Elaborative Interrogation as a Learning Technique for Students with Learning Disabilities

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Abstract

This study examined whether or not students with learning disabilities could effectively use a question and answer strategy known as elaborative interrogation. This technique involved students answering why they thought facts based on familiar animal stories were true. Thirty students from a provincial demonstration high school (for students with learning disabilities) were assigned to one of two study conditions, (a) elaborative interrogation or (b) reading for understanding. Three students, one from the experimental condition and two from the control did not complete the study. Both conditions required that the students learn 36 facts concerning six familiar animals. Immediately following the study session the students completed a free-recall test, a matched association test and a questionnaire regarding their perceived difficulty of the animal stories. After 30 days a matched association test was completed. The oneway ANOVA, 2 x 2 split plot ANOVA and Tukey's Honestly Significant Test were used to determine significance. There was no significant difference in the two conditions for free recall retention. There were significant differences in the elaborative interrogation condition for the immediate matched association test and for the 30-day matched association test. The probability of the students' responses in the elaborative interrogation were measured to determine the effects of adequate responses on long-term retention. It was found that the adequate responses were more likely to promote retention than inadequate responses. In conclusion, long-term retention of factual

information was significantly better in the elaborative interrogation condition in comparison to the reading for understanding control. For future research, the dependent measure, free recall should be given both verbally and in written format. In addition, extra time should be allowed for processing of the new information to occur.

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CHAPTER ONE: INTRODUCTION

Background of the Problem

Throughout childhood and into adulthood, individuals are constantly required to learn new information. This information has to be processed and understood in order for it to become meaningful. This process of learning can be difficult if this information is novel or conflicts with their prior knowledge. For students with learning disabilities the learning of new information becomes even more difficult as these students are typically characterized as having a poor memory (Weber, 1993).

Cognitive strategy instruction is a method used with students, who have learning disabilities, to acquire new skills (Winzer, 1990; Weber, 1993; Hodder, Waligun, & Willard, 1986). Recently, there has been considerable research which examines cognitive strategy instruction for learning in relation to students with severe learning disabilities (Graham & Harris, 1994). To date however, there is very little research on characteristics of students to predict the type of individual who will benefit from strategy instruction (Graham & Harris, 1994). One method, elaborative interrogation, is a cognitive learning strategy that has been used successfully with learners without disabilities. This method has not been used extensively with students who have learning disabilities.

Statement of the Problem

This study investigated the use of elaborative interrogation with students who have learning disabilities. Elaborative interrogation is a question and answer strategy that requires the learner to elaborate using his/her prior knowledge as to why something could be true. This cognitive

learning strategy (elaborative interrogation) has been effective in the experimental arena with students without learning disabilities (Seifert, 1992; Kahl & Woloshyn, 1994; Martin & Pressley, 1991; Mayer, 1980; Miller & Pressley, 1989; Pressley, Symons, McDaniel, Synder, & Tunure, 1988; Woloshyn, Willoughby, Wood, & Pressley, 1990; Wood, Pressley & Winne, 1990).

The present study was developed to determine if, when acquiring new factual information, elaborative interrogation is a beneficial strategy for students who have learning disabilities. The students generated elaborations which were examined through retention gains. Elaborative interrogation was compared with the traditional teaching method of reading for understanding.

Research Questions

1) Will students in the elaborative interrogation condition do better in long-term retention measures of free recall and matched association than in the reading for understanding condition?

2) Will the quality of the answer given for each fact throughout the study affect the probability of later recall?

3) Will the generation of adequate elaborations result in higher recall of the facts in comparison to the generation of inadequate response or no response?

4) Will the self-evaluation of the degree of difficulty be rated comparatively by those students in the elaborative interrogation and the reading for understanding condition?

5) Will the students' willingness to participate again be higher for the elaborative interrogation condition than the control?

Rationale for the Study

Traditional educational methods like rote learning and reading repetitively have had limited success with students with learning disabilities. This population has difficulty in assimilating novel information (Winzer, 1990). Research has indicated that a learning strategy approach is effective in teaching this population (Hodder et al., 1986). Currently, there has been no teaching method for memory recall which has proven successful with all students with learning disabilities. When determining which strategy to teach or research several issues should be examined. Initially, the question asked is, "What strategies should be studied by the student?". Secondly, the researcher must determine if that student requires strategy instruction in order to increase the likelihood of success in the school system. Once a strategy has been selected, the instructor needs to determine if the strategy encourages higher cognitive processing. Finally, the question arises as to whether the strategy is educationally relevant for that student (Graham & Harris, 1994). When these questions have been answered, the researcher will have chosen a strategy which would likely benefit this population.

Students with learning disabilities often experience difficulty with memory tasks and difficulty with competency in using strategies independently (Winzer, 1990). For example, strategies such as rehearsal, organization and elaboration require memory and students with learning disabilities may not be able to effectively use these strategies (Schneider &

Pressley, 1989). A study by Hollingsworth and Woodward (1993) demonstrated that students who were taught explicit strategies demonstrated a superior performance on recall. This finding offers encouragement that students with learning disabilities can learn cognitive strategies and effectively apply them in memory recall. Research by Pressley (1991) suggested that improvement in memory over the years is related to the usage of mnemonic strategies rather than increased memory capacity.

Teaching students with learning disabilities cognitive learning strategies can help these students to be successful in the academic setting (Scott, 1988). Many strategies which aid in learning can be taught to students (Pressley, Woloshyn, Lysynchuk, Martin, Wood, & Willoughby, 1990). Examples of strategies include visualization and story grammar. These strategies would assist the student to learn new information using previously learned knowledge.

Limitations and Assumptions

1) The population of students at Trillium School has specific and severe learning disabilities. All students have been tested by their home school board as a prerequisite to attending this demonstration school. The population is not homogeneous and discrepancies may have occurred in assigning the students to a study condition (the students were not randomly assigned). This limitation may have resulted in the two conditions having an uneven distribution of learner difficulty. It was assumed that each group contained an equal number of the varied

learning disabilities, for example dyslexia, and short-term and long-term memory deficits.

2) Another limitation was in the administration of instructions. The students had various learning disabilities and the instructions for the conditions were explained differently to each individual to ensure comprehension of the task.

3) Within the reading for understanding condition, limitations may have arisen in that poor readers may have been randomly assigned to this condition. It was the assumption of the researcher that these students would listen to the tape and read along with the narrator. This may have resulted in the student using memory strategies such as mnemonics to remember the animal facts. There was an assumption that all students were reading.

4) The study focused on only two learning strategies: (a) elaborative interrogation and (b) reading for understanding.

Definitions

The definitions for the learning strategies are similar to those of Kahl and Woloshyn (1994) and Wood et al. (1990).

Adequate Elaborations - these are answers that are logical responses as to why the facts regarding the animals are true.

Elaborative Interrogation - this technique involves the learner answering why he/she thinks a fact is true. This question encourages learners to use prior knowledge to make inferences and elaborations about this new information.

Inaccurate Elaborations - these responses are logical rationales concerning the animals, but are not scientifically correct.

Inadequate Explanations - these answers do not explain why the facts regarding the animals are true.

Incorrect Statements - these are errors made during recall of the animal facts.

Irrelevant Statements - these are facts that are accurately recalled concerning the animal but are not part of the targeted information.

Scientifically Correct Elaborations - these are adequate reasons which are compatible with true scientific facts regarding the animal.

To date, there has not been a universally accepted definition in the literature on learning disabilities (MacIntyre, Keeton, & Agard, 1980; Weber, 1993; Winzer, 1990). For this study, the Ministry of Education and Training (1984) definition will be used:

Learning Disabilities - a learning disorder evident in both academic and social situations which involves one or more of the processes necessary for the proper use of spoken language or the symbols of communication, and that is characterized by a condition that:

a) is NOT primarily the result of:

- impairment of vision
- impairment of hearing
- physical handicap
- mental retardation
- primary emotional disturbance
- cultural difference

b) results in a significant discrepancy between academic achievement and assessed intellectual ability, with deficits in one or more of the following:

- receptive language (listening, reading)
- language processing (thinking, conceptualizing, integrating
- expressive language (talking, spelling, writing)
- mathematical computations

c) may be associated with one or more conditions diagnosed as:

- a perceptual handicap
- a brain injury
- minimal brain dysfunction
- dyslexia
- developmental aphasia (Ministry of Education, 1984, p. 16).

Summary

Students with learning disabilities have difficulty in learning new information. This may occur because of difficulties in communication and learning that this population experiences. Cognitive strategy instruction is a method which has been introduced into the education system in Ontario as a means of helping the students compensate for their disabilities (Hodder et al., 1986). The strategy, elaborative interrogation, has been used extensively on students without learning disabilities. This strategy involves the student answering why a fact is true. This results in the student integrating his/her prior knowledge with the presented fact.

This study examined the effectiveness of elaborative interrogation in comparison with the traditional reading for understanding. Students

with learning disabilities generally have difficulty with reading and transferring information to long-term memory. Therefore, it was questioned whether the students in the elaborative interrogation condition would do comparatively better than the reading for understanding condition. In particular, the performance of the elaborative interrogation condition would be better in long-term retention measures of free recall and matched association. It was speculated that the elaborative interrogation condition would rate their willingness to participate higher than the reading control. This study investigates the use of elaborative interrogation with students who have learning disabilities.

CHAPTER TWO: REVIEW OF THE LITERATURE

Overview of the Chapter

In this chapter, theoretical perspectives on (a) cognition, and (b) information processing are discussed in relation to learning and learning disabilities. A general overview of learning disabilities is then provided. Learning strategies and metacognitive programs are presented in relation to their effectiveness with people who have learning disabilities. Specific strategy research on elaborative interrogation is then reviewed.

Cognitive Theoretical Perspective

How individuals acquire new information has been asked of educators, philosophers and psychologists for many years. Early philosophers Descartes (1596-1650) and Locke (1632-1704) debated whether learning was an attribute of nature or nurture. Descartes argued that learning was innate and Locke drew conclusions that an infant's mind was a blank slate (tabula rasa) and, as the child matured, experience filled the slate (Miller, 1989; Schultz & Schultz, 1987). This argument still exists in today's educational system as students with learning disabilities are taught both as innate learners and as blank slates. Teachers who viewed the students as innate learners presented the information in a rote or textbook manner and expected the students to inherently acquire the new information. Minimal emphasis was placed on how to learn; emphasis was placed on what to learn. This method is generally regarded as traditional education. The teacher who regarded the student as a blank slate may have provided the tools for the new learning to take

place. The teacher may have used outdoor education, whole language or cognitive learning strategies to aid in this process of learning.

The view of the learner as a blank slate has been modernized by recent psychology. Researchers in this field, such as Dewey, Piaget, Kolhberg and Vygotsky, regarded the child as being an active, self-directed learner who was responding to the world around him/her rather than being a passive learner (Harris & Pressley, 1991). It was believed that in order for real understanding to take place the child would have to be actively involved in his/her own development of knowledge (Harris & Pressley, 1991). Children who had actively participated in their learning would retain more information as this knowledge was processed at a higher cognitive level.

While Piaget viewed the development of individuals' knowledge as a part of their biological makeup, his work tended to ignore any effects of the social environment. He believed that development of knowledge was based on the successful accommodation and assimilation of new information (Ried, 1993; Miller, 1989). Accommodation of new information involved the learner adapting or developing relationships with the prior knowledge. Assimilation encompassed the student thoroughly comprehending the new information and creating links or developing similarities with their prior knowledge. Thus prior knowledge of an individual was constantly changing and expanding as the individual learned more information. Consequently, the best predictor of what would be learned was what was already known (Ried, 1993).

Vygotsky, by comparison, viewed development in relation to socialization. Human development was a process of developing a shared

meaning by internalizing social models. These models would at first be unconsciously developed and then later be at the conscious level where the individual had control (Ried, 1993). It was, therefore, the instruction that caused development to take place. Without the instruction it was thought that learning would not occur.

Vygotsky believed that adults operated within the zone of proximal development. This zone aided adults that were instructing students at a level that was just beyond their present knowledge but not too far beyond that the students could not learn new information (Ried, 1993; Meltzer, 1991). The proximal zone ensured that the learner was challenged to acquire the new information rather than becoming frustrated as the level of difficulty increased.

Vygotsky determined that skillful thinking was further aided by the interactions of others who were better qualified (Graham & Harris, 1994). This technique was called scaffolding. This implied that the instructor was similar to a scaffold. In scaffolding, instruction is given with many supports such as structure and guidance. This support, similar to a scaffold, is slowly removed as the students internalize the cognitive structures and are able to use them independently (Graham & Harris, 1994).

Metacognition

In research on non-learning disabled populations, metacognitive and problem-solving strategies are viewed as important (Pressley et al., 1990). Hodder et al. (1986) defined metacognition as a system that encouraged students to be consciously aware of their thinking processes. This would include a conscious awareness of intentionally remembering

and assimilating information for later retrieval. Winzer (1990) defined metacognition as a process which allows individuals to guide their thinking processes more efficiently, thus resulting in the student becoming a more flexible learner.

Students with learning disabilities may have problems with metacognition, resulting in a lack of awareness of simple learning strategies (Winzer, 1990). These difficulties may have been the result of not having recognized strategies that were used in one situation that could have been generalized to another, and understanding that when a selected strategy does not work a different method should be used (Stone & Conca, 1993). In a classroom situation this difficulty makes it harder for students with learning disabilities to acquire new information as they do not consistently use strategies.

Hodder et al. (1986) suggested that the student with learning disabilities benefited from being taught how to examine and initiate learning. In particular, the metacognitive method of a consistent rehearsal of strategies to complete a task or learn new information is beneficial (Lokerson, 1992). This method would help the student to become a self-regulatory learner. For example, a student studying for a multiple choice test would be able to use consistent strategies (once acquired) when put into a similar test environment.

Pressley (1991) concluded that research was lacking in the area of problem solving and metacognition strategies in relation to the interaction with language, memory and perception. It is important that more research be completed in this area. This new knowledge might be able to help students with learning disabilities become better strategists.

Learning Disabilities

The term learning disabilities was first introduced in 1963 by Samuel Kirk; prior to this identification students were diagnosed using the medical model (brain damaged, Strauss syndrome, minimal brain disorder). Approximately 3.7 percent of the Ontario school population has been identified as learning disabled (Weber, 1993). This exceptionality encompasses the majority of children (46.6%) who have been classified as exceptional (Weber, 1993). Learning disabilities occur more frequently in males, where the ratio is approximately four to one (Winzer, 1990).

Typically, students with learning disabilities experience difficulties in the following areas: processing language, alphabet, penmanship, copying or note taking, arithmetic, reading, slow work pace, time and sequence, spelling, time management (Weber, 1993). Students with learning disabilities also experience difficulties with metacognition and strategy (Winzer, 1990).

Higher level learning is generally not acquired without strategies being taught to this population. The student with learning disabilities may be required to learn how to think, to problem solve, and to learn how to generalize prior knowledge to new situations (Hodder et al., 1986). These students do not learn these strategies naturally and need to be taught these skills.

Memory

Students with learning disabilities have a tendency to forget previously learned information. This population has difficulty retaining information over long and short periods of time (Winzer, 1990). These

deficits occur for both auditory and visual stimuli (Winzer, 1990). This maybe a result of a failure to effectively organize the material in a system that would allow for easy recall. Children with learning disabilities may have difficulty executing a mixture of strategy processes that would require them to have a conscious awareness of the strategy and understanding the content (Pressley, 1991).

Research by Stanovich (1986) concluded that students with learning disabilities were less successful on memory tasks that encompassed several different strategies. This result may be attributed to the fact that the usage of multiple strategies requires a heavier memory load, for both long-term and short-term memory. Generally, the short-term memory can hold five to nine items of information for approximately 15 to 30 seconds (Miller, 1989). Short-term memory requires the student to rehearse the information immediately or to actively use the material to prevent forgetting. Students with learning disabilities may experience difficulty with rehearsal skills resulting in the information not being transferred to long-term memory. Long-term memory retains information indefinitely using complex mental structures (Miller, 1989). Accessing information from long-term memory may be difficult for students with learning disabilities as this population has a tendency to experience difficulties with retrieval skills.

Students with learning disabilities experience difficulties when acquiring new information as a result of deficits in short and long-term memory. This idea is supported by Mann (1986). It was found that students with learning disabilities were less proficient at remembering the words of spoken sentences when compared to good readers. Students

with learning difficulties were unable to transfer new information to long-term memory. Further research by Dyck and Sundbye (1988) concluded that children with learning disabilities were also less successful than strong readers when making inferences. This may be a result of the added memory load required to make inferences.

Generally it has been found that poor readers do not incorporate a mixture of cognitive learning strategies that aid in retention (Stanovich, 1986). This can be attributed to the difficulty students with learning disabilities experience when transferring information from short-term to long-term memory (Weber, 1993). As a result, these students do not learn from experience (Winzer, 1990). Pressley (1991) determined that some children with learning disabilities may never be able to use memory or reading comprehension strategies independently. This may be the result of the student not being able to self-assess and choose effective strategies (Stone & Conca, 1993).

Strategies like rehearsal, organization and elaboration require memory. Students with learning disabilities may not be able to effectively use these strategies (Schneider & Pressley, 1989). Walker and Poteet (1989) suggested that any new information should be linked with prior learning to help students with retention by developing semantic relationships. These semantic relationships are an important skill to develop for this population as it would aid in developing links with short-term to long-term memory.

Learning Strategies

Cognitive strategy programs incorporate many of the perspectives of Vygotsky's scaffolding and teacher/student interactions. Students are taught strategies through observation of the teacher modeling the effectiveness of the strategy and then learning the strategy independently. Each strategy is taught individually to ensure that the student is able to successfully use the technique.

The use of strategies can improve the academic ability of students in both populations of learning disabilities and non-learning disabilities (Pressley et al., 1990; Scott, 1988). Many strategies of learning new information have been documented, including reading for understanding, memorization and answering questions. When individuals read for understanding, they read and read the new information in a manner which promotes understanding and comprehension. This method is used in both learning disabled and non-learning disabled populations.

Another strategy, memorization, requires the individual to use mnemonics skills to commit the new facts to memory. This strategy may involve the use of mnemonics or visualization. A third strategy is answering questions. Individuals answer questions based on prior knowledge which aids in the new information becoming meaningful. Each of these traditional learning strategies has had varying success with learning new information. No strategy has yet proven successful with all individuals and in all settings. Thus, to be an effective educator it is important to be aware of a variety of strategies, including reading for understanding, memorization and answering questions. It is also important to examine other techniques that have not been applied

extensively in the classroom. When teaching strategies, it is important for the student to see the usefulness of the implementation of the strategy (Gleason, 1988).

In general, students with learning disabilities apply strategies they feel comfortable in using and tend to use strategies that they have had success in implementation (Hodder et al., 1986). It is, then, important that educators provide opportunities for successful strategy use in order for the student with learning disabilities to regard a new strategy as being purposeful. These students are generally regarded as not having internalized useful learning strategies (Winzer, 1990; Stone & Conca, 1993). This population, when compared to non-learning disabled peers, tends to use fewer strategies and less spontaneously (Stone & Conco, 1993). Difficulties may occur for students with learning disabilities in determining which strategy would be most successful in a situation and how to implement that strategy (Stone & Conco, 1993).

Learning Strategies Approach

This approach is a method used with students with learning disabilities (Lokerson, 1992). It is an instructional approach which teaches students how to learn rather than what to learn (curriculum). The emphasis is on the process of learning new information. The goal of this approach is for the student to become an independent learner (Winzer, 1990). Techniques such as the learning strategy approach teach the student to be self-instructional, which is an optimal goal for students with learning disabilities (Ryan, Weed, & Short, 1986). This approach is particularly important to students with learning disabilities who may take post-secondary education as it teaches them how to use their own abilities

and specific strategies to support them in higher education (Hodder et al., 1986; Trapani, 1990). Although the method is relatively new and research is ongoing, preliminary results indicate that students make significant increases in their written expressions and various other skills (Trapani, 1990). Research by Graham and Harris (1994) indicated that although cognitive strategy instruction has been proven successful in the research field, academically it is not prevalent in either regular or special education classrooms.

This approach can be used to learn written text, written expression and listening skills (Hodder et al., 1986). Examples of the learning strategy approach include the use of organizers, summarization of text and listening skills. These strategies may help the student learn new information easier (Herr, 1988). The strategies provide the students with a type of model to follow to make it easier for the individual to transfer information to long-term memory.

Harris and Pressley (1991) offer seven stages to help in using the learning strategy approach:

(1) The teacher has to look at developing the prerequisite skills needed to learn the strategy.

(2) The teacher needs to determine the level in which the student is presently operating.

(3) The teacher provides information on the strategy to ensure that the student understands the effectiveness of using this new strategy.

(4) Then the strategy is modeled with self-instructions.

(5) The teacher ensures that the student can use the strategy independently.

(6) The self-instructions are then reviewed.

(7) The final result is that the student was able to use the strategy independently.

Elaborative Interrogation

This learning strategy involves the learner answering why something is true. This question encourages individuals to use prior knowledge to attempt to understand new information. Through this attempt to answer the question, the student generates an elaboration that results in this new information becoming relevant and meaningful (Wood, Fler, & Willoughby, 1992). Martin and Pressley (1991) determined that the individual's memory would improve because answering the why question causes the learner to activate prior knowledge consistent with this new information. It is thought that this knowledge would not have been activated without the 'why' question.

Elaborative interrogation is generally used in the research domain rather than in the classroom. Researchers enlist a subject or group of subjects to participate in various conditions. A control commonly used is reading for understanding. This condition asks the subject to listen to an audiorecording of the statement and then read the materials over and over again out loud with instructions to think about what he/she is reading in order to understand it (Pressley, McDaniel, Turnure, Wood, & Ahmad, 1987; Woloshyn, Pressley, & Schneider, 1992).

A second condition which could be used is that of imagery. As the subjects review the material, they are asked to create an interactive mental image to make the information more meaningful (Wood et al., 1990).

A third condition is self-study. The subjects are asked to study the statements using any strategy that they would normally use to learn new facts. Examples of strategies that subjects have spontaneously selected include reading the information over and over, mnemonics, visualization, writing the facts down and asking questions to a partner. The experimental condition is elaborative interrogation. Elaborative interrogation subjects are asked why that fact or statement is true. All of the subjects are given the same amount of time to study or learn the facts in all the conditions.

Minimal research has been completed on the use of elaborative interrogation and students with special needs. One study by Scruggs, Mastropieri, Sullivan and Hesser (1993) focused on students with learning disabilities or mild mental retardation. The purpose of this study was to determine if elaborative interrogation would encourage recall of information using both mnemonic and non-mnemonic pictures with related non-pictured information. Thirty-five males and eighteen females in grades six to eight participated. Forty-nine students were identified as learning disabled and four were identified as having mild mental retardation. Students were required to learn nine possible reasons for the dinosaur extinction. These explanations were presented in a declining order of plausibility and each fact was accompanied by either a statement explaining why the fact might have caused the extinction or a why

question. The students were assigned to one of three conditions: Mnemonic elaborative interrogation, elaborative interrogation, or direct teaching condition. The results indicated that students in the elaborative interrogation condition were able to successfully recall the ordered reasons better in comparison to the mnemonic elaborative interrogation condition. Both elaborative interrogation and mnemonic elaborative interrogation were more successful than the direct teaching condition. These findings suggest that elaborative interrogation would be an effective method to use with students who have learning disabilities.

Results from the various studies have shown that elaborative interrogation is effective in the experimental setting. Research by Pressley et al. (1988) found elaborative interrogation to be a powerful learning procedure that is useful during fact learning. The researchers studied the effectiveness of elaborative interrogation in acquiring new information. Imagery was compared with elaborative interrogation and a reading control in all four experiments.

In experiment one the participants were required to recall the type of man presented in the fact. Participants in the elaborative interrogation condition and the imagery condition had higher recall than the reading control. It was also found that the generation of correct elaborations were associated with a higher performance than the generation of incorrect elaborations.

In experiment two, participants were again put into the three conditions and were consequently asked to recall the action that the man completed. The findings of this study suggest that recalling the action is more difficult than recalling the subject (experiment one).

In experiment three, the participants were presented 36 facts regarding the Canadian provinces and territories. The results of this study indicate that imagery and elaborate interrogation is an effective method in promoting learning in comparison to the reading control.

The final experiment focused on sex differences. The results of experiment four were comparative to the previous experiments, in that the imagery and elaborative interrogation performed better than the reading control. The findings of these experiments suggest that elaborative interrogation and imagery strategies are effective methods to use when new information is to be learned.

A study by Martin and Pressley (1991) examined 110 students enrolled in an introductory psychology course. This study examined whether answering the why question promoted learning through activation of prior knowledge that was supportive of the thirty-six facts regarding Canadian provinces. Students were randomly assigned to one of four elaborative interrogation conditions (confirm-specific elaborative interrogation, confirm-other province condition, unexpected-specific province condition and unexpected-other condition) or were placed in a reading control. Their research concluded that with elaborative interrogation a conscious processing of the new knowledge takes place. They inferred that the type of answer generated in response to an elaborative interrogation was a critical factor with memory.

These results were confirmed by Wood, Pressley and Winne (1990). They completed two studies to determine if elaborate interrogation could promote children to use their prior knowledge to form associations with to-be-learned facts. The first study examined 139 elementary school

children, enrolled in grades four to eight. The students were randomly assigned to one of four conditions, base sentence only, precise elaboration provided, imagery or elaborative interrogation. The students studied a series of facts regarding a man and an activity that the man completed (The tall man bought crackers). The results indicated that students in the elaborative interrogation condition and the imagery condition did significantly better in recall in comparison to the self-study and reading controls (Wood et al., 1990).

The second experiment by Wood et al. (1990) examined the use of elaborative interrogation in learning fifty-four facts regarding familiar animals (for example, the skunk mostly eats corn). Two hundred and fifty-seven students participated in the study ranging from grades four to eight. The students were divided into one of six study conditions, no-exposure control, base, explanatory elaboration provided, imagery, imagery plus explanatory elaboration provided and elaborative interrogation. The results indicated that students in the elaborative interrogation condition did slightly better than the imagery condition. The findings of this study indicated that production of any answer for elaborative interrogation was related to better recall than providing no answer at all. This finding is in contrast to the results to experiment one and to data collected on adults. Answers that were objectively correct responses were associated with higher recall than responses that were incorrect. Wood et al. (1990) suggested that prior knowledge is necessary for the successful use of elaborative interrogation.

A study by Woloshyn et al. (1992) examined one hundred undergraduate students from a Canadian and Germany university. The

students were randomly placed in one of three study conditions: elaborative interrogation, reading for understanding and no-exposure (control). The results indicated that in order for elaborative interrogation to be highly successful the students would need to have relevant prior knowledge of subject and strategies. This would mean that if a student did not have any prior knowledge of a targeted subject, acquiring new information would be difficult. For elaborate interrogation to be successful in aiding a student in learning information, prior knowledge has to exist. Students though, without prior knowledge were able to recall more information than the reading for understanding and the no-exposure control. This maybe a result of the cognitive processing used with elaborative interrogation.

Suggestions for the success of elaborative interrogation included that the subjects who were explaining tended to learn better as they elicited their prior knowledge in comparison to subjects who did not use this strategy (Pressley, Wood, Woloshyn, Martin, King & Menke, 1992). Another potential reason for the success of elaborative interrogation was that by attempting to explain the relevance of the to-be-learned facts, the learning of these facts were increased (Pressley et al., 1992).

A study by Mayer (1980) applied elaborative interrogation into what was considered real world situations. This study took elaborative interrogation out of the experimental arena and into the classroom setting. This research focused on information from a computer programming course. Mayer wanted to determine if elaborative interrogation would assist students in learning difficult concepts, as opposed to the traditional reading method.

The results of this study inferred that elaborative interrogation can influence the long-term retention of unfamiliar information. Students, when asked why a fact was true, drew on their prior knowledge to assimilate the information. This research is one of the first studies to allow educators to see the effectiveness of elaborative interrogation as a learning strategy that was applicable for learning new facts in the classroom. Prior to this research, which used classroom materials (the computer textbook), statements or facts which had little or no meaning to the individual were generally used to determine the effectiveness of elaborative interrogation. This research used information as targeted facts that would be relevant in real-life situations for the participants.

Later research by Seifert (1992) examined how this strategy could be used as part of a study skills program. Seifert (1992) developed a five-step program based on elaborative interrogation that could make this strategy more applicable in the classroom. This program could be taught to students to aid in effective learning of new information. The first step was to read the paragraph to be learned and locate the main idea. The next step was to use strategies, such as concept mapping, to link ideas together. The third step involved identifying the main idea. The fourth stage was to generate a why question about the main idea. Finally, the fifth step had the individual develop an answer to the why question. This type of research is important in further developing links between elaborative interrogation and the classroom.

Educators have many different tasks to accomplish in the school day and practicing new learning strategies may take too much time as they have to learn the strategies themselves in order to apply them.

Elaborative interrogation is an effective technique for learning novel information. It involves minimal preparation by the teacher as the students are only required to answer why a fact is true. For example, when teaching the concept of photosynthesis, the teacher may ask the question, "How do plants obtain food?" This question may elicit inaccurate prior knowledge as students may respond that, "mommy gives it water or vitamins". The learning of the new information (photosynthesis) is now harder, as students now must overcome inaccurate facts before learning new information. For students with learning disabilities, the new information may never be learned as the concept of plants getting food from the sun conflicts with their prior knowledge. If the teacher was to ask why plants get their food from the sun, the students would integrate their prior knowledge; thus new learning is easier.

Future research on this technique is required to determine the effectiveness of this strategy and in which learning situations it is most beneficial. Currently, this strategy is not widely used and is still very much in an experimental stage. Elaborative interrogation has its merits in learning new facts because it requires the individual to use prior knowledge and conclude why that fact is true. To date, research has proven that elaborative interrogation is an effective strategy to acquire new information in comparison to repetitious reading (Woloshyn & Stockley, 1995). This technique may be beneficial to individuals and should be studied in more detail in both the practical and experimental arena.

Present Study

Traditional learning strategies have had varying success with students in learning novel information. To date, no strategy has been proven successful with all individuals and in all settings. One method, elaborative interrogation, has been effective in the experimental arena (Kahl & Woloshyn, 1994; Martin & Pressley, 1991; Mayer, 1980; Miller & Pressley, 1989; Pressley et al., 1988; Seifert, 1992; Woloshyn et al., 1990; Wood et al., 1990). Research has indicated that this method has been successful with non-learning disabled populations in acquiring new information. Consequently, this study examined the effectiveness of using elaborative interrogation with students who have learning disabilities to determine if this method is effective in learning factual paragraphs.

CHAPTER THREE: METHODOLOGY

Overview of the Chapter

The methodology of this study was similar to Kahl and Woloshyn (1994) and Wood et al.,(1990). Kahl and Woloshyn (1994) examined the learning of factual information using cooperative learning and elaborative interrogation. In addition, methodology by Wood, et al., (1990) focused on elaborative interrogation effects on children's learning of factual content and was similar to the present study.

Thirty males from Trillium School were placed into one of two study conditions, reading for understanding and elaborative-interrogation. These students were not randomly assigned, as some students expressed a preference as to their preferred condition. Each condition studied 36 animal facts. To assess retention, an immediate free recall, immediate matched association, and a 30-day matched association test were used. To determine differences as a result of study context, Tukey's Honestly Significant Difference Test was completed. The sessions were tape-recorded and analyzed. Conditional probabilities were calculated to ascertain the association between the quality of response and later recall. From this planned pairwise comparisons followed. A questionnaire was completed on the students' perceptions concerning their participation and on the content of the stories.

Population and Sample

The population was chosen from Trillium School, a provincial demonstration school for students with severe learning disabilities. This school had a population of 34 students, thirty students with learning disabilities and four students who had attentional deficit hyperactivity disorder (ADHD). Letters of consent were sent home for the parents to sign and all thirty male English-speaking students with severe learning disabilities participated.

Three students, one from the elaborative interrogation condition and two from the reading control did not complete the 30-day matched association test because of re-integration to their home school. The median age was 14 and the ages ranged between 12.8 to 17.8 years old. All of the subjects were identified as learning disabled in accordance to Ontario Ministry of Education and Training guidelines. Each student was tested by the school psychologist and recommended by his school board to attend Trillium School (see Appendix A).

Instrumentation/Administration

Permission forms were signed by the students' parents to allow for participation in this study (see Appendix B). Each participant's learning disabilities are identified in the Ontario Scholastic Records. The parents signed a written consent form to allow this information to be accessed by the researcher (see Appendix C). The school psychologist was consulted by the researcher concerning the individual strengths and weaknesses of each participant. The students were arbitrarily assigned to one of two study conditions: elaborative-interrogation, and reading for

understanding (control). Each condition contained an equal number of students.

Method

Six animal stories were chosen for the students to learn. Each story contained six facts for the student to learn, for a total of thirty-six. The content of these animal stories were most likely unfamiliar to the students, based on their previous use by Kahl and Woloshyn (1994) and Wood et al., (1990).

The American Pika, the Blue Whale, the Emperor Penguin, Little Brown Bat, the Townsend Mole and the Western Spotted Skunk were the animals studied in the stories (see Appendix D). A practice story was presented to the students based on the House Mouse. This allowed the students to familiarize themselves with the tasks involved with their particular study condition. Each story presented information concerning the habitat, the locality in which the animal can be found, the diet, the mannerisms and the main predators for each animal. These were presented in paragraph format. The example below illustrates the story on the American Pika:

> The American Pika lives so high up in the rocky mountains that trees can't grow. The pika likes to live in and around rock piles. The pika is only found in British Columbia. It eats grasses and flowering plants. The pika sleeps during the night. The most dangerous animals for the American Pika are birds and weasels.
>
> (Wood et al., 1990).

This information was typed, using an 18-point font (to accommodate for any visual impairments) on a 8.5 by 11 inch sheet of white paper. An audiotape of each story was recorded by a male adult. The story was heard once by the student and then each fact was presented on its own. After each sentence, a 30-second pause was provided for the students to respond. A bell signified the end of each 30-second interval and the presentation of the next sentence followed. The practice story was presented first and then the six stories followed an identical format, one after the other. Throughout the study session, feedback was provided to the students. During each session, the students' responses were tape-recorded for further study. The study session lasted approximately one hour for each individual.

Pilot Study

The elaborative-interrogation method was presented to three students from Trillium School who had learning disabilities. These subjects were not used as part of the present study. This pilot study was completed to determine the validity of the materials for students with learning disabilities. This pilot study ensured that the animal stories were unfamiliar to the students. The pilot study helped to determine the length of time that each study session would take to complete. The methodology for the pilot study corresponded to the elaborative interrogation condition of the present study.

For the pilot study the animal facts were typed in a 12 point font, it was found that this size was ineffective as several students at this school had visual difficulties. The font was changed to 18 point to accommodate

these students. The free recall, immediate matched association test and the questionnaire were given to the student to fill out. The students in the pilot study experienced difficulty with writing the facts down on paper. Although, when asked to respond to the questions verbally the students could effectively recall the information. It was determined that during the formal study the students would be asked to verbally give their responses rather than using written expression. There were no other changes between the pilot study and the formal study.

Study

The students were tested individually in each condition. The study session and tests lasted for approximately one hour for each participant. The students were told at the onset of the session that they were going to learn new facts about six different animals and that they would be questioned about them after the session was completed. Students were not randomly placed into the two study conditions. Any student that expressed a concern regarding having to read-out-loud was asked to participate in the elaborate-interrogation condition. This was done to alleviate any unnecessary stress for the student participating in the study.

The students in the reading for understanding condition were asked to read the story carefully and to remember as much information as they could. The students in the elaborative interrogation condition were told that this strategy might help them to remember facts in the stories easier; their task was to listen carefully to each sentence and then answer why they thought each fact was true. Guessing was encouraged. For both

conditions, a practice story was used to familiarize the participants with their task.

Instructions

The instructions were provided prior to starting the session. During the actual session, no further instructions were provided.

The instructions for the reading for understanding condition were as follows:

Today, I am going to show you some animal stories. I am going to turn on this tape recorder and a man will read the stories out loud to you. You should also follow along by carefully reading the cards. When the man has finished reading the story, he will read the sentence over again. What you have to do is to try and remember this fact. When you hear the bell, the second sentence will be heard. Again, you are to try and remember this fact. Remember, when you hear the sound of the bell, you should go on to the next fact even if you have not finished reading the sentence.

Make sure that you listen very carefully as I am going to ask you about the sentence information later. Also make sure to speak loudly as I am going to tape record your answers. Do you have any questions? Okay, let's do a practice paragraph.

The instructions for the elaborative interrogation condition were slightly different from the reading for understanding condition. The following instructions were presented:

Today, I am going to show you some animal stories.

I am going to turn on this tape recorder and a man will read the stories out loud to you. You should also follow along by carefully reading the cards. When the man has finished reading the story, he will read the sentence over again. Your task is to answer out loud a question about each sentence. The question will always be the same and is: Why is that fact true? It is very important that you try and answer why each fact is true. In order to help you come up with an answer, you might want to think about things you have learned in school, things you have read about, and your everyday experiences. There is no one correct answer, so you should come up with as many reasons as possible. Remember, it is very important that you try and answer why each fact is true -- so, even if you are not sure that your answer is correct, make your best guess.

Make sure that you pay attention to every statement and try really hard to think of an answer to the "why" question as I am going to ask you questions about the sentences later. Make sure to speak loudly as I am going to tape record your answers. Do you have any questions? Okay, let's do a practice paragraph.

Memory Tests and Questionnaire

The students completed a free recall test upon the completion of the study session (see Appendix E). This test was given verbally to the students. The students were reminded that they had learned six facts about each animal. The researcher said the name of the animal and asked the students to verbally mention everything they remembered about

that animal. When the student could not remember any other details, the researcher would continue with the next animal name. The participants were allowed as much time as needed to complete the exercise.

A second task was the recognition test; this followed the free recall test. This was a matched association quiz that contained all of the facts that were presented in the stories (see Appendix F). Both of the conditions had a list of the animal names in front of them. Each fact was read to them by the researcher and the students' task was to point at the letter, animal name or verbally respond to the statement.

A final task was to complete a questionnaire consisting of 11 items (see Appendix G). The students were asked to rate questions concerning the difficulty of the animal stories and their study condition. This questionnaire was based on a Likert scale that ranged from 1 (not easy) to 5 (a great deal/very). The students had a Likert scale in front of them and were asked the questions verbally. Upon completion of the study session, the students were thanked for their participation.

After a 30-day period the students were given the identical matched association task again to determine if any long-term retention occurred. The participating teachers were given an in-service on elaborative-interrogation and its uses in the classroom and the students were debriefed concerning the results of the study.

Analysis

This study used a non-random population design using a sample of convenience. Quantitative data were collected. Parametric statistics were used for this study as the test scores for the quantitative data included

interval scales. Non-parametric statistics would have given the same pattern as the parametric statistics that were used in this study. The differences in the performance of the students in each of the study conditions were measured using the one-way ANOVA for free recall. A 2 (condition) x 2 (time) split plot ANOVA with repeated measurement on the last variable was completed for the immediate matched association test and the 30-day matched association test. Posthoc differences were analyzed using Tukey's Honestly Significant Difference. The transcripts of the elaborative interrogation condition were examined for the types of responses provided by the students. The conditional probabilities were calculated to ascertain the relationships within the attempts to create a response, the appropriateness of response, and the later performances on the retention measures.

The free recalls were scored as accurate or inaccurate. To determine whether the principle effects were a result of the study condition, an one-way ANOVA was completed. Significant F values were obtained and resulted in further analysis using pairwise comparisons.

Qualitative data included the analysis of the transcripts of students' responses in the elaborative interrogation condition concerning the quality and adequacy of the answer. Finally, the questionnaires were analyzed using the ANOVA to determine the students' perceptions and attitudes regarding the difficulty of the animal stories and their study condition. Differences were analyzed using Tukey's Honestly Significant Difference.

Summary

This study was developed to determine if elaborative interrogation is an effective strategy for acquiring new factual information for students who have learning disabilities. The elaborations produced were examined in relation to retention gains. The study compared elaborative interrogation with the traditional strategy of reading for understanding. The two conditions were compared through retention gains.

Students from Trillium School were arbitrarily placed into the two study conditions: reading for understanding (n=15) and elaborative-interrogation (n=15). Each condition required the studying of 36 facts, about six familiar animals. Retention was assessed via an immediate free recall, immediate matched association, and 30-day matched association test. In the elaborative interrogation condition, the types of elaborations were examined in relation to later recall. The sessions were tape-recorded and analyzed according to the type of elaboration generated. An 11-item questionnaire was completed on the students' attitudes towards their participation and on the content of the stories.

Research Questions

1) Will students in the elaborative interrogation condition do better in and long-term retention measures of free recall and matched association than in the reading for understanding condition?

2) Will the quality of the answer given for each fact throughout the study affects the probability of later recall?

3) Will the generation of adequate elaborations results in higher recall of the facts in comparison to the generation of inadequate response or no response?

4) Will the self-evaluation of the degree of difficulty is rated comparatively by those students in the elaborative interrogation and the reading for understanding condition?

5) Will the students' willingness to participate again be higher for the elaborative interrogation condition than the control.

CHAPTER FOUR: RESULTS

Overview of the Chapter

The students in the elaborative interrogation condition, in comparison to the reading control, obtained significantly higher results on the matched association test and the 30-day matched association test. In the final dependent measure there were no statistically significant differences on free recall.

For each response the elaboration of adequate answers was associated with higher retention than inadequate responses. The probability of better recollection was associated with adequate elaborations that were scientifically correct answers in comparison to those that were scientifically incorrect or inadequate answers.

Responses on the questionnaire reached statistical significance as a result of study condition on question two. There were no statistically significant differences in the other questions.

Analysis of Quantitative Data

General Format

An one-way ANOVA was completed for the free recall test. A 2 (condition) x 2 (time) split plot ANOVA with repeated measurement on the last variable was completed for the immediate matched association test and the 30-day matched association test. Post hoc analysis using Tukey's Honestly Significant Difference Test was completed on the immediate matched association test and the 30-day matched association test to determine the minimum difference necessary for significance between

the elaborative interrogation condition and the reading-control (Gravetter & Wallnau, 1992).

The transcriptions of the elaborative interrogation condition were analyzed to examine whether the response was adequate or inadequate. Adequate responses were classified as containing a logical reason why the fact was connected to the animal. Inadequate responses had no relationship to why the animal fact could be true. These responses were further analyzed according to whether they were: no response, inadequate with answers that were anthropomorphizing, incomplete or don't know, inadequate with an explanation, adequate with scientifically correct reasons, or adequate with answers that are not necessarily scientifically true. Item-by-item conditional probabilities were conducted to determine if the responses given during the free recall, matched association and 30-day matched association were related to later retention.

The questionnaire was analyzed using a one-way ANOVA to determine if differences existed between the elaborative interrogation and reading for understanding control. The differences were analyzed using Tukey's Honestly Significant Difference.

Retention Results

The means and standard deviations of the free recall, immediate matched association, and 30-day matched association are itemized in Table 1 and Figure 1.

Free Recall

The free recall measures were scored independently by two interraters. The interrater agreement was 96%; the differences were

Table 1

Means and Standard Deviations for Free Recall, Immediate Matched Association, and 30-Day Matched Association as a Function of Condition

Condition	M	SD
Free Recall		
Elaborative interrogation	7.73	3.97
Reading for understanding (control)	8.13	4.94
Immediate Matched Association		
Elaborative interrogation	27.67	4.24
Reading for understanding (control)	24.33	5.64
30-Day Matched Association		
Elaborative interrogation	20.07	4.67
Reading for understanding (control)	16.92	5.42

Note. Maximum score=36

n= for free recall and immediate matched association n= 15 for both conditions

n= for 30-day matched association n=14 for elaborative interrogation and n=13 for reading control

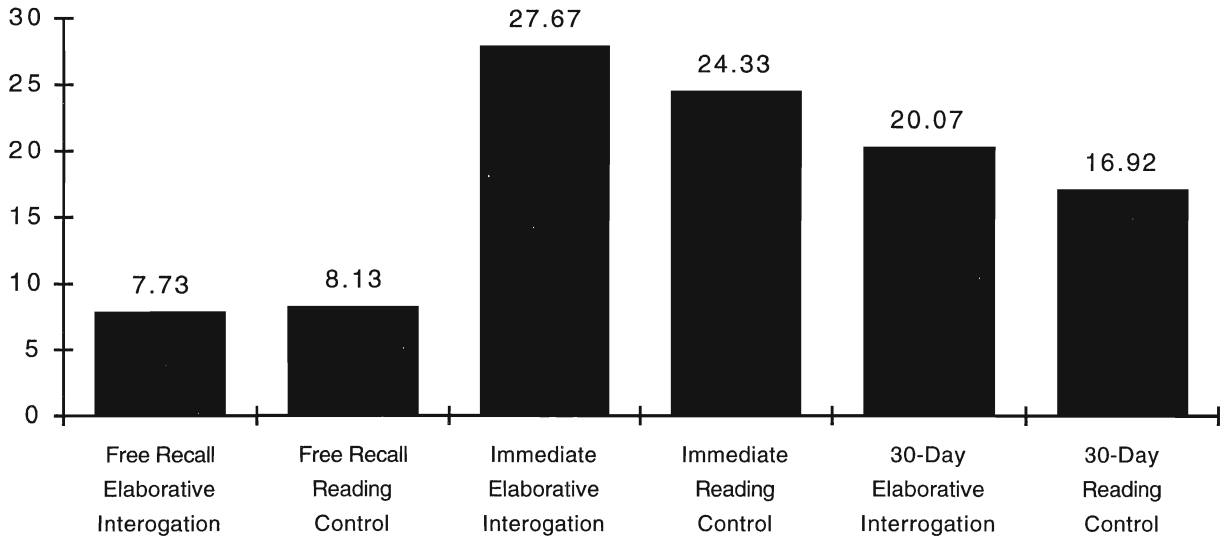

Figure 1 Means for free recall, immediate matched association, and 30-day matched association as a function of condition.

resolved through discussion. The items were scored correct if students responses were verbatim to the study items or similar in meaning. There were no significant differences between the conditions on free recall ($F(1,28)= .06$, $p>.05$).

Immediate Matched Association and 30-Day Matched Association

The main effects of condition and time were significant, $F(1,25)= 4.55$, $MS_e=42.71$, $p<.04$ and $F(1,25)=116.35$, $MS_e=6.51$, $p<.001$, respectively. The interaction effect between condition and time was not significant, $F(1,25)=.87$, $MS_e=6.51$, $p>.05$.

For the immediate matched association test, students in the elaborative interrogation condition performed significantly better than students in the reading control condition ($q=3.54$, $p<.05$, critical $q=2.92$). For the 30-day matched association test, the performance of students in the elaborative interrogation condition was superior to the students in the reading control condition ($q=3.12$, $p<,05$, critical $q=2.92$). All students' performances decreased over time ($q=11.34$, $p<.01$, critical $q=2.86$).

Elaborative Responses and Subsequent Learning

The independent raters scored all fifteen of the transcripts of the students' elaborative interrogation responses. The interrater reliability was 91.6%. The differences were resolved through discussion. The majority of the students had minimal difficulty in answering why they thought a fact was true; only one student was unable to provide a response to a given fact throughout the study (resulting in a no response rating). The responses of the students were classified by the interrater, initially as either being adequate or inadequate. From this information, responses

were scored as: inadequate with answers that were anthropomorphizing, incomplete or don't know, inadequate with an explanation, adequate response with accurate or inaccurate supporting responses. The probabilities of correct recall and its relationship with response type is listed in Tables 2 and 3 and Figures 2 and 3 according to the dependent measures.

In general, students adequate responses resulted in a higher probability of retention in comparison to inadequate responses. Furthermore, scientifically correct elaborations promoted significantly higher retention than adequate but incorrect elaborations. For all three dependent measures, free recall, matched association and the 30-day matched association test, higher retention was promoted with responses that were adequately and scientifically correct in comparison to inadequate explanations with pat answers $q=3.07$, $p<.05$, $q=9.30$, $p<.01$, and $q=11.23$, $p<.01$ respectively. Adequate and scientifically correct elaborations promoted better retention than adequate but incorrect elaborations in free recall ($q=3.22$, $p<.05$), matched association ($q=9.30$, $p<.01$), and 30-day matched association ($q=11.23$, $p<.05$). Scientifically correct elaborations reached significance when compared to inadequate explanations in the immediate matched association ($q=6.2$, $p<.01$) and 30-day matched association ($q=6.97$, $p<.01$).

Inadequate elaborations resulted in a higher probability of recall than inadequate explanations with pat answers in the immediate matched association ($q=3.1$, $p<.01$) and in the 30-day matched association ($q=4.26$, $p<.01$). Adequate but incorrect elaborations was associated with greater retention than inadequate explanations in both matched

Table 2

Means and Standard Deviations for Probability of Recall for Adequate and Inadequate Response Type

Mean and Standard Deviations	Response Types	
	1	2
	Free Recall	
M	.58	.42
SD	.28	.28
	Immediate Matched Association	
M	.59	.41
SD	.16	.16
	30-Day Matched Association	
M	.60	.40
SD	.17	.17

Note. 1=adequate, 2=inadequate.

free recall adequate (n=14), free recall inadequate (n=13), matched association adequate and inadequate (n=15), 30-day matched association adequate and inadequate (n=14).

Table 3

Means, Standard Deviations and Sample for Probability of Recall for Each Response Type

Mean, Standard Deviations and Sample	Response Types 1	2	3	4
	Free Recall			
M	.18	.26	.17	.39
SD	.21	.26	.17	.24
n	9.00	12.00	10.00	14.00
	Immediate Matched Association			
M	.17	.25	.17	.41
SD	.12	.13	.07	.13
n	15.00	15.00	14.00	15.00
	30-Day Matched Association			
M	.15	.26	.15	.44
SD	.09	.15	.09	.12
n	15.00	15.00	14.00	15.00

Note. 1=inadequate explanation with pat responses, 2=inadequate explanation, 3=adequate but incorrect elaboration, 4=adequate and scientifically correct elaboration

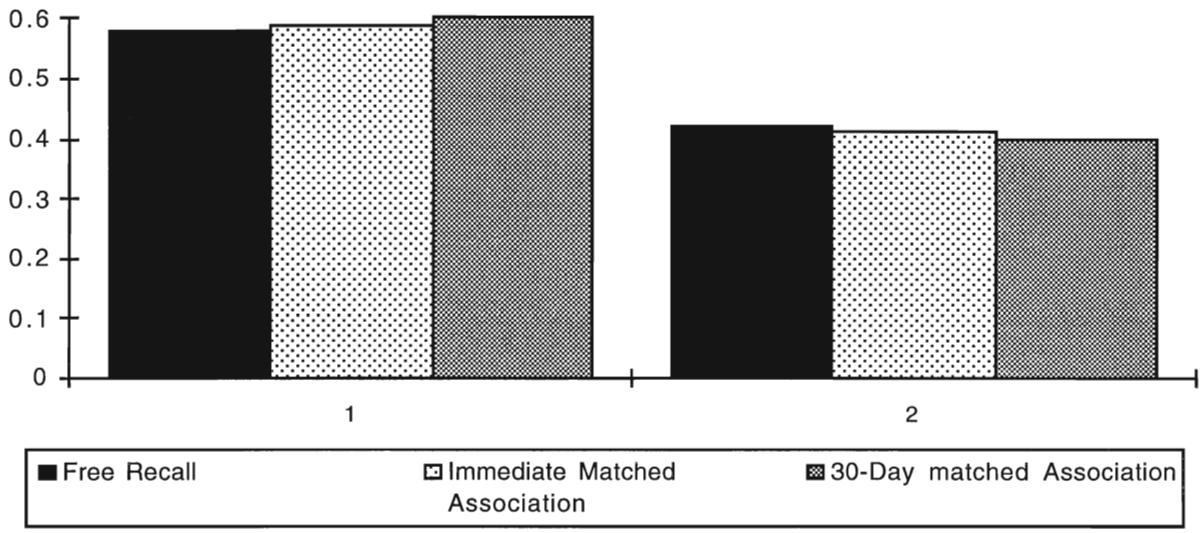

Figure 2 Means for probability of recall for adequate and inadequate response type.

Note. 1=adequate, 2=inadequate

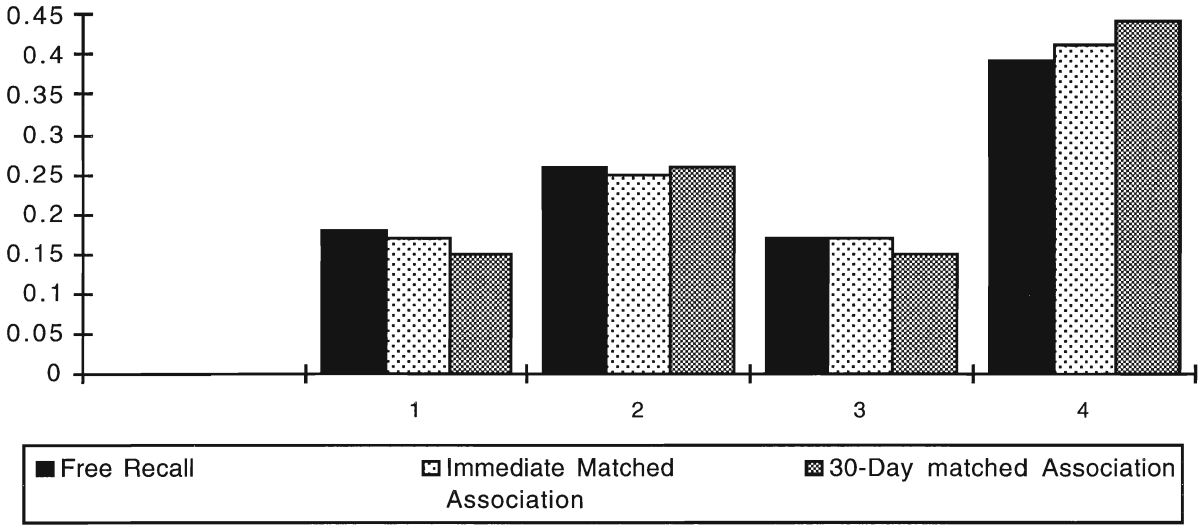

Figure 3 Means for probability of recall for each response type.

Note. 1=inadequate explanation with pat responses, 2=inadequate explanation, 3=adequate but incorrect elaboration, 4=adequate and scientifically correct elaboration

association test and the 30-day matched association test (q=3.1, p<.05; q=4.26, p<.01, respectively).

Questionnaire Responses

There were no significant differences between the two groups when asked if they found the animal stories difficult to read (F(1,28)=2.13). Significant differences occurred when asked if the animal stories were difficult to understand (F(1,28)=3.97, p<.05). Posthoc analysis indicated the reading control found it more difficult to understand the animal stories q=3.95,p<.05. There were no differences for study condition when asked about the difficulty of the free recall test (F(1,28)=.09) or on how well the students thought they did (F(1,28)=1.73). For the matching test there were no differences as to the perceived difficulty of the test (F(1,28)=1.29) or for how well the students thought they did (F(1,28)=3.46). There was not a significant difference when asked how willing they would be to participate again (F(1,28)=.19). There was not a significant difference when the students were asked about difficulty of their task (F(1,28)=3.55). When asked whether the students felt their study condition helped them to remember the facts, there were no differences (F(1,28)=.57). Means and standard deviations are listed in Table 4 and Figure 4.

Summary of Quantitative Results

The students in the elaborative interrogation condition did better on the matched association test and the 30-day matched association test in comparison to the reading control. There were no significant differences between the two conditions on free recall.

Table 4

Means and Standard Deviations for Questionnaire Responses

Condition	M	SD
Question 1		
Elaborative interrogation	2.47	1.36
Reading for understanding (control)	1.87	.83
Question 2		
Elaborative interrogation	2.67	1.23
Reading for understanding (control)	1.80	1.15
Question 3		
Elaborative interrogation	2.93	1.33
Reading for understanding (control)	2.80	1.15
Question 4		
Elaborative interrogation	3.60	.99
Reading for understanding (control)	3.07	1.22
Question 5		
Elaborative interrogation	2.13	1.41
Reading for understanding (control)	2.73	1.47
Question 6		
Elaborative interrogation	2.73	1.16
Reading for understanding (control)	3.47	.99
Question 7		
Elaborative interrogation	4.07	.96
Reading for understanding (control)	3.87	1.50

Condition	M	SD
	Question 8/10	
Elaborative interrogation	3.07	1.22
Reading for understanding (control)	2.27	1.10
	Question 9/11	
Elaborative interrogation	2.67	1.05
Reading for understanding (control)	3.00	1.36

Note. n= 15 for both conditions

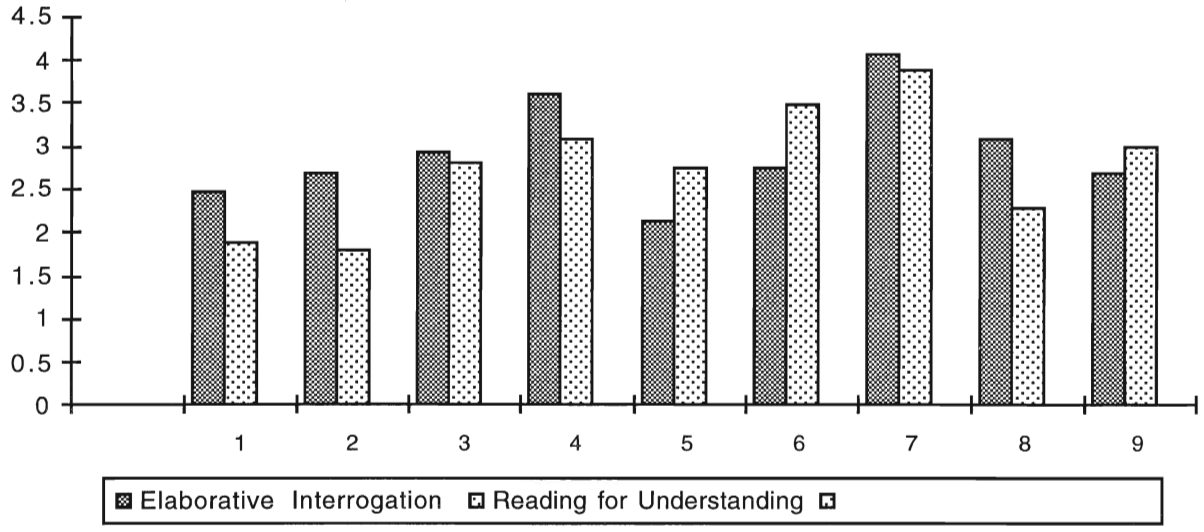

Figure 4 Means for questionnaire responses.

The elaboration of adequate responses resulted in higher retention than inadequate responses. The adequate elaborations, with scientifically correct answers, were recalled better than scientifically incorrect or inadequate answers.

Responses on the questionnaire reached significance on Question Two, which indicated that the reading control found the animal stories more difficult to understand. There were no significant differences in the other questions.

CHAPTER FIVE: DISCUSSION

Summary

Many programs have been introduced over the years designed for students with learning disabilities. These programs have traditionally been geared to aid the student in acquiring new information. To date, there has not been a method or technique introduced that has successfully aided in long-term retention for all students. For example, rote learning and reading repetitively have had limited success in long-term retention and assimilating new information. Recent literature supported by the Ministry of Education and Training recommended the use of the learning strategies approach for teaching students with learning disabilities. One strategy, elaborative interrogation, a question and answer technique, has been proven effective in the research domain.

This study considered whether students with learning disabilities could effectively use elaborative interrogation in learning factual paragraphs about familiar animals. The students were assigned to the experimental condition (elaborative interrogation) or the control (reading for understanding). The dependent measures were used to examine retention; these included a free recall test, matched association, and 30-day matched association. The elaborative interrogation condition responses to the "why" question were examined to determine the probability that the quality of their answer would affect retention. Both conditions were asked to complete a questionnaire of their perceptions of the study.

Conclusions and Implications

Elaborative Interrogation and Students with Learning Disabilities

Research Question #1: Will students in the elaborative interogation condition do better in long-term retention measures of free recall and matched association than in the reading for understanding condition?

The dependent measure of free recall did not result in a significant difference in retention for either the elaborative interrogation or reading for understanding control. The free recall test required students to verbalize all the facts they could remember about an animal after hearing only the name of the animal (i.e. the emperor penguin). The lack of significance may have been a result of the test being more difficult for students with learning disabilities to complete as they had less information to draw inferences. The students were not provided with visual cues to aid in memory recall and as a result had to retrieve more information from their long-term memory.

A memory difficulty, such as retrieval may require a longer processing time in order for the information to become meaningful for the students. This population also has difficulty with verbal expression. The students were required to provide the free recall information verbally as writing skills were minimal. The student with learning disabilities may not have been able to decode the verbal instructions or express the responses to the free recall adequately.

Students in the elaborative interrogation condition performed significantly better in the matched association test and the 30-day matched association test. Main effects occurred for condition (reading for

understanding and elaborative interrogation) and time (30-day immediate matched association). The elaborative interrogation condition performed significantly higher in the 30-day matched association test in comparison to the reading for understanding. In both conditions the performance on the matched association test decreased over time.

These results correspond with other studies that concluded that the ability to perform better on long-term retention tasks is attributed to elaborative interrogation rather than the traditional method of reading repetitively (Pressley et al., 1988;Martin and Pressley, 1991; Woloshyn & Stockley, 1995). This result may be attributed to the fact that when students are asked to answer why they think the fact is true, they draw upon their prior knowledge to assimilate this new information. This would allow stronger connections to be developed in the individual's memory by incorporating this new information. Research has highlighted that developing situations that encourage elaborative encoding may result in a higher level of recall (Walker & Poteet, 1989). Reading repetitively does not encourage this to occur. In a study by O'Shea, Sindelor and O'Shea (1987), it was found that students who are instructed to, "remember as much as you can about the story," were able to reiterate a significantly higher score for story preposition in comparison to the students required to read fast and accurately.

As reading repetitively does not encourage long-term retention, in the classroom the teacher should try different strategies, including elaborative interrogation. This strategy was able to be implemented by all participants in this study as they could all respond to why the fact was true. This population had a tendency to not learn from experience; as a

result, drawing on prior knowledge and integrating the facts together is important for learning to take place. Teachers should use the scaffolding approach to help students to learn the strategy independently.

Research Question #2: Will the quality of the answer given for each fact throughout the study affect the probability of later recall?

Conditional probabilities were calculated to determine the relationship between the quality of the explanations provided by the students and subsequent recall performance. In general, the adequate responses resulted in a higher probability of retention in comparison to inadequate responses. These adequate responses that were classified as scientifically correct were also more likely to result in better long-term retention of the facts in comparison to adequate but incorrect elaborations.

Research Question #3: Will the gernerationof adequate elaborations result in higher recall of the facts in comparison to the generation of inadequate response or no response?

In all three dependent measures, recall was higher for answers that were adequate and scientifically correct in relation to inadequate responses with pat answers and adequate but incorrect elaborations. The scientifically correct responses also reached significance in comparison to inadequate responses in the immediate and 30-day matched association test. Adequate but incorrect association had a higher retention than inadequate explanations for both immediate and 30-day matched association tests. A final finding was that inadequate elaborations had a higher probability of recall than inadequate explanations with a pat answer.

These findings corresponded with existing literature (Wood et al., 1990; Kahl & Woloshyn, 1994). In the elaborative interrogation condition the students' focused on answering the why question. As a result, when processing information at higher levels stronger connections were made to prior knowledge, and this assimilation contributed to long-term retention.

Research Question #4: Will the self-evaluation of the degree of difficulty be rated comparatively by those students in the elaborative interrogation and the reading for understanding condition?

There were no significant differences in how the students in the reading control and the elaborative interrogation conditions rated the difficulty of the animal stories to be read. This result may be attributed to the audiotape of the facts prior to the student reading it independently. Differences occurred in the level of difficulty to understand the animal facts. In post hoc analysis, the reading control group found the facts harder to understand. The students in this condition may have found it more difficult to read the facts and understand them because of limited decoding strategies.

Research Question #5: Will the students' willingness to participate again be higher for the elaborative interrogation condition than the control?

There were no significant differences in the students' willingness to participate in a similiar study.

Recommendations

Students with learning disabilities experience difficulty when acquiring new information. This population has difficulty learning

strategies and successfully implementing them. They may experience difficulties in memory recall and transference. In order to become independent learners, the students with learning disabilities need to acquire basic strategies in order to cope with their disabilities. As the student progresses through the school system, these strategies become even more important. For example, at the high school level students need to develop a repertoire of strategies to assist them with the higher level thinking exercises that occur in later high school, college and university.

The Royal Commission (1994), in its recommendations to the Ministry of Education and Training, has identified the need to incorporate process skills into the school curriculum. These process skills include strategy instruction. Elaborative interrogation is one strategy that has been proven effective in the experimental arena. Explicit instruction in the use of elaborative interrogation would be an effective strategy to use in the classroom to teach students with learning disabilities to promote long-term retention. Students with learning disabilities have a tendency to not learn from experience. This is why it is important to integrate the prior knowledge of these students with factual information through a process of question and answer of "why" questions. Elaborative interrogation is an easy strategy to teach, as the students are required to answer only one question: why something is true. It is this approach that seems effective in creating a link with their prior knowledge and the to-be learned information. This study has demonstrated that elaborative interrogation is an effective technique for students with learning disabilities in relation to long-term retention. The students who used this technique were able to

recognize a significant number of correct facts about each animal when this information was presented in a matched association setting.

The Common Curriculum requires the integration of basic skills (i.e., reading, composition, grammar, spelling) in all of the subject areas. The explicit instruction in the use of elaborative interrogation could be a common method that is used in each subject area of the curriculum. This strategy could aid the student in acquiring and committing to long-term memory new and difficult concepts in the various subjects. The research indicates a greater likelihood of this information being recalled at a later date if students were given time to elaborate on facts presented each time new information was presented.

This population is typified as having not acquired effective strategies. Repeated exposure to elaborative interrogation through modeling by the teacher and scaffolding will empower the students to take ownership of their learning. Independent learners utilize a repertoire of different strategies, most of which are implicit and the students are not cognizant of when these strategies are most effective. Therefore, if the student with learning disabilities learns to use elaborative interrogation effectively he/she could improve his/her retention of to-be learned information.

There is a limitation to this approach. For elaborative interrogation to be effective, the students need to be familiar with the material being presented. Teachers would need to develop into their delivery methods opportunities for students to have some degree of prior concrete experiences with the ideas to be learned. This would allow for meaningful links to be made with factual information presented in an abstract format

in a classroom lesson (e.g., words on a page). Prior knowledge can be both effective and ineffective. If the student has accurate prior knowledge, then elaborative interrogation is more easily implemented. If the student has inaccurate prior knowledge, the teacher must try to dispel the false information while providing opportunities to acquire the accurate knowledge.

Many students with learning disabilities have reading difficulties resulting in less opportunities for exposure to many concepts that are in the written format. This may result in the teacher having to provide experiential learning to ensure that concrete experiences occur for these students to develop schemata of information.

Through the introduction of elaborative interrogation, long-term memory can be improved. In the classroom setting, elaborative interrogation would be effective in introducing a lesson. The educator should encourage the students to elaborate on facts as to why they are true and discuss their responses. This discussion will aid the student in sifting through inaccurate prior knowledge and integrate the new information presented. This could effectively reduce the working memory load on the students and assist them in focusing their attention on particular facts that would be required for later recall.

General Conclusions

Current trends in education, such as the Common Curriculum and the Royal Commissions' For the Love of Learning, offer encouragement for the use of strategy instruction in the classroom. The students in today's classroom are required to learn by process rather than by product.

Therefore, teaching students effective strategies is important for all students, regardless of disability. The use of one strategy, elaborative interrogation, with students who have learning disabilities is new and the research is ongoing. The results of this study, that elaborative interrogation promotes long-term retention, correspond with others that investigated the use of this strategy in non-learning disabled populations. This method is a tool that students with learning disabilities can learn and use successfully when acquiring new information.

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Appendix A

The Trillium School

The Trillium School was established in September, 1979 as a result of concerns from the Ministry of Education, The Ontario Association for Children with Learning Disabilities, parents and other action groups. The 34 students have severe learning disabilities that are considered to be too severe to be handled in the regular school system. Each student will spend between one and three years at Trillium before being integrated into the regular school system or the workforce. The population is male and currently ages range from twelve to eighteen, with a median age of fourteen. The class sizes are small, approximately seven per class. The students who attend Trillium have severe sequencing, discrimination, organization and memory deficits. The placements are residential in nature with home visits on the weekend. Trillium School also offers an in-service program for Ontario teachers (Winzer & Vainio, 1982; Winzer, 1990).

Appendix B

Letter of Consent

Dear Parent(s),

In the near future, a study will be conducted at Trillium School investigating whether students' learning of science facts can be improved following instructions to use a question-answering learning strategy. Basically, the question-answering strategy requires that students attempt to answer why presented facts are true. The purpose of this letter is to request your permission for your child's participation in the project. This project is for my thesis in completion of a Master of Education program at Brock University. This study has the support of Mr. Clive Hodder (Program Director) and Elaine Moroney (Psychological Associate) of Trillium School. This study has also passed the Brock University Ethics Committee.

Each student will be seen by me for approximately one hour. The students will be seen individually and asked to study six brief animal stories, each containing six facts. Different students will be given different study instructions and will be randomly assigned. Some students will be asked to attempt to answer why these facts are true (e.g., "Why do you think the house mouse is often found where people live?"). Others will be asked to reread the stories. These sessions will be audio taped for later analysis. As a follow-up, students will be asked to answer some short quizzes and a brief questionnaire.

In the past, both children's and adults' learning of factual information has been improved following instructions to answer why the presented facts are true. I am particularly interested in determining if this strategy is beneficial for students with learning disabilities.

In general, students enjoy participating in these types of sessions. However, if for any reason, a student indicates that he or she does not wish to continue, the student will be allowed to withdraw from the study. All of the data from this study will be stored anonymously in order to protect the privacy of students. The audio recordings of the study sessions will be destroyed after students' responses have been analyzed. Although group averages may be reported, the performances of individual students will never be discussed.

Please return the attached consent form to Trillium c/o Elaine Moroney as soon as possible indicating whether you give your permission or not. Please note that it is important that you return the form in either case. Thank-you for taking the time to read this letter and for sending the permission form back to the school. If you have any questions or concerns about this study, please feel free to contact me at (905)934-4975.

Sincerely,

Denise Stockley, B.A., B.Ed.

Consent Form

I have read the letter of explanation describing the study regarding the use of the question-answering learning strategy and student's acquisition of science facts. I have been informed that with my permission, my child will be asked to complete the science questionnaire and read several science facts. In addition, my child may be asked why the science facts are true. I understand that my child will do these tasks individually, that my child's responses will be audio taped for future analysis, and that he or she will be later asked about the science statements.

I have been informed that my child's participation in this study is entirely voluntary. All information will be kept confidential so that any reports(s) or the results will not be associated with my name or my child's name. I have also been informed that I may withdraw my child from the study at any time.

I AGREE to have my child participate in this study

Parent's signature_____
Date_____

Student's signature_____
(optional)

I DO NOT AGREE to have my child participate in the study

Parent's signature_____
Date_____

Student's signature_____
Date_____
(optional)

I wish to receive a summary of the competed study
Name:_____
Address:_____
_____
_____
_____

Appendix C

Authorization to Obtain and Release Information

In order that I may precede with this study I am requesting your cooperation with the release of information regarding the Ontario Student Record (O.S.R.) of your child. The purpose of this request is to be able to account for the individual learning differences of each student participating in the learning strategy study. This information will be kept confidential and will be used to place your child in an appropriate study instructional situation. This information will not be associated with your name or your child's name, and only group data will be reported.

I, _____ being the parent and/or guardian of _____ do hereby
(name of child)

authorize Denise Stockley to obtain the educational history on the above named child from Trillium School.

It is acknowledged that the exchange of such information shall not be regarded as a breach of confidentiality and it is understood that the information shared will be used for the research study placement of my child.

This authorization will remain in force for the duration of the learning-strategy study and consent can be withdrawn, in writing, at any time.

_____ _____

(signature of parent/guardian) (date)

_____
(signature of student/optional)

Appendix D

Animal Stories

The House Mouse

The house mouse likes to live in warm, dry areas. It is most often found anywhere people live. The house mouse lives in southern Canada. it eats nuts, vegetables, fruits and grains. When it is tired, the house mouse heads for its home which is usually a tiny hole or dark corner. There are many dangers for the house mouse like owls, hawks, and snakes.

The Townsend Mole

The townsend mole lives in tunnels. It especially likes to live in warm, humid areas. Usually the mole prefers the Pacific coast. The townsend mole eats insects and grubs. The townsend mole naps throughout the day. There are few dangers for the mole except for snakes.

The Emperor Penguin

The emperor penguin lives only in Antarctica. It likes to live in the sea for a few weeks at a time. The emperor penguin never makes a nest or home to hid in. The emperor penguin eats squid and fish. Although Antarctica is cold all of the time, the emperor penguin sleeps longer when it gets really cold. One real danger for the emperor penguin is the leopard seal.

The Little Brown Bat

The little brown bat lives in dark places like caves, attics, or abandoned houses. The little brown bat lives with a few to several hundred other bats. The little brown bat lives in eastern Canada. Its favorite food is flying insects. The bat sleeps all winter. There are very few dangers for the little brown bat except for the weather.

The Blue Whale

The blue whale in the Arctic and Antarctic oceans. Most of the time the blue whale prefers to be near the surface of the water. The blue whale only eats for about three months of the year. When it does eat, it likes ocean plants and small shrimp-like creatures. The blue whale sleeps by taking short naps. The worst danger for the blue whale is being caught under the ice.

The Western Spotted Skunk

The western spotted skunk lives in a hole in the ground. Often the skunk lives alone, but families of skunks sometimes stay together. The skunk's hole is usually found on a sandy piece of farmland near crops. The skunk mostly eats corn. It sleeps just about anytime except between three o'clock in the morning and sunrise. The biggest danger to this skunk is the great horned owl.

The American Pika

The American pika lives so high up in the rocky mountains that trees can't grow. The pika likes to live in and around rock piles. The pika is only found in British Columbia. It eats grasses and flowering plants. The pika sleeps during the night. The most dangerous animals for the American pika are birds and weasels.

Appendix E

Free Recall Quiz

The Townsend Mole

The Little Brown Bat

The Western Spotted Skunk

The Emperor Penguin

The Blue Whale

The American Pika

Appendix F

Matched Association Quiz

A--The Townsend Mole
B--The Emperor Penguin
C--The Little Brown Bat
D--The Blue Whale
E--The Western Spotted Skunk
F--The American Pika

___ lives in Eastern Canada

___ usually prefers to be near the surface of the water

___ lives in tunnels

___ is only found in British Columbia

___ eats fish and squid

___ its hole is usually found on a sandy piece of farmland near crops

___ flying insects are its favorite food

___ lives in a hole in the ground

___ usually prefers the Pacific coast

___ eats for only 3 months of the year

___ lives high up in the rocky mountains where trees can't grow

___ lives in the sea for a few weeks at a time

___ eats insects and grubs

___ lives in dark places like cave, attics, or abandoned houses

___ sleeps during the night

___ mostly eats corn

___ sleeps by taking short naps

___ lives in warm, humid areas

___ its main enemy is the great horned owl

___ eats ocean plants and small, shrimp-like creatures

___ sleeps all winter

___ lives only in Antarctica

___ lives in and around rock piles

___ sleeps just about anytime except between 3 am and sunrise

___ its worst danger is being trapped under the ice

___ eats grasses and flowering plants

___ often lives alone, but sometimes stays with families of its own kind

___ lives with a few to several hundred others of its kind

___ never makes a nest or a home to hide in

___ naps throughout the day

___ has very few dangers expect for the weather

___ birds and weasels are its main enemies

___ the leopard seal is its one enemy

___ lives in the Arctic an Antarctic oceans

___ has few enemies except for the snake

___ sleeps longer when it gets really cold

Appendix G

Questionnaire

Please rate each of the following statements from 1 (not very) to 5 (a great deal/very).

___ 1. How difficult were the animal stories to read?

___ 2. How difficult were the animal stories to understand?

___ 3. How difficult was it for you to complete the free recall quiz?

___ 4. How well do you think you did on the free recall quiz?

___ 5. How difficult was it for you to complete the matching quiz?

___ 6. How well do you think you did on the matching test?

___ 7. How willing would you be to participate in more studies like this one?

Questions 8 and 9 should be answered by those participants who answered "why" questions.

___ 8. How difficult did you find it to answer the "why" questions about the answers?

___ 9. Did you find that answering the "why" questions helped you remember the facts better?

Questions 10 and 11 should be answered by those who read the stories and tried to remembered the details.

___ 10. How difficult did you find it to read the stories over again by yourself as you studied the facts?

___ 11. Did you find that reading the stories over again helped you remember the facts better?