

**The Effect of
Pictorial Graphic Organizers On Learning and
Remembering Information**

**A Thesis Submitted in Partial
Fulfillment of the Degree of
Master of Arts**

by

**Jacqueline Mary Armitage Keddy
Saint Mary's University
April, 1994**

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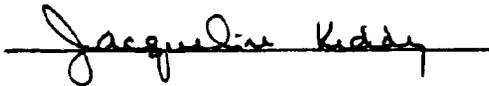
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Abstract

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April, 1994

The study investigated the use of a pictorial graphic organizer as opposed to a verbal organizer. The intent of the study was to determine the benefits of pictorial representations combined with text in the organized structure of a graphic organizer. Two classes of grade fours ($N = 52$) read a poorly structured passage for the first experiment and the same classes ($N = 50$) were involved in the second experiment. Both control and experimental groups received the different organizer forms before, during, and after reading the text. On immediate and three delayed recall measures, the experimental groups recalled significantly more than the control groups. Results support the use of the pictorial graphic organizer for use with grade fours having difficulty reading a poorly structured passage.

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Chapter One

Introduction

There is empirical documentation that pictures related to a text facilitate storage and retrieval for the learner (Mandl & Levin, 1989). For many years now, educators concerned with the improvement of reading comprehension have used graphic displays and organizers in a variety of forms. The advance organizer, first developed by Ausubel, (1960) has branched out into such forms as the graphic organizer, mapping, schema organizer, concept maps, fact maps, and graphic pictorial organizers. Even though there are many organizer forms to serve different purposes in the reading/learning process, they all have the primary function to aid in the organization of information (Dunston & Ridgeway, 1990).

The efficacy of advance organizers to facilitate learning in all content areas was examined by Luiten and Ackerson (1980) in their meta-analysis. They found that the advance organizer benefited the treatment groups of all grade and ability levels. When an analysis was done for the graphic organizer it was found to produce conflicting results. Moore and Readence (1980, 1984) found the position of the organizer played a significant role in the results. Both studies concluded there were generally small effects for graphic advance organizers on learning from text. They did however find evidence to suggest that the graphic organizers produce the most learning when they follow the presentation of content. (Moore & Readence, 1984).

Studies that introduced pictures to the organizers have been limited but those found have shown results to support their use (Dean and Kulhavy, 1980; Dean and Enemoh, 1983; Tajika, Atsushi, Yamamoto and Mayer, 1988; and Townsend and Clarihew, 1989).

Advance Organizers

David P. Ausubel (1980) wrote of his advance organizer that he first developed in 1960, that the principal function of the organizer is bridging the gap between what the learner already knows and what he needs to know so that he can learn the task at hand. In the preface to Ausubel's book, *Educational Psychology: A Cognitive View*, (1968) he states, "The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly." (p. vi).

Ausubel (1970) classifies his organizer into *expository* and *comparative*. The expository organizer is used for teaching completely unfamiliar material. It requires the provision of relevant nearest subsumers by finding terms that are familiar to the learner so they act as anchors for new material to be attached to prior knowledge. The comparative organizer is used to bring together new ideas with similar concepts in cognitive structure and to increase the ability to note the difference between new and existing ideas which are basically different but similar enough to be confusing.

This procedure is simplest for the expository organizer as the material is entirely new to the students. The students' prior knowledge will influence the kinds of learning activities that will be chosen by the teacher for the model. Procedure to determine the instructional background of the

students will vary. Formal pretest, discussion and question, and specific lessons beforehand to provide background information are three ways that can be used to determine how much prior knowledge the students have before planning the Ausubel model. (Eggen, Kauchak, & Harder (1979).

The advance organizer was developed by Ausubel as part of a deductive teaching method called the Ausubel Model. The advance organizer, given at the beginning of a lesson, acts as a connection between the material to be learned and the learner's cognitive structure. It acts as a cognitive road map and is intended to act in guiding the student over the new content to be learned. (Eggen et al., 1979). Ausubel developed the organizer to ensure that meaningful learning occurs when a prose passage is read. His organizer is written in such a way as to offer information prior to the main passage. One or more short prose paragraphs contain key concepts related to those in the main passage, but at a higher level of abstraction, generality and inclusiveness (Ausubel, 1963).

Ausubel (1968) sees the brain as storing information in a highly organized way with links forming between new material being processed and the old information already in storage. This is what he refers to as the *cognitive structure*. As new material is connected to old, it is then stored in a hierarchical fashion, the more inclusive being at the top and the less inclusive subsumed as it goes down in general importance.

The advance organizer gives the students a conceptual framework by which they can store facts in an organized manner. It is hierarchically organized at a higher level of abstraction and generality than the facts, concepts, and generalizations of the lesson itself. It provides ideational scaffolding as it links new material to old. It is not simply a summary or overview (Eggen et al., 1979). It differs from the summary in that the

summary is at the same level of abstraction as the ideas in the text itself. The summary is a shortened form that simplifies the text and eliminates less important information (Tyler, Delaney, & Kinnucan, 1983). The advance organizer is used to teach relationships between different kinds of content. When it is used effectively it will act as a summary as well as relate content learned from previous lessons.

Novak and Gowin, (1984) break Ausubel's theory of cognitive learning into three parts. The first is that the cognitive structure is *hierarchically organized*. Secondly, the cognitive structure undergoes *progressive differentiation* and the last part is that *integrative reconciliation* occurs when two or more concepts are recognized as relatable in new propositional meanings/or when conflicting meanings are resolved (p. 97).

The hierarchical structure means that ideas must be presented from the most inclusive down to the less inclusive. The ideas are carefully arranged so that they proceed from general concepts to more specific ideas (Novak & Gowin, 1984).

Progressive differentiation involves the process of breaking down broad ideas into narrower less inclusive ones. Differentiated simply means that the more general is broken down into subordinate concepts which are then contrasted with each other. These concepts are continually (progressively) to be divided into subconcepts until concrete examples are reached. (Eggen et al., 1979). New concepts gain greater meaning as new links are made. They are always being learned, modified, and made more explicit and more inclusive as they become progressively more differentiated. Meaningful learning is a continuous process of subsuming the previously learned concept. Ausubel (1958) uses the term "obliterative

subsumption” to mean that the individual singular ideas are blotted out as they form the new, larger, single concept through understanding. This is explained by Novak (1977) as the modification of the previous concept by the new information . Novak goes on to explain that the new material becomes part of the previously acquired knowledge as it links itself to facilitate learning. The stored information is altered as the subsumed concept becomes modified with the new information. Concept differentiation occurs with the new links forming between the old and new concepts.

Meaningful learning is enhanced when the learner recognizes new relationships or is able to make the link between related sets of concepts. A conscious awareness is needed to link new relationships between old and new sets of concepts (Novak & Gowin, 1984). An explicit attempt by the instructor to help the learner determine the important similarities and differences between facts, concepts and generalizations results in *integrative reconciliation*. By using comparisons, the relationships are clarified and the material is comprehended in a meaningful fashion (Eggen et al., 1979). At this point the students will examine the similarities and differences between the concepts. If a unified body of knowledge is attained in which relationships are made clear and differences are recognized then integrative reconciliation has been achieved.

According to Eggen et al.(1979) there are three important characteristics of the Ausubel Model that make it distinctive. The first is that it is *interactive*.; the student and teacher are actively involved in dialogue to promote deeper understanding. It is *deductive* since it uses the hierarchical structure with the more general, inclusive ideas at the top

leading down to the narrower, less inclusive ideas. It uses *examples* that allow the student to see that the abstractions are meaningful.

Models based on Ausubel's cognitive theory and advance organizer fall into three categories (Eggen et al., 1979). These categories are concept definition, generalization, and analogy. Concept definition models are defined in terms of superordinate concepts that will help link the new terms to concepts which already exist in the learner's cognitive structure. The instructor using this model must be careful to choose terms that the students already understand. Activities such as visual aids and concrete experiences are needed to introduce new material. These can also be used when reviewing previously learned material.

The generalization models include concepts already familiar to the students. They provide the cognitive roadmaps for the material that follows and help to link new material to material already learned.

The analogical model calls on analogies to be found that come from the student's background knowledge. Since these analogies will be familiar, they then act as a conceptual anchor. This organizer becomes the student's reference point and is similar to mnemonic devices since it is used to remember desired information. This organizer is seen by both Eggen et al.(1979) and Mayer and Bromage (1980) as the most effective and easiest to customize. The analogical models presented by Mayer and Bromage proved to be useful for unfamiliar information, by establishing the anchorage of the material to be learned.

The function of the advance organizer is twofold according to Ausubel (1970). It is first to provide scaffolding of the formation of ideas that will allow for a firm, fixed joining and good retention of the more detailed and differentiated material that will follow in the material to be

learned. Secondly it will increase the learners ability to note the difference between the prior learned material and similar or conflicting ideas in the process of perception (cognitive structure). Ausubel continually emphasizes in all of his writings that the advance organizer is intended to bridge the gap between what the learners already know and what they need to know before successful learning can occur. The organizer is to aid in the development of a meaningful learning set. It consequently allows for those with inadequate prior knowledge to increase their chances of making the new material become meaningful.

It is most important that the instructor is aware of the students' prior knowledge in order to make full use of the meaningful instruction sequencing (Cliburn, 1986). Cliburn believes that "meaningful learning involves a personal association between the new material and what is already known, it may well be more flexible and durable than rote learning." (p. 377). An interesting statistic noted by Novak (1977) is that "most information learned by rote in schools is lost within six to eight weeks" (p. 85). Failure to determine prior knowledge may interfere with successful comprehension (Ausubel, 1966; Novak, 1977). Novak explains how meaningful learning differs from rote learning. Rote learning merely involves acquiring new information without a particular association to existing elements in cognitive structure. Meaningful learning occurs when the new information is connected to the existing concepts and this process then alters the prior concepts and allows them to become subsumed and differentiated. The new information increases the base of existing knowledge or broadens the concepts that were known before. Ausubel's theory of meaningful learning, as cited by Novak and Gowin (1984), is in

contrast with rote learning since the individual must choose to relate the new knowledge to relevant concepts they already know.

Advance organizers act as a means of anchoring new knowledge in the learner's cognitive structure. The organizer itself can provide the relevant concepts that may not already be present for the learner. These new concepts would then become the link for the new information that follows the introduction of the advance organizer as the lesson unfolds (Novak,1977).

Ausubel (1978) emphasizes the need for researchers to correctly implement the advance organizer strategy. He states that prior knowledge should be of vital concern for the researcher to be able to construct a valid advance organizer for the experiments. Adequate advance organizers that are general, abstract, and inclusive must be designed by the researcher so the results will be of significance in the outcomes.

Dana (1980) found weaknesses in advance organizer research in the past. The lack of an operational definition for an advance organizer was argued in Barnes and Clawson (1975). In response to this, Dana cites how Lawton and Wanska (1977) saw it as limitations of the review that led to incorrect interpretation of Ausubel's theory. Their comparisons, according to Dana, were of highly divergent studies and there was no consistent rationale for inclusion of studies reported in their tables.

Other researchers such as Barron and Stone (1974), felt the earlier failure of the advance organizer to show significant results in studies stemmed from the fact it had been treated as an "additional discrete piece of information" (p. 173). The original intent of the advance organizer was to provide a conceptual framework into which the more specific information for the learning passage can be related. The organizer should

assist the learner to make the cognitive bridges necessary to differentiate and subsume the existing concepts and thus allow learning to take place. According to Mayer (1989), the advance organizer model contains seven characteristics in order to be a good conceptual model. It must be complete, concise, coherent, concrete, conceptual, correct and considerate.

The three premises of implementing an advance organizer are that it is introduced in advance of the new material to be learned, its terms and vocabulary relate to prior knowledge, and it is presented hierarchically in scaffold fashion with subsumers to allow for anchorage (Ausubel, 1970). It is important that the teacher knows how to make the Ausubel organizer meaningful to the students. "Students need to be encouraged to make cross links and see how nearly all new concepts can be related to previously learned concepts." (Novak & Gowin, 1984, p. 78).

The advance organizer, as classified by Ausubel (1963) and Joyce (1986), is either expository or comparative. The expository organizer is used when students are not familiar with the material-to-be-learned while the comparative organizer is used when the material to be taught is relatively familiar.

Joyce (1986) explains that the advance organizer is used through three phases. In phase one the organizer is presented. The terms, concepts, illustrations, and analogies must be familiar in order to activate prior knowledge. The learning material is presented in phase two. Discussion, visual presentations, and reading of the passage take place in this phase so the material is made explicit. Phase three provides the anchorage of the new material to the old in the students' cognitive structure. This is where the material becomes strengthened and clarified in the students' knowledge base.

Graphic Organizers

The graphic organizer, first labeled by Richard F. Barron (1969), as a structured overview, incorporates the use of diagrams rather than the prose form of Ausubel. The graphic organizer is seen as constructed by the teacher so that students can subsequently learn to organize the material-to-be learned (Simmons, Griffin, & Kameenui, 1988).

Alvermann (1981) views the two forms of organizers as being alike in that they are both working towards the activation of the reader's prior knowledge. Through the encouragement of encoding strategies the organizers will eventually lead to increased retention. The difference between the two organizers comes at the level to which they are written. While the advance organizer is written at a higher, more abstract level, the graphic organizer is often written at the same level as the to-be-learned material.

Suhor and Little (1988) explain the graphic organizers as being "deeply rooted in schema theory and reading research. They are essentially visually-based ways of developing schemata for concepts in various content areas." (p. 473). Tyler, Delaney, and Kinnucan (1983) share the same idea of a schema organizer. Theirs looks much like a graphic organizer and is designed to meet the needs of the less able reader. The assumption by these authors was that the poor readers needed an organizer that relied less on the reading process in order to understand the information.

The traditional graphic organizer is presented through chart form showing the concepts as they progressively differentiate in the hierarchical

structure. Various forms can be used to depict the graphic organizer such as charts, diagrams, data retrieval charts, or outlines. The presentation format is merely the means to an end (Eggen et al., 1979). It is through these forms that the graphic organizers are designed to increase the student's awareness of text structures (Alvermann, 1988).

Since graphic organizers are spatial rather than linear, they may appeal to students who need a different learning style (Johnson, 1989). Research has been done to show graphic organizers can aid varied learning ability levels. Weisberg and Balajthy's (1979), study with disabled readers found the graphic organizer enabled them to "synthesize information into meaningful and manageable chunks" (p. 17). With the aid of the organizer they were able to improve their ability to summarize passages into their own words. They could identify the important concepts in the graphic organizer and then write their own summaries. While this skill did not carry over into beneficial results for post testing (recall of information), the experimenters were satisfied with the newly acquired summarization skills.

Creative graphing allows for a stronger connection of seemingly random details. Students get a "picture" of how things fit together. As Johnson (1989) notes that when the students read a difficult text they fail to see the parts relating to the whole picture. Johnson gives much credit to the graphic organizer as a way for students to learn an effective strategy. Taylor (1982) also notes that only a small percentage of elementary students involved in an investigation were able to organize their recall of expository text in the same way as the passage had been organized. Those who can organize material for themselves are more sensitive to the expository text structure than those who do not possess this facility. Moore

and Readence (1984) note that one of the greatest advantages of the graphic organizer is that it actively engages the students in the reading process.

Some factors that contribute to children's difficulty with expository text would be lack of familiarity with the content, insufficient interest or motivation, a heavy concept load, or lack of organization of the ideas in the text. Many of these factors lead to greater difficulty in comprehending and remembering expository material (Taylor, 1982). Researchers who have examined and found supporting evidence of the benefits and value of using the graphic organizer as a means of facilitating comprehension are Alvermann (1981); Alvermann and Boothby (1982); Bean, Sorter, Singer, and Frazee (1986); Boothby & Alvermann (1984); and Dana (1980).

Dana (1980), in her study with sixth grade students, found the graphic organizer facilitated comprehension of multithematic text and strengthened retention of content. Alvermann (1981) found results to support using the graphic organizer to compensate for the text that is not easily organized (organizer acts as a reorganization for such text). The study done by Alvermann and Boothby (1982) showed the graphic organizer helped the students to know what the teacher saw as the important facts. In their 1984 study, these same authors found both immediate and 48 hour recall were improved with the use of the graphic organizer. Bean et al. (1986) achieved results to support the graphic organizer as a strategy to learn difficult prose as well as allowing the transfer of the new strategy to other subject areas.

While these research studies proved in favor of the graphic organizer, Simmons, Griffin, and Kameenui (1988) in their study with 49 sixth grade students failed to find significant difference for the graphic organizer facilitating comprehension. This finding was explained as being

due to the organizer having oversimplified the comprehension process. Prior knowledge was not activated or known by the teacher well enough to facilitate learning. Their study however did show significant difference for the use of the graphic organizer as being effective on delayed post test when completed eleven days later.

Alvermann and Swafford (1989) investigated strategies most frequently used by teachers at the secondary school level. Of the 13 strategies that teachers reported using the most, 4 of them were organizers (advance organizers, graphic organizers, semantic mapping, and structured overviews).

Concept maps, similar to semantic maps, are hierarchical in the same way as the advance organizer. They differ by being graphic rather than prose (Cliburn, 1990) and are sometimes seen as a visual road map. A metaphor for the advance organizer is the "road map" as it provides the cognitive road map for the material that follows while also linking the new material to material already learned (Eggen et al., 1979).

Cliburn sees the concept map as a pre-instructional strategy to present major background concepts. They are constructed at a higher level of generality than the material to be learned and are intended to fill in the gaps between prior knowledge so as to allow more meaningful learning to occur. Cliburn strongly supports teacher prepared instructional tools such as concept maps (Cliburn, 1990).

Another type of mapping organizer was examined by Beck, Omanson, and McKeown (1982). Their study, involving 48 grade three students, was to determine the effect on comprehension when reading lessons were redesigned. One of their main theoretical notions for their study centered around the idea "...that highlighting content that is central to

the story facilitates comprehension.” (p. 464). From this came the “story map” which gives a unified representation of the main story idea as well as the implied events. Their results were that the story map enhanced recall and comprehension but showed no significant effect.

Pictorial Graphic Organizers

There is empirical documentation to state that pictures related to a text do facilitate storage and retrieval for the learner. In the book *Knowledge Acquisition from Text and Pictures*, edited by Mandl and J. Levin (1989), the contributing authors strongly support the use and defend the importance of visual presentations blended with text. Studies by Hegarty and Just (1989) found that since previously acquired knowledge is relevant for the learner to encode further information, then the text must direct the learner’s attention to this relevant information.

A. Paivio, cited by Molitor, Ballstaedt, and Mandl (1989), makes the assumption that there are two processing systems in the brain which function independently, yet interact with each other. The verbal system processes the linguistic information and the imaginal system processes the visual information. Text is stored in the verbal system and allows for concrete information to be visualized and then sent into the imaginal system. Pictures are stored in the imaginal system but also enter the verbal system as a “partially verbalized copy” (p. 7). He goes on to explain that when learning occurs from text and pictures it does so because the pictures allow for retrieval from both memory systems.

The saying, that a picture is worth a thousand words, has been heard for many years and may be interpreted to mean that the pictorial equivalent

of a passage is much longer lasting in one's memory than the words alone. Pictures have conveyed knowledge for many hundreds of years. Going back in time we know that pictures were the sole medium for conveying messages, both religious and political, to the illiterate. History shows Johann Amos Comenius introduced pictures to his Latin text-book, written in 1658, as a mnemonic aid in support of his theory that "...man primarily acquires his knowledge about his world by his senses" (p. 5, Molitor et al., 1989).

It is a natural extension of these ideas that one can see the value of using some sort of visual representation in the graphic organizers. Graphics can aid different tasks such as identification, sequencing and patterning, and problem solving. When the graphics are presented realistically they aid in the identification of the concept to be learned. Graphics can convey information about the sequence and pattern for the elements and the patterns they form. As for problem solving, students can make graphic representations to help them solve a problem. Such an experiment was carried out by Tajika et al. (1988). They used 48 grade five students to see if the use of abstract or concrete pictures would aid them to solve a problem. The results support the use of the integrated abstract picture. In their research they cited an earlier study done by Tajika, Taniguchi, and Yamamoto (1985) using abstract pictures (such as geometrical figures). The elementary school children reported the geometrical figures helped them to either understand passages or aid in solving arithmetic word problems.

The purpose of the advance organizer is to help the learner select and organize material from the text. Pressley and J. Levin (1983) point out in their book *Cognitive Strategy Research*, that even with the advance

organizer, extra steps to help the encoding and organization may still be necessary to aid the learner. It is here that the pictorial graphic organizer becomes an important tool in the educational process.

In order to effectively use pictures as a memory strategy, the picture must simultaneously communicate the desired message. Pictures that allow an association with a concept will provide a greater depth of processing the information. A relevant picture will facilitate both learning and attitude. The blending of the auditory and visual presentation will be more memorable than the words alone in the verbal or prose advance organizer.

The question of whether pictures can effect comprehension was addressed by Samuels (1970), Peeck (1974), and Beck et al. (1982). While Samuels found pictures did not really effect comprehension, Peeck found that if the pictures were in agreement with a text, they did improve comprehension. Beck et al., following their study using 48 grade three students, stated the need for pictures to complement the concepts of the text but not to conflict with the theme or content This idea is also emphasized by Molitor, et al. (1989). They point out the importance of interaction between the information of the text and the picture when they relate to one another. Overlapping of the details in both verbal and pictorial information must occur.

According to Molitor et al. (1989) "a visualization illustrates structures and relationships of the reality, which cannot be perceived under normal visual conditions "(p. 3). The examples they give for these structures are the hierarchies and organizational schemata that include the advance and graphic organizers. An organizer will help show the organization of a text and speed up the encoding process, thus meeting the needs of both the high and low ability reader.

Tyler et al. (1983) use a verbal plus diagrammatic advance organizer when they carried out their experiments with undergraduate students of both high and low ability. The poorer readers were assisted by the verbal advance organizer. They felt the high level readers get more on their own from the text and do not necessarily benefit from the strategy of an organizer while the lower ability readers gain from the organizational structure. According to the research of Alvermann (1981), the low comprehenders seldom use any structure to aid their learning and retention.

The addition of pictures to the verbal advance organizer was used by Townsend and Clarihew (1989) in their study to see whether it would affect the comprehension of children (aged 8.6) in a prose reading task. The pictorial representation combined with text was found to serve to concretize the abstract concepts presented in the text that lacked structure. The graphics helped to increase the students' attention to the material-to-be-learned in a meaningful way, thus making the learning material more comprehensible. Their instructional strategy showed significant effects for groups of both strong and weak prior knowledge.

The research material covered for this paper shows that the word "pictorial" can take many forms when used in the title of a pictorial graphic organizer. It can be a spatial organizer and graphically illustrated map used by Dean and Kulhavy (1980), abstract pictures used by Tajika et al. (1988), a diagrammatic form of a graphic organizer such as the one used by Tyler et al. (1983), or concrete pictures used by Dean and Enemoh (1983), as well as by Townsend & Clarihew (1989).

Pictorial organizers are compared to concept mapping by Cliburn (1986) since both organizer types identify the important concepts and

evaluate their relationships. Cliburn believes that concept maps help bring the information into a cohesive representation in the same way as the pictorial organizers. An organizer, such as a pictorial one, is designed to show the general structure of the article's information without giving all the details.

Dean and Kulhavy (1980) viewed the spatial map as a pictorial organizer. Their study with undergraduate students demonstrated that the use of pictures in the organizational device of the map facilitated comprehension and remembering of prose material. The idea for using pictures to support an organizer goes back to Ausubel (1978) and Eggen et al. (1979) advocating the need for concrete props to aid in strengthening prior knowledge and meaningful learning. Cliburn (1990) sees the visual aids as taking advantage of the human capacity to use visual memory. Pressley et al. (1983) agree that strategies to aid elementary students are appropriate since the younger students do not focus so well on the more important aspects of a text as do the older students. Hegarty and Just (1989). suggest one of the purposes for diagrams is to provide information that is not given in the written or oral form of a text or an organizer. Studies done by D'Ydewalle and Van Rensbergen (1989) with children in grades 2, 4, and 6 show they interact with both picture and words.

A picture can act like an organizer that will aid the learner to comprehend the passage since it bridges the gap between what is already known and what needs to be known (Dean & Enemoh, 1983). When the material to be learned is of a complex nature or is written in a poorly structured manner, the use of graphic illustrations as organizers can facilitate learning (Dean & Kulhavy, 1980).

Research on pictorial organizers has shown that the retention of passages can be improved when the organizers are provided prior to studying a passage (Dean & Enemoh, 1983). In a study, carried out by Bransford & Johnson (1972), subjects were given a pictorial organizer before studying an ambiguous passage. The treatment group recalled more than those given the organizer after reading. In the study completed by Dean and Enemoh, the subjects who saw the picture of a meandering river as the pictorial organizer recalled more from the passage than those not given the picture.

Slate and Charlesworth (1989) cite much research to support the use of visual imagery as a memory aid that significantly enhances the learning process. They make suggestions of ways teachers can increase information processing for their students. "Meaningfulness" is emphasized as being the key element of the information processing model (p. 3). Students need to see relationships between what they already know and need to know or learn. Students need to actively process the new information in order to make meaningful associations with prior knowledge and not merely memorize the new material. The organizational structure in which the new material is presented requires it to be meaningfully related. It is the use of advance organizers that will specifically allow for the necessary hierarchical structure needed for meaningful learning to occur (Ausubel, 1963).

Design, position of organizer and length of study were important considerations for this present study. The decision to use a teacher constructed pictorial graphic organizer was supported by previous research results of Bean et al. (1986); Moore and Readence, (1984); Griffin, Simmons, and Kemeenui (1991); and Simmons, et al. (1988). The pictorial

graphic organizer designed for this experiment was intended to provide a holistic impression of the concept which would include a blend of both words and pictures. Since the teachers know what they want their students to learn, they are often the best ones to design the organizer. As Alvermann and Boothby (1986) reported, the teacher, who was untrained in using the graphic organizer before their study, found she liked it and continued to use it. She found it helped her organize the text that would possibly be a problem for students as it helped her focus on the important ideas before presenting them to the students. By being actively involved in the construction of the graphic organizer, the teacher becomes very sensitive all aspects of the information before the presentation to the students. Better predictions for the difficulties that could be met by the students can be made and therefore those needs can be met ahead of time.

The position of the organizer designed by Ausubel was initially to be in advance of the material to be presented. There have been numerous studies carried out to test if one position might be more effective than another. Organizers have been used before, during, and after presentation of the material to be learned with reasonably good results. Dean and Enemoh (1983) used their spatial organizer prior to the geology material to be studied with results that facilitated comprehension and remembering of prose material. Tajika et al. (1988) gave their integrated pictorial organizer both before and during reading with results of improved retention of the passage studied. Dana (1980) used the graphic organizer for the multithematic text before, during and after the reading. Her organizer facilitated retention of the content. Based on these findings, the pictorial graphic organizer for this study was used in all three positions.

Another technique to be used in this experiment is that of actively involving the students with the organizer as was supported by Slate and Charlesworth (1989). Descriptive passages most often occur in texts for students. The ideas are listed randomly and relate to one superordinate idea, not necessarily to each other. This difficulty with the organization for the reader can often lead to poor comprehension. Student involvement with completion of the organizer, as used by Alvermann (1981), will be used in this study. When students have a role to play in completing the keywords, they can develop a better sense of ownership. By actively processing the material to be learned, they can recall, through the visual memory of their completion of the blanks, the important concepts that were related in the organizer. Other studies using the same technique include Dean and Kulhavy (1980) and Simmons et al. (1988).

Support for the addition of pictures to the graphic organizer for this experiment came from Townsend and Clarihew (1989). They included pictorial material added to a verbal advance organizer which resulted in benefits for both the weak and strong prior knowledge groups. Peleg and Moore (1982) found the written form of the advance organizer to be more effective than the oral form (cf Townsend & Clarihew, 1989). Their control group received a verbal advance organizer as did the control group for this experiment.

The value of the pictorial organizer can be seen in its success as a visual substitute. Salomon (1989) found that some students who are unable to create their own imagery to facilitate their learning have success when visuals are provided.

The pictures used in the pictorial organizer for this present study fit into four of the categories outlined by Levin (1989). He listed them as

fulfilling the functions of representation, organization, interpretation and transformation. When pictures overlap with the text, they tend to make it more concrete in the representation. Structure and coherence are added to an otherwise poorly or weakly organized passage. Interpretation can be aided by pictures since they make a difficult-to-process text more comprehensible. Lastly, pictures can be designed to explicitly enhance the memorability of a text by transforming it into a more mnemonically powerful form. Mnemonic cues act to motivate students to recall the picture as an aid to making links (M. Levin, Rosenheck, & J. Levin, 1988).

The decision to use a form of pictorial advance organizer at the elementary level was supported by Stone's meta-analysis (1983). She reported that organizers are particularly effective for students who are at the concrete operational stage. The concrete operational period is described by Piaget in Novak (1977) as being the age group of 7-11 yr. old children. During this age period they still require concrete material in order to make comparisons and contrasts.

In the present research I was also interested in how the pictorial graphic organizer might work to influence text recall. I hypothesized that the hierarchical structure would improve the retention of the concepts of the poorly organized text; that providing the pictorial organizer before, during, and after the passage was read would be more effective than receiving a verbal-only organizer; and that the group receiving the pictorial organizer treatment would show improvement in their long term recall for two tests delayed 5 days then 14 days.

Chapter Two

Method

Two experiments were designed to see if a pictorial graphic organizer given before, during, and after the presentation of a poorly organized reading passage would improve recall and retention. Pictures should serve to concretize the difficult concepts in the unstructured passage better than a verbal organizer. It was expected that the addition of pictures to a graphic organizer would increase the interest and improve the retention for the students. The pictures would provide meaningful connections for those students having weak prior knowledge relevant to the reading task.

Experiment I

Subjects and Design

The subjects were 52 grade four students enrolled in an elementary school in Dartmouth, Nova Scotia. They were a random mix of ability, placed in two classes by the previous teachers at the end of the school year. The two classes consisted of 26 students in each so the control group and treatment group were of equal numbers. Three students were absent during two of the lessons as well as two tests and were subsequently dropped from the experiment. The final count of subjects completing the experiment was 49.

Materials

Material consisted of a 246 word passage (Appendix A) that was rated as 7.5 Flesch Grade Level by Grammatik Mac (2.0) software for the Macintosh computer. The passage was designed to offer an explanation of why the leaves of deciduous trees turn different colors in the fall and are then shed from the trees. The passage was written in an entertaining way rather than being strictly informative. It lacked structure and organization. The passage was chosen as it was viewed as a difficult passage for grade four students to comprehend so as to identify the important concepts and relationships.

The pictorial graphic organizer was a teacher constructed organizer arranged hierarchically with the three phases of change that the trees undergo during the fall and spring. Keywords of the most important concepts were underlined for easy recognition by the students. Arrows were used in keeping with the construct of a graphic organizer. A large coloured organizer, used by the teacher for the beginning of the initial lesson, was present during the three lessons involved with the treatment group. Students were given individual black and white copies on $8\frac{1}{2}$ x 11 in. paper (Appendix B).

The pictorial organizer with blanks (Appendix C) was used in lesson three by the treatment group so they would be actively involved with the organizer to develop a sense of ownership. The students were permitted to color this copy of the pictorial graphic organizer.

The verbal organizer (Appendix D) was for the teacher's reference and was not shown to the students in the control group. It was presented to the control students verbally according to the outline. The keywords of the

concepts were emphasized through the presentation and were clarified as needed but were not shown in written form to the students.

A coloring activity sheet (Appendix E) was used by the control group to balance the coloring time on task given to the treatment group.

The 18-item fill-in-the-blanks test (Appendix F) was used by both groups for the pre-test, post-test, 5-day and 14-day delayed test. This test was rated as 8.5 Flesch Grade Level by the Grammatic Mac 2.0 Program. It was teacher constructed, proofread, and accepted by two university education professors.

The experiment was conducted in three lessons with additional time being taken to complete the pre-test and three post tests. Subjects in the treatment and control group did not see or know of the two different approaches to the lesson. They were not told of the ongoing experiment. Appropriate verbal permission was obtained from the school principal to carry out this experiment in my classroom.

Procedure

All testing and delivery of lessons took place in the students' own classrooms so as not to change their routine. I was the only teacher involved with all aspects of this experiment so consistency was maintained. In this study the experimenter and the researcher were the same. Consequently the possibility exists that the results may be due to an experimenter expectancy effect (Rosenthal, 1976). While this should be kept in mind when interpreting the results, it characterizes most teacher-conducted classroom research and is not unique to this study.

The pre-test was given one day before the lessons began. Three separate 30 minute lessons were given to both groups for three consecutive days. The immediate post-test was administered the day following the third lesson, with 5-day and 14-day delayed recall testing following accordingly.

The schedule for the control group was outlined to follow as closely as that of the experimental group. Lesson one for the experimental group began with the pictorial graphic organizer being displayed. Discussion of what the students already knew about the shedding of leaves from deciduous trees, along with examples shown of leaves from deciduous trees took place with reference being made to the pictorial organizer for clarification. The presence of the visual provided the context and allowed for prior knowledge to be established. The control group received the verbal organizer while viewing a colorful picture of deciduous trees in the fall. Students contributed their knowledge about why these types of trees shed leaves and also saw the examples of leaves from deciduous trees so their prior knowledge was established.

Lesson two for the experimental group began with the presentation of the passage while the pictorial organizer was prominently in view at the front of the room. The students read the passage together with the teacher. They underlined the keywords in the passage as they were reviewed from the visual organizer. The students were given their own copy of the pictorial graphic organizer to establish the connections and relationships of concepts.

Lesson two for the control group began with the verbal organizer being repeated while the students received the reading passage. Students and teacher read the passage together followed by time given to underline

what they believed to be the important points as well as to write their own set of questions and answers.

Lesson three for the experimental group began with a review of the pictorial graphic organizer. Students then received copy #2 of the organizer and were instructed to complete the blanks where keywords had been omitted. A review of correct answers was given followed by time for the students to color the pictures. Vocabulary was clarified as needed with the final review of the organizer. The control group was given a review of the verbal organizer before vocabulary was clarified with spelling strategies provided as needed. A review of questions and answers took place before students were given coloring activity sheets to complete.

Quiet testing time was given to both groups with an open time limit allowed for the completion of the fill-in-the-blanks test. Instructions given were to encourage the students to read the completed statements before moving on to the next one. Both groups were reminded to think of the passage they had read and the experimental group was told to close their eyes and visualize the pictorial graphic organizer. Once individual students finished their test, the papers were collected and students remained sitting quietly (reading or completing other work) at their desks until all students were finished.

The tests were scored by myself. Results for all tests were not made known to the students until the experiment was completed after the 14th day delay test was completed.

Experiment II

Subjects and Design

A second experiment was conducted in a similar manner as the first one. The experimental groups were from the same school and grade four classes as the first experiment. For the second experiment the experimental and control groups were reversed. With 50 students in this experiment, there were 23 students in the experimental group and 27 students in the control group. The change in class sizes between experiments was due to three students transferring from one class to another school and a new student transferring into the other class before the second experiment was begun. The subject material was also on the topic of trees as the students' prior knowledge had now been established to satisfy that component of the advance organizer.

Materials

Materials consisted of a 482 word passage (Appendix H) that was rated as 6.3 Flesch Grade Level by Grammatik Mac 2.0. The passage was designed to offer an explanation of the parts of a tree and their function. It was written in an informative manner, with difficult vocabulary and concepts that would be hard to visualize without the benefit of graphics.

The pictorial graphic organizer (Appendix I) presented to the treatment group was teacher-constructed. The three parts of the tree were outlined at the left side of the page so the inset diagrams depicting the function of each part could be shown to the right of the tree. Keywords of the most important concepts were underlined for easy recognition by the

students. A larger coloured organizer was used by the teacher for the beginning of the initial lesson and was present during the four lessons involved with the treatment group. The pictorial organizer with blanks was used in lesson three by the treatment group so they could be actively involved with the organizer to develop a sense of ownership. The students were also allowed time to color this copy of the pictorial graphic organizer.

The verbal organizer, (Appendix J) presented to the control group, was for the teacher's reference. There was no colouring sheet provided for the control group so they were directed to design their own version of the parts of a tree based on what they had learned from the discussions and the reading passage.

The 26-item fill-in-the-blanks test (Appendix K) was used by both groups for the pre-test, post-test and 3-day delayed test. This test was rated as 6.3 Flesch Grade Level by the Grammatik Mac 2.0 Program. It was a rather lengthy three-part test, and somewhat more complicated for the students when compared to the test in Experiment I. It was teacher-constructed, proofread, and accepted by a university education professor.

The experiment was conducted in four 30 minute lessons, with additional time being taken to complete the pre and two post test. Subjects in the treatment and control group did not see or know of the two different approaches to the lesson.

Procedure

Experiment II followed the same procedure as Experiment I with the exception of the addition of a fourth lesson. As the passage used for this experiment was longer, the students would need an extra lesson to cover the material adequately.

Chapter Three

Results

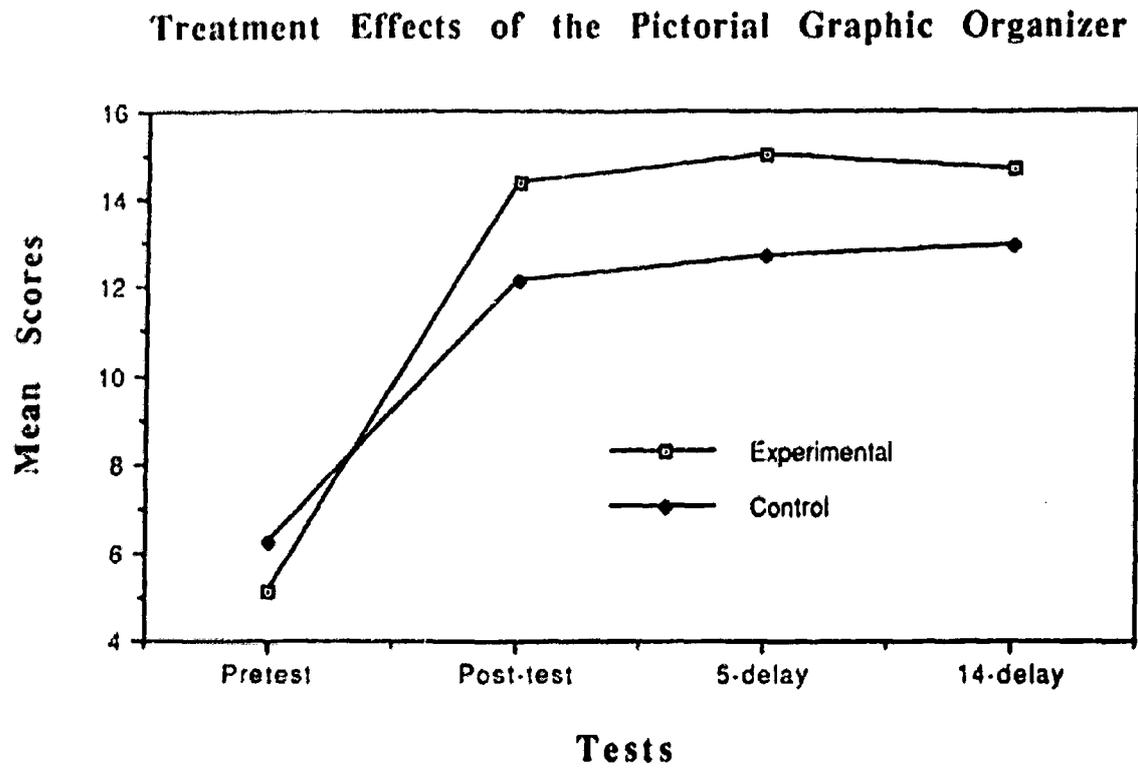
Experiment 1

Analysis of the Data

The method of data analysis for this study was a two-factor repeated measures analysis of variance (ANOVA) using the StatView statistical package for the Macintosh microprocessor.

In the graph, Fig. 1, the mean scores for the four tests show the significant differences between the experimental group having received the pictorial graphic organizer and the control group receiving the verbal organizer only. The graph also indicates that both groups did indeed learn the material that was taught as the increase for the control group shows they doubled their mean scores for the first test and continued to increase with the next two tests.

Figure 1



Sums of squares, mean of squares, F-test, and p value of pre-test and post-test are shown in Table 1. Means on the pretest for the control group were higher than the experimental group. There was no significant difference between experimental group and the control group before treatment since $F(1,46)=1.2$, $p=.2792$. The repeated measure (B) between pre-test and post-test is highly significant at $F(1,46)=358.8$, $p=.0001$. The interaction effect between the experimental/control and pre-test/post-test were also highly significant at $F(1,46) = 13.725$, $p=.0006$. These results yielded the significant difference for effect of the pictorial graphic organizer.

Table 1

Anova table for a 2-factor repeated measures Anova.

Source	df	Sum of Squares	Mean Square	F-test	P value
Experimental/Control	1	15.167	15.167	1.199	.2792
subjects w. groups	46	581.739	12.647		
Repeated Measure (B)	1	1403.01	1403.01	358.88	.0001
AB	1	53.657	53.657	13.725	.0006
B x subjects w groups	46	179.833	3.909		

There were no missing cells found 3 cases deleted with missing values.

The AB Incidence table

Repeated Mea...		Pretest	Post-test	Totals:
Experimente	Experimen...	25	25	50
	Control	5.56	14.64	10.1
Totals:		23	23	46
		6.261	12.348	9.304
		48	48	96
		5.896	13.542	9.719

Results for the 5-day delayed post-test are shown in Table 2. Results show the continued high significance of effect for the repeated measure between pre-test and 5-day delayed post-test with $F(1,45)=475.7$, $p=.0001$. The interaction effect between experimental/control and pre-test/5-day delay was highly significant at $F(1,46)=18.1$, $p=.0001$.

Results for the 14-day delayed post-test are shown in Table 3. Results show the continued significant effects even though they are mildly declining $F(1,47)=395.5$, $p=.0001$. The interaction effect between the experimental/control and pre-test/14 day delay were significant at $F(1,46)=7.4$, $p=.0091$.

The entire results are shown in the Table 4. The repeated measure (B) between pre-test/post-test/5 -day delay/14-day delay are highly significant at $F(3,43)=308.2$, $p=.0001$. The interaction effect between experimental/control and pre-test/post-test/5-day delay/14-day delay are highly significant at $F(3,46)=12.6$, $p=.0001$.

Differences in the numbers of subjects, as are seen on the four tables, were due to different individuals being absent for different test days. This change in numbers did not affect the significance of the results.

Table 2

Anova table for a 2-factor repeated measures Anova.

Source:	df:	Sum of Squares:	Mean Square:	F-test:	P value:
Experimental/Contro...	1	10.996	10.996	1.003	.322
subjects w. groups	45	493.429	10.965		
Repeated Measure (B)	1	1560.521	1560.521	475.745	.0001
AB	1	59.371	59.371	18.1	.0001
B x subjects w. groups	45	147.607	3.28		

There were no missing cells found. 3 cases deleted with missing values.

The AB incidence table

Repeated Mea..		Pretest	5-day del...	Totals:
Experimente	Experimen...	25	25	50
		5.32	14.96	10.14
	Control	22	22	44
		6.227	12.682	9.455
Totals:		47	47	94
		5.745	13.894	9.819

Table 3

Anova table for a 2-factor repeated measures Anova.

Source:	df:	Sum of Squares:	Mean Square:	F-test:	P value:
Experimental/Contro...	1	1.286	1.286	.098	.7558
subjects w. groups	47	617.979	13.148		
Repeated Measure (B)	1	1640.827	1640.827	395.483	.0001
AB	1	30.674	30.674	7.393	.0091
B x subjects w. groups	47	194.999	4.149		

There were no missing cells found. 1 case deleted with missing values.

The AB incidence table

Repeated Mea...		Pretest	14-day d...	Totals:
Experimente	Experimen...	25	25	50
		5.36	14.64	10
Control		24	24	48
		6.25	13.292	9.771
Totals:		49	49	98
		5.796	13.98	9.888

Table 4

Anova table for a 2-factor repeated measures Anova.

Source	df.	Sum of Squares	Mean Square	F-test	P value:
Experimental/Control	1	76.522	76.522	2.623	.1126
subjects w groups	43	1254.478	29.174		
Repeated Measure (B)	3	2169.644	723.215	308.249	.0001
AB	3	68.695	29.565	12.601	.0001
B x subjects w groups	129	302.66	2.346		

There were no missing cells found. 5 cases deleted with missing values

The AB Incidence table

Repeated Meas.		Pretest	Post-test	5-day del...	14-day d...	Totals:
Experimental	Experiment	23	23	23	23	92
	Control	5.13	14.391	15	14.696	12.304
Totals	Experiment	22	22	22	22	88
	Control	6.227	12.136	12.682	12.955	11
Totals		45	45	45	45	180
		5.667	13.289	13.867	13.844	11.667

Experiment II

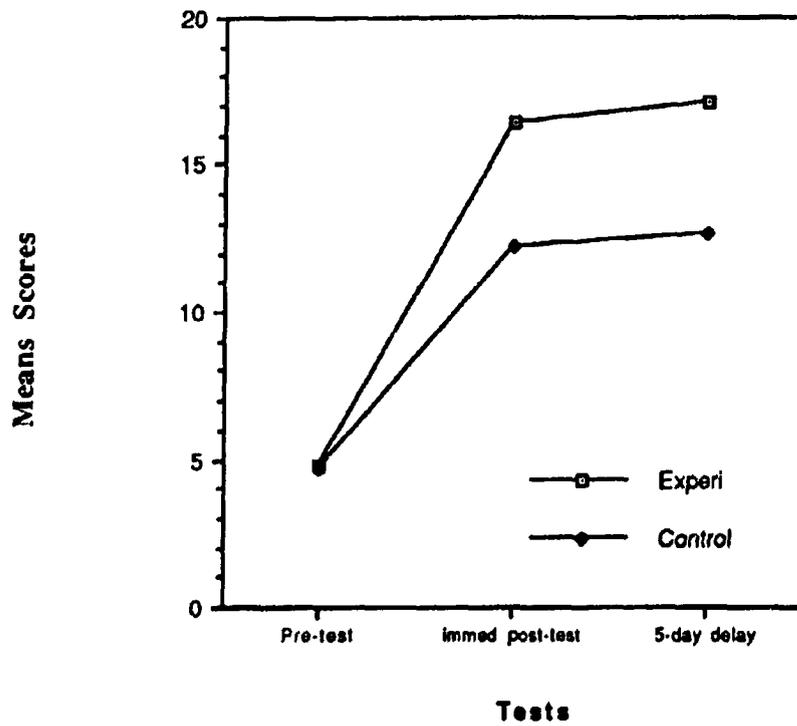
Analysis of Data

The method of data analysis for this study was the two-factor repeated measures analysis of variance (ANOVA) using the StatView statistical package.

In the graph, Fig. 2, the mean scores for the four tests once again show the significant differences between the experimental group having received the pictorial graphic organizer and the control group receiving the verbal organizer. The graph also indicates that both groups did indeed learn the material that was taught as the increase for the control group shows they doubled their mean scores for the first test and continued to increase with the next two tests.

Figure 2

Treatment Effects of the Fictorial Graphic Organizer (Exper. 2)



Sums of squares, mean of squares, F-test, and p value of pre-test and post-test are shown in Table 5. There was no significant difference between experimental group and the control group before treatment since $F(1,48)=5.2, p=.0276$. The repeated measure (B) between pre-test and post-test is highly significant at $F(1,46)=263.8, p=.0001$. The interaction effect between the experimental/control and pre-test were also highly significant at $F(1,48) =12.2, p<.001$. These results yielded the significant difference for effect of the pictorial graphic organizer.

Results for the 5-day delayed post-test are shown in Table 6. Results show the continued high significance of effect for the repeated measure between pre-test and 5-day delayed post-test with $F(1,49)=249.5, p=.0001$. The interaction effect between experimental/control and pre-test/5-day delay was highly significant at $F(1,49)=11.6, p=.0013$.

Table 5

Anova table for a 2-factor repeated measures Anova.

Source:	df:	Sum of Squares:	Mean Square:	F-test:	P value:
Exp/Contrl (A)	1	118.35	118.35	5.161	.0276
subjects w. groups	48	1100.66	22.93		
Repeated Measure (B)	1	2199.61	2199.61	263.824	.0001
AB	1	101.694	101.694	12.197	.001
B x subjects w. groups	48	400.196	8.337		

There were no missing cells found. 2 cases deleted with missing values.

The AB incidence table

Repeated Mea...		pre-test	immed. p...	Totals:
Exp/Contrl	Exp	23 4.826	23 16.391	46 10.609
	Contrl	27 4.667	27 12.185	54 8.426
Totals:		50 4.74	50 14.12	100 9.43

Table 6

Anova table for a 2-factor repeated measures Anova.

Source:	df:	Sum of Squares:	Mean Square:	F-test:	P value:
Exp/Contrl (A)	1	128.647	128.647	6.474	.0141
subjects w. groups	49	973.667	19.871		
Repeated Measure (B)	1	2570.039	2570.039	249.535	.0001
AB	1	119.294	119.294	11.503	.0013
B x subjects w. groups	49	504.667	10.299		

There were no missing cells found. 1 case deleted with missing values.

The AB incidence table

Repeated Mea...		pre-test	5-day del...	Totals:
Exp/Contrl	Exp	24 4.75	24 17.083	48 10.917
	Contrl	27 4.667	27 12.667	54 8.667
Totals:		51 4.706	51 14.745	102 9.725

Chapter Four

Discussion

Results of this study examining the effect of pictorial graphic organizers on learning and remembering information were supported by the results of significant difference for the experimental groups. These findings support other research investigating the effect of pictorial graphic organizers (Dean & Kulhavy 1980; Dean & Enemoh, 1983; Tajika et al., 1988; Townsend & Clarihew, 1989). These results extend theories of advance organizers of Ausubel (1968) and graphic organizers of Barron (1969).

There can be a distinction made between the verbal and pictorial graphic organizer. This study has provided evidence that pictorial graphic organizers can increase students' retention of prose (Dean & Enemoh, 1983).

The findings of these experiments show benefit for long-term recall and support those of Dana, 1980 ; M. Levin, et al., 1988; Simmons, 1988; and Tajika et al., 1988. The significant difference in recall was maintained for the experimental group after the 5-day delay test and was reduced only marginally in the 14-day delay test in the first experiment.

This study has supported the idea that an organizer can aid in the comprehending of poorly structured material (Alvermann, 1981; Ausubel, 1968). The pictorial graphic organizer benefited students in this group as they had something to visualize in their memory before writing the post tests. My results concur with Dana (1980) that the pictorial graphic

organizer can be beneficial when used before, during, and after reading a passage. The picture mnemonics used in the pictorial graphic organizer for this experiment also supports the findings of M. Levin et al. (1988).

These results of using a pictorial graphic organizer indicate the facilitative effect on retention for young children. This extends the findings of Townsend and Clarihew (1989) who used pictorial material with their verbal advance organizer. The educational significance is that a difference can be achieved. Both the experimental and control group improved in retention of material, but the pictorial graphic organizer group, having a significant difference of $p > .01$ in both experiments, showed improvement was far from accidental.

The benefit of the change in mode of presentation by including pictorial representation in the organized structure is consistent with benefits found by Dana (1980) working with sixth grade students, Lehman (1992) with learning disabled students at the high school level, and Tyler et al. (1983) when working with college students

Tyler et al. (1983) used a verbal organizer in a diagrammatic manner, Dana (1980) used a graphic advance organizer that was arranged diagrammatically, while Lehmann (1992) arranged the organizer in a pictorial manner so as to aid disabled students.

It is important that the pictorial graphic organizer not be seen as another device to promote rote learning. The idea that knowledge acquired meaningfully is retained longer (Novak, 1977) was supported in this experiment with the long term retention results. The students using the pictorial organizer were given cues to make connections toward progressive and interactive differentiation. They were more easily motivated to retain the new information when they were reminded to recall

the mnemonic pictures as aides in making the links (M. Levin et al., 1988). Recall of pictures from the organizer should act as a cue to recall the relevant information and their connections to the important concepts. The success of connecting prior knowledge with the new concepts occurred through using the pictures in the organizer to make that relationship for those with weak prior knowledge.

Forgetting depends on the degree of meaningfulness that is associated with the learning process (Novak, 1977). We cannot recall all we have learned. The key to remembering is how well the anchors were made in the cognitive structure to enable recall of the subsumed concept. The pictorial graphic organizer allowed the anchors to be formed due to familiar pictures being used.

When students form relationships between previously learned concepts and the new material, it becomes more meaningful if it has been made personal. By the students taking part in recalling key words used in the pictorial organizer, they become involved with the association between picture cues and the verbal cues. In this way the organizer acted as a trigger for the occurrence of a conscious effort to facilitate new information in the cognitive structure on a non-rote basis (Barron & Stone, 1974; Dean & Enemoh, 1983)).

The incomplete pictorial graphic organizer was used to allow the students to take some ownership for the device as was done by Alvermann and Boothby (1982); Alvermann, Boothby, & Wolfe (1984); and Dean and Kulhavy (1981). These researchers all included time for the students to complete blank portions of the organizer as a way of the learners actively processing the newly learned information. By completing the blanks for

my pictorial graphic organizer, the students were actively involved in the information processing.

Meta-analysis by Moore and Readence (1980) indicated that the effect of graphic organizers is low both in short-term and long-term treatment conditions. The length of treatment in these experiments was obviously not a negative factor. While the students in the treatment group of the first experiment received only three 30-minute sessions they were able maintain their recall with significant results still showing on the 14-day delayed test. Long term delay relies heavily on meaningful learning having occurred. Hence, the length of time spent and activity with the pictorial advance organizer meant that the students were able to take all the information to the stage of full integrative reconciliation.

Another important factor in the promotion of meaningful learning and its long-term effect would be the establishment of the prior learning through the pictorial organizer. Pictures in the organizer allowed for adequate connections to prior knowledge to be established. The long term memory was meaningfully established in the learner's cognitive structure.

The findings here indicate that the pictorial graphic organizer can be beneficial to improve comprehension of a particularly difficult text. This significant difference in the first experiment for both the immediate and 5-day delay recall proves this fact and while the 14-day delay scores were showing a loss, it was only marginal. Structure can be imposed on material that lacks a natural structure through the use of the organizer as stated by researchers Ausubel (1968), Eggen et al. (1979), and Novak, (1977).

The interpretation of the significant effect when the pictorial advance organizer is used for a difficult passage is that it has influenced the learners to process a set of anchors to allow the new material to be hooked onto.

Ideas have been planted that have allowed for the anchorage necessary to help piece together and hold information from text that is less than optimal in organization. This information was held by the anchors until it could be reorganized and made meaningful (Alvermann, 1981). Similarly the reading passage chosen for this study was poorly structured and the organizer that was used facilitated for this structure compensation with a highly structured organization. Also supported through Alvermann's study was the fact that organizers aid recall when the readers must reorganize this difficult material. Johnson (1989) calls creative graphing a thinking skill. She sees the organizers giving the learner a chance to fill-in the gaps and connect the links of information. The learner grasps a better sense of the arrangement and structure from the pictorial graphic organizer than from the difficult text alone.

J. Levin (1989) sees the need to evaluate different learning strategies in terms of their relation to specific learning outcomes. First the learner must comprehend or understand the information while processing it before moving on to the memory stage. Once they have it in their memory at the understanding level, they then can apply the previously learned material to the newly learned material. The pictorial graphic organizer of my study forces students to process the information more deeply (Alvermann, 1981).

The value of using a pictorial graphic organizer is that students can study along with the reading of the text. This idea was generated by J. Levin and Divine-Hawkins (1974) as well as Peeck (1974) and supports the use of the organizer during reading. Pictures served as cues, while students read, and acted as reminders when they were thinking about this content. Researchers whose results also recommend the use of the organizer during the lesson are Alvermann (1981); Alvermann and

Boothby (1982, 1986); Alvermann et al. (1984); Dana (1980); Mayer and Bromage (1980); and Tajika et al. (1988).

The visual imagery provided by my pictorial organizers gave the students the opportunity to link the visual literacy to the print literacy (Suhor & Little, 1988). This also allows the organizers to act as the bridge between picture and print (Dean & Enemoh, 1983). In my first organizer, an illustration, such as that of breaking down the chlorophyll, provided an explanation that was plausible while the print did not easily provide such clarity. J. Levin (1989) clearly stated that "...pictures can indeed facilitate students' processing of text information..."(p. 83).

The pictorial graphic organizers used for this study can be classified as expository (Ausubel, 1963; Joyce, 1986) since the students had not yet been taught this particular topic about trees during this school year. I believed they had a general awareness of knowing the leaves changed colors but lacked a knowledgeable understanding of why this happened.

The outline for the lessons was based on Joyce's division of the advance organizer into 3 phases. In phase one the organizers were presented. The terms, concepts, illustrations, and analogies were familiar in a pictorial form in order to activate prior knowledge. The learning material was presented in phase two. Discussion, visual presentations, and reading of the passage took place in this phase so the material was made explicit. Phase three provided the anchorage of the new material to the old in the students' cognitive structure. This was where the material became strengthened and clarified in the students' knowledge base.

Learners must attend to the information being presented and relate to it what they already know (Mayer, 1983). Based on this, the material was presented in the format of the pictorial organizer so as to allow this to

occur. It provided an easy way to learn and remember concepts; all the criteria was met for creating a meaningfully good conceptual model as stated by Mayer (1989).

Through the design of the pictorial organizers, I attempted to meet the seven characteristics for a good conceptual model as outlined by Mayer (1989) My organizers were complete since they contained all the essential parts of the concept as well showed their relationships. The model was presented at an appropriate level for the learner, detail did not overwhelm them, and the general function of each part was made concise. The model used was coherent, it made sense so the learners could see a logical system at work. The model presented was at a level of familiarity appropriate for the learner and included physical models (sample of leaves from deciduous trees; shapes of actual leaves from examples of trees were drawn for the pictorial organizer). The model was conceptual since it was based on material that allowed for meaningful learning. The pictures were correctly drawn and easily related to the actual leaves of the deciduous trees. The model used appropriate vocabulary and organization according to the learners who were present in the two grade four classes.

The pictorial graphic organizer can be categorized as a special kind of text illustration (Mayer,1989). My conceptual model allowed the learner to see how the part of the concepts to-be-learned fit together.

The impact of the schema-directed top-down process in picture processing can be a strong influence on the depth of processing according to Molitor et al. (1989). Placemient of the picture in relation to the text served to create an attitude for the readers. It hopefully influenced how well they looked at and then processed the information given in the

organizer. The pictures made the readers look closely and the text combined with the pictures, helped to impact the meaning.

According to Seel and Strittmatter (1989), “..knowledge is linked to concrete features.” (p. 41). A mental model is formed through perceptual experiences based on prior knowledge or what is being observed immediately by the learner. This imagery was created for my students in the visual pictorial graphic organizers. A concern for the design of these pictorial organizers was how it was going to induce my students to use their skills, such as imagery, together with the graphics provided in the organizers in order to make an effective learning strategy. The pictorial advance organizer provided the students with the concrete visual images rather than only verbal. Since elementary students at the grade four level benefit from the concrete materials, they did indeed benefit from the pictorial graphic organizer. This idea was supported by both Stone (1983) and Novak (1977) as students in the elementary grades are at the concrete operational stage.

The meta-analysis carried out by Luiten et al. (1980) showed the largest average effect size for retention was at the primary grade levels. The data for retention showed the advance organizer effect to increase with time thus giving support for use of my organizer at the grade four level. This was also supported by other studies using graphic and pictorial organizers that were also used with students at the elementary level (Alvermann & Boothby, 1986; Dana, 1980; Tajika et al., 1988; Townsend and Clarihew, 1989).

The decision to use mnemonics in the pictorial organizer was based on the work of J. Levin, Morrison, McGivern, Mastropieri, and Scruggs (1986) as well as M. Levin et al. (1988). The exaggeration in the

mnemonics analogy provided the concrete awareness of the connections. The cold wind using a hammer to “breakdown” the green chlorophyll helped to form the relationship of how the cold temperature leads to the cessation of water and food being provided for the leaves; thus the leaves turn color in the fall and drop from the tree.

The blend of picture with the verbal organizer was proven by Townsend and Clarihew (1989) to be beneficial for both high and low prior knowledge. Their first experiment with the verbal organizer benefited only those with strong prior knowledge. The addition of pictures to the verbal proved beneficial for both groups. This result also gave support to my work as my study included both the verbal and pictorial organizer. My results showed that the control group did indeed learn from lessons with a verbal organizer but not as significantly as did the treatment group provided with a pictorial organizer.

Alvermann (1988), in her work with low achieving elementary students, demonstrated the need for these students to have a strategy provided for them in the form of the organizer. These students do not always recognize their need for deeper processing of information. As the two classes involved in this study consisted of students with a range of academic abilities, the organizer met the needs of all. Every student gained new knowledge with the treatment group as a whole, retaining more than the control group.

The attitude of the learner toward the material to be learned can be greatly influenced by the teacher (Novak, 1977). Since the abilities and learning styles vary greatly from one student to another in a class, the teacher must use many and varied resources in the attempt to stimulate and provoke meaningful learning. Success of the teacher designed pictorial

graphic organizer relies on the teacher knowing the interests and needs of the students. Elementary teachers are often left to their own resources when it comes to providing meaningful supplementary materials for their students. By creating these pictorial organizers, I gained a great deal of confidence in my ability to clarify a concept in such a way as to produce significant results. With support from colleagues and mentors, this curriculum material now belongs to my growing collection of resources. It was both absorbing and interesting to become illustrator, writer, and problem solver as Johnson (1989) observed it to be. It might make an interesting study to compare commercial (text) made graphic organizers with a teacher-made organizer in some future study.

It might also be beneficial for future research to look at the potential for elementary children to be able to aid in the construction of a pictorial graphic organizer. As Bean et al. (1986) discussed, the student constructed graphic organizer was most beneficial for their students. Their students developed a positive attitude toward the strategy and some used it in other subjects. Elementary students feel a great sense of satisfaction from creating their own learning tools. Dana (1980) recommended the need for training students how to use as advance organizer; I would recommend the need for the students to learn how to construct a simple pictorial graphic organizer. My students in the experimental group thoroughly enjoyed learning through the use of this pictorial graphic organizer and I am confident they would take great care and pride in producing their own model someday.

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Appendix A

Deciduous Trees in the Fall

If you live where there are cold winters, you know that a sure sign that winter's coming is the colour change of the leaves on the trees. Why do leaves suddenly change colour? In most cases, the new colours, such as orange and yellow, have actually been in the leaves throughout the year, but they were hidden by the dominant green colour of chlorophyll. Some colours, though such as reds, aren't produced until the fall. In the fall, the tree prepares for a rest. It will not grow during the winter because of the cold temperatures and lack of water. Part of the tree's preparation for winter involves stopping photosynthesis that is the food making process. First the chlorophyll in the leaves breaks down and when the green colouring breaks down, the other colours can be seen.

Once the leaf colours have brightened up the landscape, it will soon be time to get out the rake as the leaves begin to fall. Only certain types of trees, called deciduous, shed all their leaves at once. Oaks, maples, poplars and birch are all deciduous trees. Where you live, the annual dropping of leaves likely occurs in the cool days of autumn. But even in tropical areas or climates with wet and dry seasons, deciduous trees lose their leaves at the start of the dry season.

Why do trees get rid of their leaves? The main reason is to conserve water. In cold winters, for example, the ground is frozen and it is very difficult for the roots to soak up water. So the tree has to stop using as much water as possible. Since leaves use up and release a lot of water, especially during photosynthesis, the leaves have to go. As autumn approaches, cells at the base of each leaf's stem die and form a barrier that blocks the flow of food and water between the leaf and the tree. This, along with the breakdown of chlorophyll in the leaf, kills the leaf. Once the chlorophyll is gone, the leaf can't photosynthesize any more. Eventually, the leaf can't hold on to the twig any longer and falls to the ground. The tree remains inactive through the winter until spring, when the buds open and the new leaves grow and start to photosynthesize again.

Appendix B



The Change Stop

I



Cold

absorb

Carbon

photosynthesis

photosynthesis

The Inactive

II



2000 ft. courses

need to

conserve

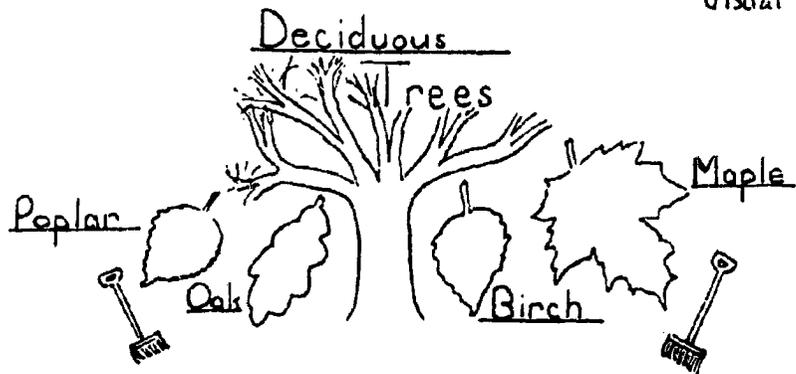
Water

870

Age the
of the
water
up to
the
bottom
of the
lake

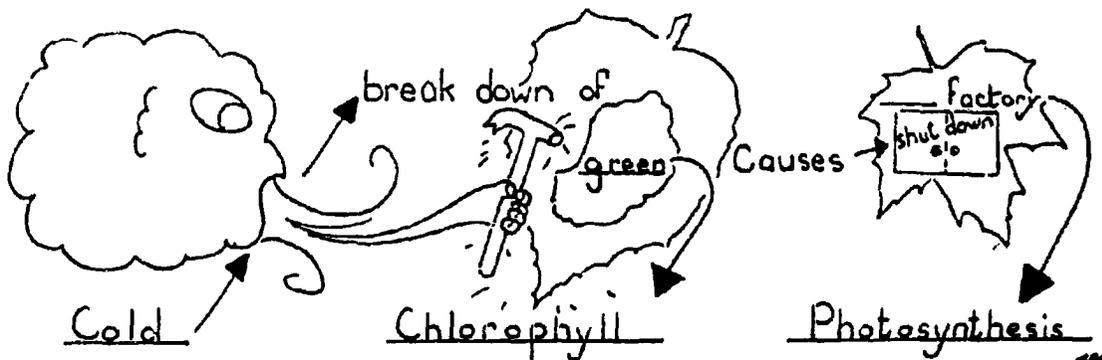
Slope





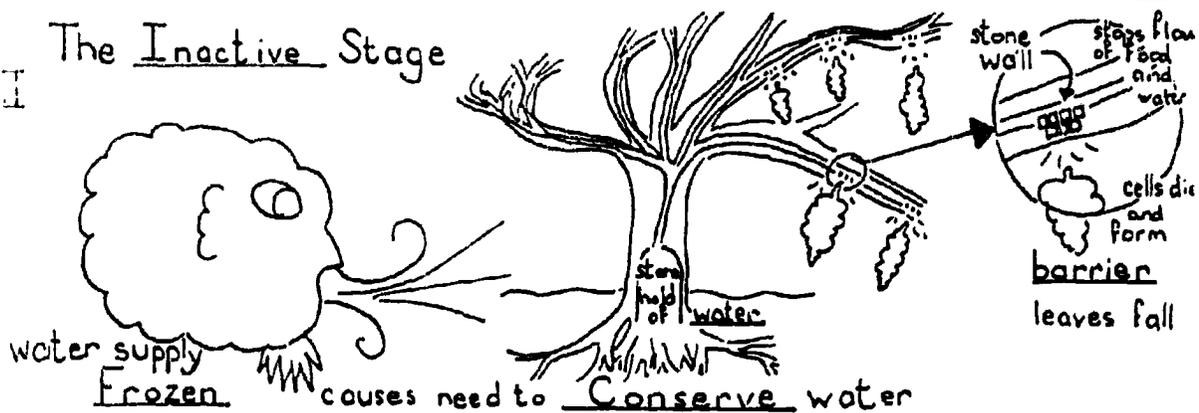
The Change Stage , FALL

I



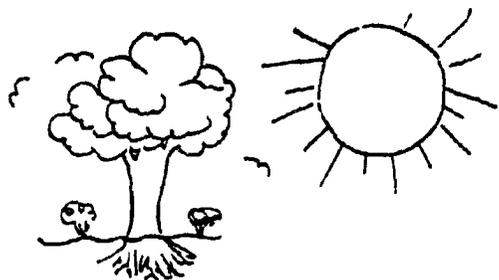
The Inactive Stage

I

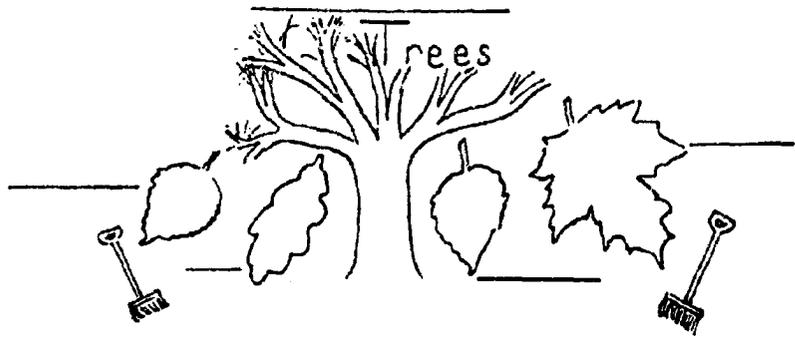


The Renewal Stage

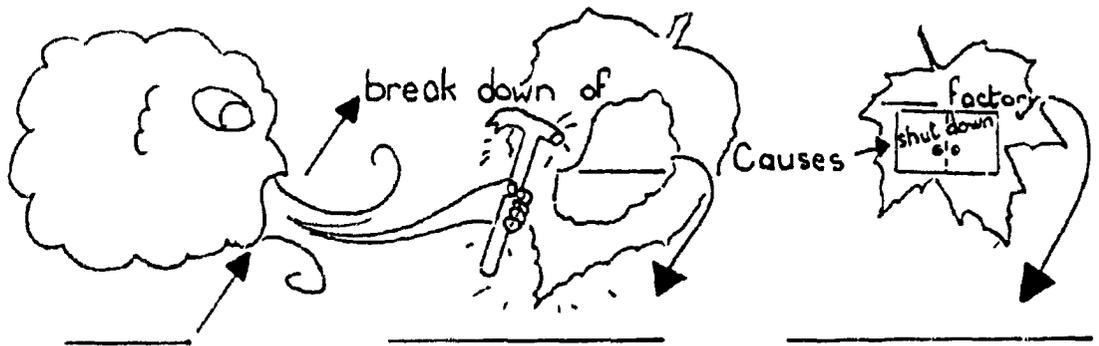
I



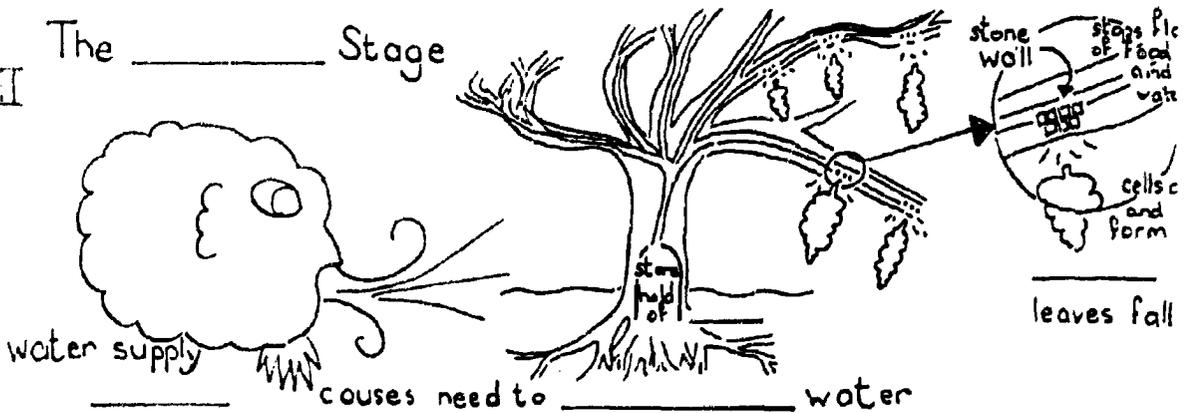
Appendix C



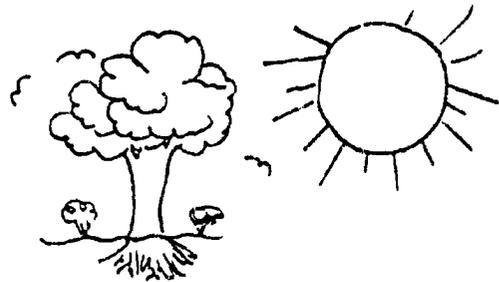
I The Change Stage, _____



II The _____ Stage



II The Renewal Stage



Appendix D

VERBAL ORGANIZER

Control Group

1) Deciduous Trees - lose leaves in the Fall

- ex. - birch
- poplar
- maple
- oak

- 2) Reasons 1) Cold temperature - green chlorophyll breaks down
- causes photosynthesis (food factory) to stop
 - colour of leaves change to yellow and orange, red made in fall

ii) Trees become inactive due to frozen water

- causes need for tree to conserve use of water
- no water and food going to leaves due to barrier of dead cells formed at base of stem.
- leaves fall off

3) New growth - warm days

- new buds
- new leaves

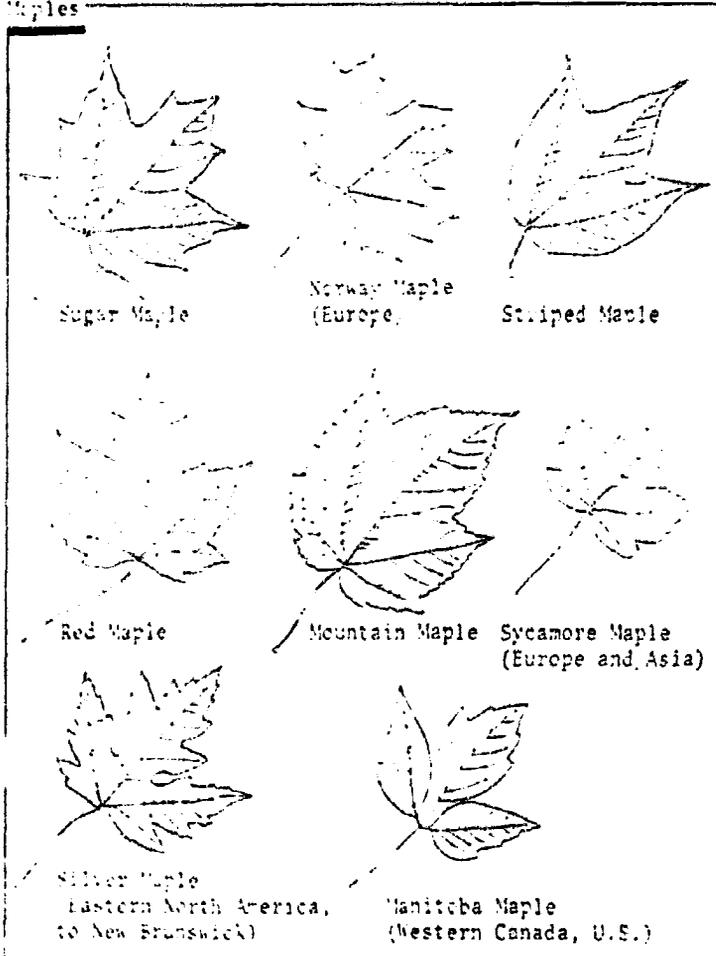
Appendix E

Tree Leaves

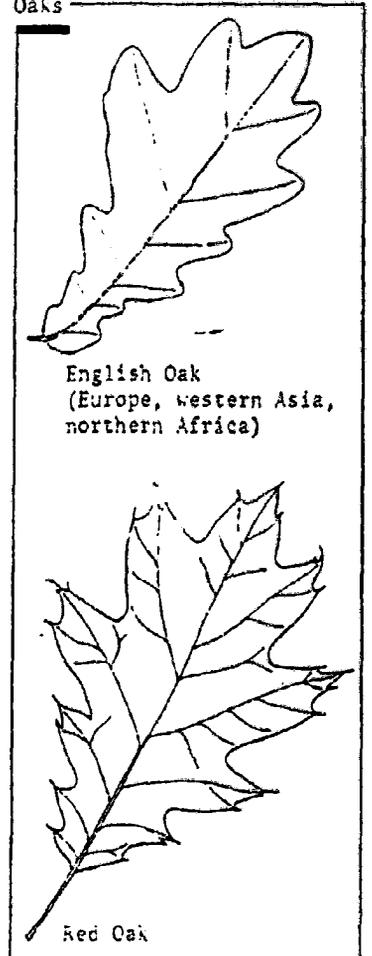
Tree leaves are often the first objects from nature to be collected by a budding naturalist. Even though you sometimes need to also study flowers, twigs or seeds to positively identify a tree, leaves are the most obvious feature.

This info may be a first step in identifying most of the native and introduced trees of Nova Scotia. When the leaves are confusing, refer to a book like Trees of Nova Scotia, by G. L. Saunders, Department of Lands and Forests. For trees not native to Nova Scotia, possible places of origin are given.

Maples



Oaks



Appendix F

**Pre/Post test
Experiment 1
TREE STUDY**

- 1) Trees that shed their leaves are called _____ trees.
- 2) Four trees which shed their leaves are _____ ,
_____, _____ , and _____ .
- 3) The season of the year when leaves change colour is called _____ .
- 4) Leaves change colour because of the _____ temperature.
- 5) The dominant green colour of the leaves is called _____ .
- 6) The colours of orange and yellow have been in the leaf all year but they were _____ by the dominant green colour.
- 7) When the green chlorophyll is broken down , the food making process called _____ , stops.
- 8) Shortly after the leaves change colour they _____ from the trees.
- 9) It is important that trees lose their leaves before winter because the leaves use and give off _____ .

10) In winter, the water in the ground is _____ so the trees can no longer use it.

11) The leaves fall because the cells at the base of each leaf stem die and form a _____ .

12) These dead cells block the flow of _____ and _____ between leaf and tree.

13) Throughout the winter deciduous trees remain _____ .

14) Then in the warm spring buds open and new _____ grow.

Pre/Post test(with ANSWERS)

**Experiment 1
Tree Study**

- 1) Trees that shed their leaves are called deciduous trees.
- 2) Four trees which shed their leaves are popular , birch , maple , and oak . (or any other deciduous trees)
- 3) The season of the year when leaves change colour is called fall or autumn .
- 4) Leaves change colour because of the cold temperature.
- 5) The dominant green colour of the leaves is called chlorophyll .
- 6) The colours of orange and yellow have been in the leaf all year but they were hidden (masked , covered) by the dominant green colour.
- 7) When the green chlorophyll is broken down, the food making process called photosynthesis , stops.
- 8) Shortly after the leaves change colour they fall or drop from the trees.
- 9) It is important that trees lose their leaves before winter because the leaves use and give off water .

10) In winter, all the water in the ground is frozen so the trees can no longer use it.

11) The leaves fall because the cells at the base of each leaf stem die and form a barrier .

12) These dead cells block the flow of food and water between leaf and tree.

13) Throughout the winter deciduous trees remain inactive .

14) Then in the warm spring buds open and new leaves grow.

Appendix G

SCHEDULE

CONTROL GROUP

EXPERIMENTAL GROUP

Pretest for Knowledge

Pretest for Knowledge

Lesson I - Verbal organizer

- colourful picture of tree
- give examples
- provide context
- repeat
- relate to prior knowledge

Lesson I - Visual/Graphic Organizer

- give examples
- provide context
- repeat
- relate to prior knowledge

Lesson II - Learning task

- present passage
- read together
- verbal highlights
- repeat verbal organizer
- write own set of questions and answers

Lesson II - Learning task

- Present passage with visual organizer present
- underline keywords
- individual visual organizers for student (copy #1).
- connect to visual organizer.
- repeat

Lesson III -

- trees to colour
- vocabulary meanings
- spelling strategies
- review questions and answers

Lesson III

- review visual organizer
- students complete blanks on copy #2 of organizer
- clarify vocabulary

Post Test

Post Test

Appendix H

Parts of A Tree

THE TRUNK of the TREE

The trunk is the strong, woody stem. The hard center, or *heartwood*, of the trunk is what holds the tree upright. Just outside the heartwood, a new ring of woody tubes called *sapwood*, carries water and mineral up the trunk from the roots. The very thin layer next to the sapwood, called the *cambium*, is the new layer of growing tissue produced each spring. The cambium enables the tree to continue to grow. The *phloem*, also called the *inner bark*, is a layer of soft tissue surrounding the cambium. This fibrous layer of tubes carries water mixed with food down from the leaves to the roots. This water and food mixture, called *sap*, is made by the leaves.

By late summer the cambium growth slows down and the woody tubes are smaller and darker. If you find a tree stump, you can count the rings to find the age of the tree. Each light and dark ring represent one year of growth. Most trees expand by about 2.5cm each year.

THE BARK

Bark is the outer layer of the tree. It forms a kind of skin of hard dead tissue that protects the living inner parts from injury. It also protects the tree from losing too much water. The tree breathes through tiny holes in the bark.

The outer bark stretches, like skin, to let the trunk and branches grow thicker. The bark of a few kinds of trees, such as beeches and birches, is smooth because it stretches easily. But the bark of most other trees do not stretch so well. As the trunk and branches grow thicker, they push against the bark. It finally cracks and dries and so becomes grooved and rough. Most trees lose old bark from time to time and replace it with a new layer.

ROOTS as ANCHORS

Roots are long underground branches of the trunk that form the tree's anchor. If trees had no roots they would fall over! The main root is called the *taproot*. It can grow as deep as 5m into the soil. Closer to the surface, trees spread out an enormous web of roots. Some trees have more growth underground than above. All the layers of the trunk of the tree continue into the branches and into the roots.

Thousands of tiny root hairs grow near the tips of a tree's roots to soak up water and minerals from the soil. They deliver this water through the trunk to the leaves.

Although trees need large amounts of water, their roots also need air. Most trees are unable to grow where the earth is always waterlogged. Some trees solve this problem by growing roots above the ground, like stilts.

There are trees whose roots seem to have a life of their own. If the tree is felled, the roots send up new trunks and leaf. These new growths, called *suckers*, will grow into full-size trees.

Appendix I

Appendix J

VERBAL ORGANIZER

EXPERIMENT 2

1) Three main parts of the tree- Bark, Trunk, Roots

2) Trunk (stem) consists of - heartwood

- sapwood

- cambium

- phloem (inner bark)

Place/function of:

a) heartwood - hard center

- holds tree upright

b) sapwood - layer outside of heartwood

- tubes to carry water and minerals up trunk from roots.

c) cambium - next layer outside of sapwood

- thin layer of growing tissue

- growth occurs in spring

d) phloem - layer beside cambium

- tubes to carry sap (mixture of food and water) from leaves down to roots.

e) growth slows down in late summer, woody tubes become smaller and darker.

f) growth per year about 2.5 cm.

3) Bark - protects living inner parts from injury

protects tree from loss of too much water

- holes in bark for breathing.
- bark stretches as tree grows.
- bark of beech and birch trees is smooth
(stretches easily)
- bark cracks due to pressure from growth
- tree replaces old bark with new layer

4) Roots - act as anchor

Taproot is main large root - can grow as deep as 5m

roots contain all the layers of the tree

roots grow out of main root and form a web of roots close to the surface.

root tips contain thousands of tiny root hairs that soak up water and minerals from the soil.

Appendix K

**Pre/Post test
Experiment 2
Tree Study**

Part I

- 1) The trunk of the tree is a strong, woody _____ .
- 2) The hard center of the trunk that holds the tree upright is called the _____ .
- 3) The layer just outside this hard center contains the new growth of woody tubes and is called the _____ .
- 4) These tubes carry _____ and _____ up the trunk from the roots.
- 5) The very thin layer of growing tissue that surround these woody tubes is called the _____ .
- 6) The season of the year when this new growth in the tree occurs is the _____ .
- 7) Surrounding the cambium is the layer of soft tissue called _____ .
- 8) These outer tubes carry the mixture of food and water, called _____ from the leaves down to the roots.
- 9) When the growth of new tissue slows down in late summer, the woody tubes are smaller and _____ .
- 11) Most trees expand by about _____ cm. each year.

Part II

- 1) The outer dead layer of bark protects the _____ inner parts of the tree from injury.
- 2) The bark of the tree also protects it from losing too much _____ .
- 3) The tree breathes through tiny _____ in the bark.
- 4) The outer bark stretches to allow the tree to _____ .
- 5) On some trees, such as the beech and the birch, the bark is _____ because it stretches easily.
- 6) Growth causes pressure against the bark causing it to _____ and as so in most trees. it becomes grooved and rough
- 7) Trees that lose the old bark _____ it with a new layer.

Part III

- 1) Roots of the tree keep it from falling over and form an _____ .
- 2) The largest or main root of a tree is called the _____ that can grow as deep as 5m or more.
- 3) All the layers of the tree continue into the _____ as well as the branches.
- 4) Smaller roots branch out from the main root and form a _____ of roots closer to the surface of the soil.
- 5) Near the tip of all the roots are thousands of tiny root _____ that soak up _____ and minerals from the soil to be carried up to the leaves through the trunk.

6) Since roots also need _____ , trees are unable to grow where the earth is waterlogged.

7) When a tree has been cut down, the roots start a new growth of trunks and leaves called _____ .

Pre/Post test (with ANSWERS)
Experiment 2
Tree Study

Part I

- 1) The trunk of the tree is a strong, woody stem .
- 2) The hard center of the trunk that holds the tree upright is called the heartwood .
- 3) The layer just outside this hard center contains the new growth of woody tubes and is called the sapwood .
- 4) These tubes carry water and minerals up the trunk from the roots.
- 5) The very thin layer of growing tissue that surround these woody tubes is called the cambium .
- 6) The season of the year when this new growth in the tree occurs is the spring .
- 7) Surrounding the cambium is the layer of soft tissue called phloem (or inner bark) .
- 8) These outer tubes carry the mixture of food and water, called sap, from the leaves down to the roots.
- 9) When the growth of new tissue slows down in late summer, the woody tubes are smaller and darker .
- 11) Most trees expand by about 2.5cm. each year.

Part II

- 1) The outer dead layer of bark protects the living inner parts of the tree from injury.
- 2) The bark of the tree also protects it from losing too much water.
- 3) The tree breathes through tiny holes in the bark.
- 4) The outer bark stretches to allow the tree to grow.
- 5) On some trees, such as the beech and the birch, the bark is smooth because it stretches easily.
- 6) Growth causes pressure against the bark causing it to crack and as so in most trees. it becomes grooved and rough
- 7) Trees that lose the old bark replace it with a new layer.

Part III

- 1) Roots of the tree keep it from falling over and form an anchor.
- 2) The largest or main root of a tree is called the taproot that can grow as deep as 5m or more.
- 3) All the layers of the tree continue into the roots as well as the branches.
- 4) Smaller roots branch out from the main root and form a web of roots closer to the surface of the soil.
- 5) Near the tip of all the roots are thousands of tiny root hairs that soak up water and minerals from the soil to be carried up to the leaves through the trunk.

6) Since roots also need air, trees are unable to grow where the earth is waterlogged.

7) When a tree has been cut down, the roots start a new growth of trunks and leaves called suckers.

Appendix L

SCHEDULE 2nd Experiment

CONTROL GROUP

EXPERIMENTAL GROUP

Pretest for Knowledge

Pretest for Knowledge

Lesson I -Verbal organizer

- colourful picture of tree
- give examples
- provide context
- repeat
- relate to prior knowledge

Lesson I - Visual/Graphic Organizer

- give examples
- provide context
- repeat
- relate to prior knowledge

Lesson II -Learning task

- present passage
- read together
- verbal highlights
- repeat verbal advance organizer
- write own set of questions and answers

Lesson II -Learning task

- Present passage with visual organizer present
- underline keywords
- individual visual organizers for student (copy # 1).
- connect to visual organizer.
- repeat

Lesson III -

- trees to draw
- vocabulary meanings
- spelling strategies
- review questions and answers

Lesson III

- review visual organizer.
- students complete blanks on copy #2 of organizer
- clarify vocabulary
-

Lesson IV

- review material

Lesson IV

- review material

Post Test

Post Test