed a primacy and recency effect. The primacy effect and recency effects were evident only in the older age groups while the recency effect was found with the youngest group (8 1/2 years). These serial-position effects may have accounted for the performance differences at different ages. The effects of rehearsal showed no significance, but the average scores increased at both the upper age levels under rehearsal when compared to standard administration of the CI task.

Tarver, Hallahan, Cohen and Kauffman (1977) expanded on Tarver et al. (1976) and the differences in primacy recall between different age levels of LD students. While using older LD children (age 15 1/2) and administering Hagen's task, these authors compiled their results with Tarver et al. (1976) for children 8 1/2, 10, and 13 1/2 years. The findings revealed a primacy and recency effect for the oldest age group. This was due to a developmental increase between the oldest groups (13 1/2-15 1/2), perhaps the result of verbal rehearsal strategies continuing development through adolescence. Tarver et al. (1977) concluded that this trend in serial-position curves supported the developmental lag hypothesis for verbal rehearsal strategies among learning disabled students.

There had been contentions that problems in selective attention were not due to a develomental lag in verbal rehearsal strategies but to a motivational lag in learning disabled youngsters (Hallahan, Tarver, Kauffman, & Graybeal, 1978). Hallahan et al. (1978) found

that a monetary reinforcement strategy improved LD performance on Hagen's selective attention task. They found a primacy effect for the reinforcement condition, indicating the use of rehearsal strategies (Ellis, 1970). These findings appeared to support Flavell's (1970) production deficiency hypothesis whereby having the ability to produce mediators does not presume their use. However, another study (Dawson, Hallahan, Reeve, & Ball, 1980) found that rehearsal improved selective attention more than reinforcement. Serial-position analysis showed a primacy and recency effect for all subjects combined within the various conditions. The group with rehearsal and reinforcement combined performed the best of all groups. Thus, the results of these recent studies in conjunction with the past research suggest there may be potential use in combining behavioral strategies of reinforcement along with cognitive strategies of mediation.

This review of research involving mediational strategies has led to the conclusions that LD children lag in the development of rehearsal strategies and may have a motivationally-based performance deficit when compared to their normal peers on a task of selective attention. As noted, throughout the developmental research, a primacy effect indicating verbal rehearsal was evident in normal children about 8-10 years of age and in the LD children about 10-12 years. LD children tended to lag in the adequate strategies to perform Hagen's task, and the effects of rehearsal on eliminating this lag is the purpose of this study.

CHAPTER III

METHODOLOGY

The third chapter covers the basic methodology of the present study. Included in this chapter is a definition of the sample, the process of identifing participants, the experimental design, the experimental task, and a description of the statistical analysis to be completed with the data.

Sample

The 80 subjects intially chosen for this study were drawn from the community school systems of Cedar Falls (n = 20) and Waterloo, Iowa (n = 60). Four schools participated, two from each community, with students selected from grades 6-8 with the exception of one 5th grader and one 9th grader. For the purpose of this study it was necessary to draw a sample of students from the normal curriculum and a sample of students from special education programs (learning disability programs). Each of the learning disabled students had been identified as learning disabled by Area Education Agency-7 following the rules criteria for the Department of Public Instruction of the State of Iowa. The breakdown of the total sample of 80 was 40 LD and 40 normal students, each school in Waterloo had 15 LD and 15 normals while the Cedar Falls schools had 5 LD and 5 normals.

The LD children selected were limited to those with attention problems as identified through teacher interviews. Each interview was of an informal nature, approximately 20 minutes in length, in which the teacher described their students with attention problems that fit

at least two of the four criteria put forth by the experimenter. The four criteria were stated in questions or statements and they were:

(1) While considering the student's age and ability level, do any of your students display signs of inattention that are developmentally inappropriate?

(2) While considering your students, can their performance on various tasks and school work be characterized by oversights such as misinterpretations, omissions, or insertions even when the student is well motivated and/or the items are easy?

(3) Does this statement describe any of your students? The student tends to pay attention to the unimportant or irrelevant information of a task and not to the necessary, important, or relevant information of a task. PAUSE Specifically, does the student attend selectively to the critical features or ignore these and attend selectively to the unessential features?

(4) Do any of your students tend to be easily distracted by peripheral material that is contained within, but is not the major part of an assignment?

These criteria were taken from the diagnostic criteria for a Attention Deficit Disorder (APA, 1980) and from definitions of selective attention taken out of literature pertaining to selective attention.

Students that met two of the four criteria were then screened on an IQ measure. To be included, the student's IQ needed to be within one standard deviation unit on either side of the test mean.

The normal students were randomly selected from regular classrooms. After the random selection, the students chosen had their scores checked on the most recently administered group IQ test. The IQ criteria for selection was one standard deviation either side of the test mean inclusive.

Participation for all students was limited by the requirement of parental consent.

Assignment to condition was done randomly, there were four experimental groups: (a) normal sample standard administration; (b) LD sample standard administration with no rehearsal; (c) normal sample with verbal rehearsal treatment; (d) LD sample with verbal rehearsal treatment.

The final sample of the present study consisted of 25 LD students and 25 normal students. There were approximately 3 females and 22 males for the LD group and 12 females and 13 males for the normal group.

Materials and Procedures of the Central Task

Eight 3 x 6 inch stimulus cards, each containing a black line drawing (approximately 2 x 2 inches) on a white background made up the physical materials to be used. The line drawings were composed of two conceptual categories, household objects and animals (see Appendix B). The location of the drawings alternated randomly between the top part of the card and bottom portion of the card (ie. card #1 has animal top/household object bottom, card #2 has household object top/animal bottom). This alternation served to counterbalance the positioning of

central and incidental stimuli (Hagen, 1967). Probe cards were 3 x 6 inches and identical to the intended response card.

The subjects were administered four practice trials, one of a 2 card series, one of a 5 card series, and two 7 card series (Dawson, 1978). The central task consisted of 14 seven card presentations. Each stimulus card was presented to the subject for approximately 2 seconds and then placed face down in a horizontal row from the child's left to right. The students were instructed to attend to only the animal pictures. Immediately following the presentation of the seventh card in each series, a probe card exactly like one of the stimulus cards was presented. The subjects were asked to turn over the card in front of them that contained the animal identical to the probe card. If the student did not choose a card immediately, the student was given 15 seconds to choose, then the examiner would ask the student again to choose and if no choice was made at that time the examiner would turn up the correct card. The total central recall score was the number of first responses correct of the total 14 trials (see Appendix A for verbatim instructions).

The verbal rehearsal treatment groups were given the same task but with additional instructions. The actual rehearsal strategy involves instructing the student to label, rehearse and chunk the stimulus material so they might better remember the relevant material (Tarver et al., 1976; Dawson et al., 1980). Labeling the simulus material involved naming outloud each animal as it was visually presented. Rehearsal pertained to having the students repeat the

names of the animals outloud in the sequence they had appeared. Chunking the stimulus material involved grouping the rehearsal of names into a sequence of 3:3:2 for the seven animals. The examiner provided prompts if any step of the procedure was left out over the total 14 trials (see Appendix A for verbatim instructions).

Materials and Procedures for the Incidental Task

The students were using cards containing only pictures of the animals, with one-half of the card blank. The examiner had cut-outs of the household objects that were to be placed in the corresponding position of the correctly matched card. This task took place immediately following the central task.

The seven animal pictures were presented individually with one-half of the card containing the animal and one-half of the card a white space, each animal's positioning (top/bottom) corresponded to the same position as in the central task. Cut-outs for the household objects were randomly presented in a scattered array before the student making sure all cards faced forward toward the student. The cards containing the animals were given one at a time to the student, and they were instructed to pick up the household object they thought corresponded with the animal picture as they saw them in the central task. They then placed the cut-out onto the white space area of the animal card. After each response, the household object cut-out was placed back in the array so each time the student had to choose from the whole array. All seven animal cards were shown, and the score for

the incidental recall task was the number of correct matches out of the seven possible.

General Considerations

For each condition, the target animals and target serial positions were presented randomly, with the stipulation that each animal and each position was probed twice. To control for fatigue, each trial was counterbalanced within each group such that student one was presented with trial 1 and concluded with trial 14, subject two was presented with trial 2 first and concluded with trial 1, etc.

The experimenter pointed to each card rehearsed as the student verbalized the animal's name for the rehearsal condition. If a label was not provided within 2 seconds during the rehearsal condition, the experimenter prompted by providing the label. No corrections on mistakes were made during any labeling.

Statistical Analysis

The major analysis of the data involved analysis of mean differences through a directional t-test. The probability level used for a statistically significant finding was the .05 level. The grouping variable (LD and Normal) and the condition variable (Rehearsal and Nonrehearsal) were the two independent variables. The dependent variables of the included the following: (a) Central raw scores; (b) Incidental raw scores; (c) Selective Attention Efficiency; (d) Proportion of correct central responses at the individual serial-positions 1-7; (e) Primary serial-position score, the mean proportion

of central responses for the first two positions; (f) Middle serial-positions, the mean proportion of central responses for the middle three serial-positions; (g) Recency, the mean proportion of central responses for the last two serial-positions.

CHAPTER IV

RESULTS

The purpose of this study was to determine if verbal rehearsal would improve performance for learning disabled children on a selective attention task. The selective attention task used in this study (Hagen, 1967; Dawson unpublished, 1978; Dawson, Hallahan, Reeve, & Ball, 1980) produced scores of central and incidental recall. In addition, the selective attention performance of students was assessed by measures of selective attention efficiency (Hallahan, 1975) and serial-position analysis. The results of the present study follow.

There was a significantly higher mean central score for the learning disabled children using rehearsal than for learning disabled children using no rehearsal strategy $t(1, 23) = 1.88$, $p < .05$. Therefore, hypothesis one stating LD children using rehearsal would score higher central recall than LD children not using rehearsal was supported. Hypothesis two indicated normal children using rehearsal would have lower central recall scores than normal children not using rehearsal. This difference was not found to be statistically significant $t(1, 23) = .58$, $p > .05$. However when normal and LD students were compared under a no rehearsal condition, the normal students had significantly higher central scores than the LD students $t(1, 22) = 2.29$, $p < .05$. A descriptive summary of these results can be seen in Table 1.

Table 1

Mean Central Recall Scores

	Condition	
Group	Rehearsal	Nonrehearsal
LD	M=7.85	M=5.67
	SD=2.41	SD=2.90
	n=12	n=12
Normal	M=7.92	M=8.58
	SD=2.33	SD=3.00
	n=13	n=13

The second group of hypotheses concerned the effects of rehearsal on incidental learning. Hypothesis four stated that LD students would have lower incidental scores using rehearsal. As seen in Table 2, the mean incidental scores for the different groups did not vary to much degree. The statistical analysis for hypothesis four did not support the contention the rehearsal group would show lower incidental scores, $t(1, 23) = .49$, $p > .05$. When comparing normal students using rehearsal with those not using a rehearsal strategy (hypothesis five), the notion that the rehearsal group would have higher incidental scores neared significance, $t(1, 23) = 1.57$, $p > .05$. Normal students did not demonstrate significant lower incidental scores when compared to LD students also not using rehearsal, $t(1, 22) = .08$, $p > .05$. In

fact, by looking at the means in Table 2 one can see the LD group having a slightly lower mean incidental score thus in opposition to the stated sixth hypothesis.

Table 2

Mean Incidental Recall Scores

	Condition	
Group	Rehearsal	Nonrehearsal
LD	M=5.62	M=5.25
	SD=1.71	SD=1.71
	n=12	n=12
Normal	M=6.08	M=5.33
	SD=1.04	SD=1.37
	n=13	n=13

Hypothesis number seven stated selective attention efficiency scores would be higher for LD students using a rehearsal strategy than for LD students not using a rehearsal strategy. As seen in Table 3, results were in the stated direction for this hypothesis but were not statistically significant, $t(1, 23) = .40$, $p > .05$.

The comparison of normal students using rehearsal versus those not using rehearsal on a measure of selective attention efficiency (Table 3) indicated that those students not using rehearsal scored higher (closer to zero) than those using a rehearsal strategy. Due to

the great degree of variability of these percentages as indicated above there was no significance for hypothesis nine, $t(1, 23) = 1.62$, $p > .05$. The last comparison using the dependent measure of selective attention efficiency was hypothesized (hypothesis nine) to show normal students without rehearsal to have a higher selective attention efficiency than LD students also not using rehearsal. As observed in Table 3, the mean percentages tended to support the hypothesis but the statistical analysis did not bear this out, $t(1, 22) = 1.01$, $p > .05$.

Table 3

Mean Percentages of Selective Attention Efficiency

	Condition	
Group	Rehearsal	Nonrehearsal
LD	M=-24.18	M=-34.52
	SD=64.70	SD=58.15
	n=12	n=12
Normal	M=-30.22	M=-15.48
	SD=21.06	SD=23.95
	n=13	n=13

The mean numerical values in Table 4 give the reader an idea of a serial-recall curve of the seven positions on Hagen's task. The increased value at the primacy positions in Table 4 may likely be a result of an occurrence of active rehearsal.

Table 4

Mean Proportions of Correct Central Responses for Individual Serial-recall Positions

	Serial-recall position						
Experimental Group	1	2	3	4	5	6	7
LD Rehearsal	.31	.65	.46	.54	.63	.54	.81
LD Nonrehearsal	.71	.42	.25	.42	.21	.21	.63
Normal Rehearsal	.58	.54	.35	.54	.38	.77	.88
Normal Nonrehearsal	.83	.63	.54	.58	.54	.42	.79

Hypothesis 10 presumes improvement on primacy recall for LD students when using a rehearsal strategy. The intent of this hypothesis was demonstrated through the significant main effect of condition, $F(3, 46) = 12.18$, $p < .05$ and the significant main effect of group on the primacy recall, $F(3, 46) = 4.52$, $p < .05$, there was no significant interaction effect on primacy recall, $F(3, 46) = .59$, $p > .05$. Although the intent of hypothesis 10 was supported through significant findings, the logic was not. Improvement on primacy

recall using a rehearsal strategy was not apparent from the analysis of means in Table 4. The means provide indications that rehearsal depleted performance at the primacy position one for both LD and normal students. Furthermore, the means in Table 4 had normal students performing better at serial-position one than LD students, and the above F value supports this.

Hypothesis 11 was supported by the results as indicated in Table 4. Normal students did perform better without than with rehearsal at the primacy position.

In grouping individual serial-positions one and two, the mean values in Table 5 provide a picture similar to the above results of primacy position one but of a lesser degree and without statistically significant findings. The nonrehearsal groups of LD and normal children performed better without than with rehearsal. Thus the effect of rehearsal is opposite the notion stated in hypothesis 12; LD students using rehearsal demonstrated lower primacy recall than LD students not using rehearsal. The normal students appeared to perform better on grouped primacy recall than LD students, however this was not found statistically.

Hypothesis 11 was supported through individual serial-position analysis for the main effect of condition at position one as indicated in the previous paragraph. Hence, normal students recalled more central information at the primacy positions when using their own strategies to remember rather than being induced with a rehearsal strategy.

Table 5

Mean Proportions of Correct Central Responses for Grouped Serial-recall Positions

	Grouped serial-recall position		
Experimental Group	Primacy	Middle	Recency
LD Rehearsal	.48	.54	.67
LD Nonrehearsal	.56	.29	.42
Normals Rehearsal	.56	.42	.83
Normals Nonrehearsal	.73	.56	.60

Serial positions two through four showed no significant results. However, the mean proportions of correct central responses for positions two through four are greater for LD students when using rehearsal and normal students when they do not use a rehearsal strategy. This trend indicates circumstantially that rehearsal improves performance for learning disabled students while impeding performance for normal students.

At the fifth serial-recall position, a significant effect was noted for the interaction of rehearsal and grouping, $F(3, 46) = 8.93$,

$p < .05$. LD children using a rehearsal strategy increased recall on middle recall positions. Furthermore, the statistical analysis of the combined middle serial positions follows the results indicated on individual position analysis. Specifically, LD and normal students performed better at the middle positions when using rehearsal (Table 5). This supports the notion of hypothesis 14, LD students showed higher middle scores when using rehearsal; however, this notion fails to support hypothesis 15 in that normal students' scores were not lower but higher under rehearsal. The significant finding of the middle positions was the interaction of condition and grouping, $F(3, 46) = 8.22$, $p < .05$.

Serial-recall position six clearly demonstrated the effectiveness of rehearsal for improving recency recall, main effect for group was $F(3, 46) = 4.16$, $p < .05$; main effect for condition was $F(3, 46) = 10.01$, $p < .05$. Furthermore, recency recall improved for both LD and normal children as a result of the rehearsal strategy (Table 5). The significant results of serial position six support hypothesis 12 and discredit hypothesis 13. With rehearsal, recency recall was higher for both LD and normal children.

Grouped serial recall analysis of the recency positions reinforces the above results. The effect of rehearsal at the recency positions improved scores on selective attention for both LD and normal children, $F(3, 46) = 10.31$, $p < .05$. Furthermore, normal children, as a group, perform better overall on recency recall, $F(3, 46) = 5.2$, $p < .05$.

In summary, LD students had greater central recall when using a rehearsal strategy than when using no rehearsal. Normal students had greater central recall when compared to LD students under standard administration. There were no significant findings on incidental recall or selective attention efficiency. The serial recall analysis of the seven serial positions demonstrated significant main effects (group and condition) at the primacy (position one) and recency position (position six); an additional finding revealed an interaction effect at position five. Lastly, grouped serial recall analysis noted a significant main effect for group and condition at the recency positions of the serial-learning curve. Furthermore, the middle serial positions revealed a significant interaction due to grouping and condition.

CHAPTER V

DISCUSSION AND CONCLUSION

Information processing has been explored in this study by way of the process of selective attention. Broadbent (1958) and other current researchers (Parrill-Burnstein, 1981) have discussed components of human processing and its relationship to selectivity in the attentional process. The limited processing capacity of all individuals, the subjective-controlled strategies (i.e. rehearsal), and not structural processing components, are the focus of the present investigation.

The review of literature in Chapter 2 demonstrated that children develop selective attention with age. Learning disabled children have been hypothesized to lag in the development of selective attention. The explanations expressed to answer why LD children lag developmentally have been reviewed by many researchers. In the following discourse, the explanations of importance include Ross' theory (1976) of a lag in sustained selective attention, a production deficiency of mediators (Flavell, 1970) and the mediational deficiency of ineffective mediators (Reese, 1962). These hypotheses have been indirectly addressed with the use of a verbal rehearsal strategy to improve recall on selective attention tasks. The following paragraphs will highlight the present study with respect to the above hypotheses. The areas to be covered are: the relationship of the present study to the study by Dawson, Reeve, Hallahan and Ball (1980); the significant results of the present study as they support or negate hypotheses

regarding LD children; subjective impressions from this study; and the conclusions.

Relationship of the Present Study to the Dawson et al. Study (1980)

The design of the present study and the Dawson study differed in many respects. Dawson and her colleages used only LD students and examined the effect of age, rehearsal, reinforcement, and rehearsal-reinforcement on selective attention measured via Hagen's task. In contrast, the present study examined LD and normal children's responding on Hagen's task due to the effect of only rehearsal. Dawson found that older students recalled more central information on Hagen's task and less incidental information than younger students. Selective attention efficiency was also greater for older students than younger students in Dawson's et al. (1980) study. The effects of rehearsal and reinforcement showed the combination of the two led to the greatest selective attention (central recall) of all conditions tested. Further analysis indicated rehearsal had a greater central recall effect than reinforcement alone; rehearsal is the strategy of interest between studies.

The major finding for Dawson was that verbal rehearsal improved selective attention performance for LD children. This finding was also explored in the present study by looking at the effect of rehearsal on both LD and normal children. The results of the present study showed significant findings in selective attention for LD children when using a rehearsal strategy. Specifically, LD students using rehearsal had greater central recall than those not using

rehearsal. This finding regarding rehearsal with LD students supports the findings of Dawson et al. (1980); Dawson found that the rehearsal group recalled more central information than either group using standard administration or a reinforcement strategy.

The present study determined no effect on incidental recall due to rehearsal or group, however, normal students using rehearsal approached significance perhaps due to an interference effect when using rehearsal. However, Dawson did find incidental recall when using rehearsal to decline.

Selective attention efficiency demonstrated no significant findings due to rehearsal or grouping in the present study. Dawson found a difference due to age and condition for selective attention efficiency.

Essentially rehearsal decreased incidental recall and improved selective attention efficiency for Dawson students; however, the present study found no significance due to group or rehearsal on either of these dependent measures.

Furthermore, Dawson's study showed significant effects for individual serial-position due to conditions. Rehearsal facilitated recency recall for older students when compared to students not using a rehearsal strategy. The present study followed with similar results in that the rehearsal group had greater recall than the no rehearsal group for both LD and normal students at the recency position. However, the present study found only individual serial-recall analysis for position one and six to be significant due to the main

effects of rehearsal and interaction effect at position five. Furthermore, these significant effects differed in direction from Dawson and showed rehearsal to lower the proportion of correct central recall at position one for both LD and normal students and position six for normal students. Contradictory to Dawson, not all seven positions demonstrated differences on the proportion of correct central recall due to condition. Furthermore, Dawson found all three grouped serial-position demonstrating a significant effect due to condition. The present study had only the recency positions showing main effects of condition and group.

By visual observation of Tables 4 and 5, the reader can note the greater scores occurred at the primacy and recency serial-recall positions. These effects were not serially compared across positions; therefore, the finding that Dawson expresses in relation to primacy and recency effects may only be descriptively supported by observation.

The comparability of Dawson's study with the present study may be summarized by stating the main effect of rehearsal showed higher recall scores across studies. Differences in findings were noted on incidental recall and selective attention efficiency with Dawson demonstrating statistically significant effects for age and/or group. Moreover, differences were noted in all seven serial positions for Dawson while only positions one and six showed significance due to group and condition effects in the present study. Finally, group serial position analysis showed primacy and recency effects due to

rehearsal for Dawson, while the present study resulted in only a recency effect.

Theoretical Application of the Results

In this part of the discussion, the focus will be on how the results of the present study fit the current theoretical models and their hypotheses. From an information processing model, the use of verbal mediatiors to facilitate the process of selective attention has been reviewed by the present study. The hypothesis that LD students lag in the ability to sustain selective attention (Ross, 1976) was not directly assessed, since age was not a factor assessed in relation to selective attention performance. However, the present study provides positive support to the hypothesis that a rehearsal strategy increases selective attention for LD students. As observed in Table 1, LD students outscored normal students using rehearsal and approached the mean score of normal students using no rehearsal strategy. Hence by following Ross' hypothesis, the speculation arises that rehearsal enables LD students to perform comparably to their normal counterparts.

In regards to Flavell's (1970) production deficiency hypothesis and Reese's (1962) mediational hypothesis, the results of the current study might better support the production deficiency hypothesis over the mediational hypothesis. This statement is made because use of rehearsal with a prompt in the present study demonstrated higher scores on a selective attention task for LD students. Following the production deficiency hypothesis, the speculation emerges that LD do

not produce appropriate rehearsal strategies when needed. However, the present study insured that rehearsal occurred and demonstrated that the lack of production could indeed be the potential factor of selective attention problems. In contrast, a mediational deficiency hypothesis might better explain the results of the present study for normal students. The normal children in the present study were provided mediators, however the insignificant effects of rehearsal and the observed decreases in mean scores might well be explained by the lack of efficacy of the mediator. Ellis (1970) speaks of an interference for normal students due to the effect of imposed mediators on their current mediational strategy. This interference seemed apparent from the present findings.

Furthermore, the basic assumption taken from past literature is that LD and normal children perform qualitatively alike but LD children lag in their quantitative development of selective attention (Hallahan & Bryan, 1981). Consequently, the evidence on quantitative differences between normal and LD students from past research was supported from this study. Hence, further considerations might be needed to increase the occurrence of the use of rehearsal when relevant information involved is to be attended to and remembered.

One last area of discussion when applying the results of the current study to the theoretical literature involves the serial-learning curve. The significant findings of the present study indicate the occurrence of a primacy and recency effect on the serial-learning curve. Individual serial-position analysis showed positions

one (primacy) and six (recency) to have significant effects for grouping and condition. Normal students recalled more at position one than LD students and the nonrehearsal condition scored higher than the rehearsal condition. Of these findings, the effects of rehearsal at position one is not consistent with Dawson's (1980) findings. Essentially, the present study shows the nonrehearsal condition to have mean scores higher than the rehearsal condition in both LD and normal students at position one while Dawson had rehearsal students score higher at all age groups. It should be noted that in the present study the main effect of rehearsal combined LD and normal students while in Dawson's study the main effect for rehearsal included only LD students. Hence the effect of rehearsal as the strategy for primacy recall at position one on the serial-learning curve was not demonstrated in the present study. This finding is consistent with research by Tarver, Hallahan, Kauffman, and Ball (1976) but is inconsistent with studies by Ellis (1970); Tarver, Hallahan, Cohen and Kauffman (1977); and Dawson, Reeve, Hallahan and Ball (1980). The data with normals from the present study demonstrated more recall than LD at position one and is in accordance with Dawson and other researchers (Tarver, Hallahan, Kauffman, & Ball, 1977).

The interaction effect of group and condition at position five is a unique finding of the present study. The LD rehearsal interaction group had the highest mean scores at position five followed by the normal nonrehearsal group, the normal rehearsal group and lastly the

LD nonrehearsal group. These comparisons indicated rehearsal improved performance for the LD students at the middle positions. The effect of the rehearsal and chunking procedure of the present study may help explain this mediacy interaction. The students were required to rehearse positions four and five as a chunk, then name the last two animals of the last two serial-positions; hence, the last name actually repeated aloud was at position five. Hence, the verbal mediation (Ellis, 1970) at position five along with the echo auditory trace (Parrill-Burnstein, 1981) may strengthen recall at these middle positions and result in the present findings.

The main effects of grouping and condition evident in position one also occurred at position six. A comparison of means showed normal students had a mean score higher than LD students and the rehearsal improved mean scores over the nonrehearsal condition at serial-position six. This finding is consistent with recency evidence from past studies (Tarver, Hallahan, Cohen, & Kauffman, 1977; Dawson, Reeve, Hallahan, & Ball, 1980).

The grouped serial-position analysis revealed a unque finding of a middle position effect and absence of a primacy effect while an expected recency effect also occurred. The lack of primacy effect is incongruent with many established findings regarding active rehearsal and primacy recall. The researchers Tarver, Hallahan, Kauffman, and Ball (1976) found no primacy effect for younger LD students (8 1/2 yrs.) while the older students (10 1/2 & 13 1/2 yrs.) did show a primacy effect. Visual analysis of the mean proportions of Table 4

does show a trend toward a higher proportion of correct central responses at the primacy positions in the present study.

The significant interaction effect found at the middle positions follows the same pattern as found with the interaction at position five during individual serial-position analysis. The rehearsal improved mean scores for LD but not for normals at the combined middle positions. The procedure of rehearsing then chunking may be a feasible explanation for the LD. On the other hand, the rehearsal may have interfered with normal students' recall strategy (Kendler, 1963; Hangen & Kingsley, 1968). The significant main effects of group and condition at the grouped recency serial-positons clearly demonstrate that rehearsal helped recall for both LD and normal students. This improvement may be explained by way of a visual and auditory trace. Both auditory and visual modalities were involved with the reception of stimulus information from the last two positions of Hagen's task, hence a better chance for memory processing and recall. Furthermore, if one considered the motor movements during speech as another modality imput, the likelihood of recall at these last positions is yet increased.

Subjective Impressions

Past investigations using Hagen's selective attention task have demonstrated differences in recall of incidental information between age groups and exceptionalities (Maccoby & Hagen, 1965; Hagen & Sabo, 1967; Hale, Miller, & Stevenson, 1968; Tarver, Hallahan, Cohen, & Kauffman, 1977). The present study claimed no effects due to grouping

or condition on incidental responding. The incidental task of the present study may have had a confounding factor on the recall of the incidental stimulus material. The stimulus materials used in the present study and past studies are not standardized nor published; hence, a photographic reproduction taken of the stimulus cards were taken obtained from a previous source using Hagen's task (Hagen, 1972). As the cards were manufactured for the present study, the edge cut between the incidental stimuli and central stimuli on all cards tended to match like pieces of a simple puzzle. Hence, an astute student could visually recognize this matching and possibly use these cues as a strategy for incidental recall. This material effect could possibly provide an explanation for lack of significant findings amongst groups or conditions on incidental learning.

Overall, it appeared that most students were well-motivated to perform on the experimental task. Hence, when considering Dawson's study and the reinforcement condition she used to improve selective attention, one may wonder why any effects would occur as a result of this condition. Although the Dawson study indicated that LD students performed best under a combination rehearsal-reinforcement condition, the author of the present study contends that reinforcement in and of itself would not provide LD students with the best strategy for selectively attending to information. This contention is based on the premise for the categorical definition used for students classified as LD. LD students have the ability to achieve but often fall short of expected levels of achievement, and motivation to perform is not

usually an area used within the definitional category. Torgensen (1977) states that the passive learner needs to actively engage a task with efficient cognitive strategies rather than engage into a reinforcement paradigm.

Some of the unique findings in the present study, middle serial-position effect, could possibly be explained when looking at the individual learning involved for effective execution of the rehearsal condition of the task. Students ability to learn the use of a rehearsal strategy appeared (via experimenter observation) to be interfering with the task's focus, remembering where the animals were placed. During the primacy positions students would remember to repeat the names and by the middle positions the rehearsal strategy did not interfere with other central learning and a better encoding of material may have occurred. A possible study to investigate a learning interference may help explain whether this subjective notion holds validity. This could be accomplished by comparing students who have mastered the rehearsal strategy on related content to those who are taught a rehearsal strategy using the method of the present study.

One last observation concerns learning and responding of the two groups involved in the present study. It appeared that many of the normal children benefited as much from a rehearsal strategy as the LD children. This idea would follow Flavell's (1970) production deficiency hypothesis in that both groups failed to always produce mediators when needed. If future research clearly demonstrates the effectiveness of chunking and rehearsal, the educational system would

have to further implement curricular strategies involving mediation in both regular and special education programs.

Conclusion

The present investigation demonstrated that verbal rehearsal was an effective strategy for selective attention in children classfied under the learning disability diagnosis. Further, the present study demonstrated that normal children have comparatively better recall than LD children at the primacy, middle and recency positions on the serial-learning curve of Hagen's task. These findings support the findings of Dawson, Reeve, Hallahan and Kauffman (1980) which the present study partially replicated. However limiting the present results appear in comparison to Dawson's findings, the experimental method and empirically based nature of this study give strength to the present findings. The nature of verbal rehearsal as an effective mediator under individual learning structure seemed effective according to these results. With consideration for the techinical merit of this study, further investigation will likely be needed to determine if LD students can consistently improve their attending behavior to be more selective through a verbal rehearsal strategy.

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APPENDIX A

VERBATIM INSTRUCTIONS FOR HAGEN'S TASK

No rehearsal instructions - central task

Instructions: "We are going to play a memory game to see how well you remember what you see. I will show you a card like this one (show card) and turn it over and place it here on the table (demonstrate). Then I will show you some more cards with different pictures on them, one at a time and turn them face down on the table (demonstrate). Pay attention only to the animals and remember where I place them on the table. When I finish showing you the cards, I will hold up another card just like one of the cards on the table and ask you to find the card just like mine and turn it over. Remember to pay attention only to the animals. Let's do some for practice first."

Presentation order, probe card

Practice trial 1 - Bear, Fish (Bear)

Practice trial 2 - Cat, Monkey, Horse, Dog, Camel (Horse)

Practice trial 3 - Dog, Monkey, Cat, Bear, Deer, Camel, Horse (Monkey)

Practice trial 4 - Horse, Bear, Dog, Camel, Cat, Deer, Monkey (Cat)

Present probe and say, "Find the card just like mine and turn it over."

Note: The stimulus card containing the fish was only used during the explanation phase of the task procedure and not during the actual 14 experimental trials. Hagen (1967) originally used only seven stimulus cards while Dawson et al. (1980) used eight stimulus cards with the fish card being the extra.

Rehearsal instructions - central task

Instructions: "We are going to play a memory game to see how well you remember what you see. I will show you a card like this one (show card) and turn it over and place it here on the table (demonstrate). Then I will show you some more cards with different pictures on them, one at a time and turn them face down on the table (demonstrate). Pay attention only to the animals and remember where I place them on the table. When I finish showing you the cards, I will hold up another card just like one of the cards on the table and ask you to find the card just like mine and turn it over. It will help to remember if you say the name of each animal out loud as you see it's picture and rehearse the names in groups like this: Say the names of the first three animals in the order in which you see them (demonstrate). Then repeat the names of all three animals in the order in which you saw them (demonstrate). Then say the names of each of the next two pictures as you see them, and repeat both those names in order (demonstrate). Then name the last two animal pictures as you see them (demonstrate). After that I will hold up a card just like one of the cards on the table and ask you to find the card just like mine and turn it over. Remember to pay attention only to the animals. Let's do some for practice first.

Explain that in practice trials 1 and 2 the student should group as if they had seven cards.

Presentation order, probe card.

Practice trial 1 - Bear, Fish (Bear)

Practice trial 2 - Cat, Monkey, Horse, Dog, Camel (Horse) chunk first 3 cards then last 2

Practice trial 3 - Dog, Monkey, Cat, Bear, Deer, Camel, Horse (Monkey)

Practice trial 4 - Horse, Bear, Dog, Camel, Cat, Deer, Monkey (Cat)

Present probe and say, "Find the card just like mine and turn it over."

Incidental task instruction for rehearsal and non-rehearsal groups

Cut-outs of the household objects should be arranged to the right or dominant-hand side in a random fashion. Make sure all cards are oriented so they face the student and are not upside down or sideways.

The cards containing the animal pictures will be presented one at a time. The student should be instructed to, "Choose the card from this group (pointing to the array of household objects) and place it on the blank part of the card with the animal, the card that should go there (point to the blank part on the animal card). That is put the card of the correct household object as they went together in the first part of the memory game."

After each response, make sure the household object card is placed back into the array to be used again.

APPENDIX B

STIMULUS CARDS