AN INVESTIGATION OF THE EFFECTS OF PICTORIAL AND PROSE OVERVIEWS ON ADULT LEARNING OF PROSE TEXT

R. K. Gellner

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ABSTRACT

AN INVESTIGATION OF THE EFFECTS OF PICTORIAL AND PROSE OVERVIEWS ON ADULT LEARNING OF PROSE TEXT

R. K. Gellner

Although there is a growing need for adult education, very little research has focussed on the learning behavior of a population of "continuing education" students. This study examined the effects of an adjunct aid, the pictorial overview, on adult learning of a prose passage. The subjects were 122 continuing education students who were randomly assigned to one of five experimental conditions: pre-passage verbal overview, pre-passage pictorial overview, post-passage verbal overview, post-passage pictorial overview, and a no-adjunct aid control group. Before the experiment began, subjects were asked to complete the Nelson Denny Reading Test (NDRT). An immediate posttest was administered, followed by a delayed posttest two weeks later.

A regression analysis provided strong evidence that the NDRT was an excellent predictor of posttest scores. A repeated measures analysis of variance of the overall design revealed no significant interaction among overview position, overview type, and the time interval. One significant main effect was a significant increase in overall scores over time.

Results from this study suggest that pictorial overviews were no more effective in facilitating adult learning of prose text than their verbal counterparts or a no-overview control condition. In addition, overviews in either a pre- or post-position were ineffective in facilitating adult learning of prose text. Finally, none of these treatments were effective over a time interval for the population.

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CHAPTER I

Introduction

In the past, all the education that one really needed for a lifetime was attained in a few years of public school. Today, as a result of ever-accelerating technology, the knowledge gained during these formal school years in public school is no longer valid ten years later (Knowles, 1970). The rapid information explosion that has characterized this century has resulted in more and more adults who need or wish to be "re-schooled" or to continue their schooling.

There has been a considerable amount of literature produced which has addressed the learning behavior of college students. This literature deals primarily with people who have not yet left what can generally be referred to as the normal educational stream. That is, a university can be viewed merely as an extension of the public school system. The present study attempted to address a larger group of adults than those who are narrowly defined as "undergraduates". Adults are herein defined as students who are attending "continuing education" courses intended for those no longer directly involved in the formal public school stream.

The paucity of research in the realm of adult learning has been noted before (Glynn & Muth, 1979). The traditional focus has been on undergraduates or children still a part of the normal schooling continuum. As a result of this, when courseware is needed for adults, the instructional designer is obliged to rely on techniques and materials based on the research conducted on younger learners.

Adults are not just "big kids" (Kidd, 1973) any more than children are miniature adults. It is therefore important for the Educational Technologist

or anyone else involved in instructional design to initiate serious and systematic examinations of the special learning characteristics of this growing population. The current study was such an examination focussed on one aspect of adult learning, that is, learning from prose materials.

Prose Text

The prose text, in spite of recent applications of electronics to instruction (e.g. television, computers), remains the primary medium for transmitting large amounts of information, both inside and outside the classroom. Unlike its modern counterparts, text "is still a relatively cheap, accessible and flexible source of learning and hence will probably continue to be a major source of instruction for a long time to come" (Gagne, 1978, p. 629).

Researchers as well as teachers have recognized the importance of prose text in instruction and have spent many years attempting to optimize its influence on learning. The analysis of adjunct learning aids is one of the alternative approaches which have been taken in recent years. Adjunct learning aids are supplementary "bits" of information intended to enhance the learning of a core passage. Such aids include headings, objectives, organizers, orienters, overviews, questions and pictures.

The Role of Pictures

Of these, pictures rank as one of the most widely used supplements to modern instructional materials. However, in spite of this apparent popularity, Dwyer (1978) points out that:

> There is little available evidence supporting the contention that visual illustrations in textbooks currently on the market add proportionately to learning. Furthermore, there are no guidelines available to indicate where visual materials should be placed in the content material, what kinds of visuals should be employed, and how visualization should be organized to benefit from the use of questions, advance organizers, covert and overt responses, etc. (p. 118).

In addition, there is little evidence to support the generalization of results from children's pictorial materials to materials designed for adults (Levin & Lesgold, 1978).

Pictures have been utilized as prose adjuncts for centuries (Orbus Pictus, 1658) but have only recently begun to attract research attention. It is thought that pictures increase learner interest and add attractiveness to the printed page. The result of this general sentiment has promoted the design of pictorial materials based on aesthetic criteria (Levin & Lesgold, 1978). However, one wonders at the sagacity of this use of illustrations in view of their relatively high cost. This is of particular concern because, as yet, there are no conclusive results supporting pictorial facilitation of learning or improvement of reading comprehension. Reviews by Fleming (1979), Hartley (1978), and Duchastel (1981) reiterate the general lack of research evidence on picture/text interaction. Clearly, more research is needed in order to improve our understanding of the effects of pictures on the learning of prose materials.

Duchastel (1978) argues that pictures can perform three major roles

when they are used in conjunction with prose instructional materials. The attentional role is primarily for motivational purposes and as such the picture is intended to add interest and appeal to otherwise bare textual formats. Illustrations fulfilling an explicative role directly portray an aspect of the passage content which is not clearly defined or explained by words alone. Finally, the retentional role of pictures is the least researched and yet possibly the most valuable of the three. Retentional pictures, according to Duchastel, function much like other adjunct aids (e.g. overviews, outlines) in that they provide the learner with a conceptual plan of the passage content. However, unlike verbal adjunct aids, their pictorial characteristics may promote longer retention of the content structure, thus increasing the probability that subsumed prose materials will be remembered.

Likewise, Levin (1979) hypothesizes eight major functions of pictures in prose. These include decorative, remunerative, motivational, reiterative, representative, organizational, interpretational, and transformational. The first three of these functions correspond well with the attentional illustration proposed by Duchastel. None, however, is likely to have a great influence on learning. Their primary purpose is to make people buy and want to read a given text.

Reiterative and representational illustrations fall nicely into Duchastel's explicative category. These types of illustrations, for suitably adaptable prose, serve to concretize information provided in text, thereby offering a moderate but potentially significant contribution to improved understanding.

The final three functions put forward by Levin generally fit under Duchastel's retentional classification. They have the greatest potential

for contribution to the learning of prose material. The organizational illustration is one which would serve to help the learner handle text which is "less than optimally" organized. The interpretive illustration is one which guides the learner to better understanding of potentially meaningless information by relating that material to existing knowledge. An example of such an illustration might be a pictorial advance organizer (e.g. Ally, Note 1).

The final pictorial function proposed by Levin, the transformation function, is the one which has the greatest relevance to this study. As Levin points out:

> ... the transformation function is reserved for prose passages whose constituents may not be that difficult to comprehend; but which contain information that is difficult to remember. (p. 21).

He finds such illustrations to be particularly useful in "medical and other scientific texts, where easily identified concepts, principles and functions have to be associated with unfamiliar technical terminology" (p. 21). It is felt that investigation of such a type of prose material is particularly relevant when it comes to adult learners. Typically, children learn from prose text which is relatively easy to concretize whereas adults are often confronted by dry, abstract, difficult to concretize material.

Support for Duchastel and Levin's views on the potential effects of pictorial adjuncts is provided by Paivio's (1971) research into the effects on long-term memory of pictures interacting with words. Paivio sees cognitive processing as being a dual-coding activity. He believes that information received can be stored via a verbal code, an imaginal code,

or a combination of both. His research (1971, 1975) provides evidence that there is a redundancy effect of combined encoding (e.g. pictures and words) which leads to optimal learning. Paivio (1971) asserts that "Memory increases directly with the number of alternative memory codes available for an item" (p. 179).

Pictures as Overviews

In many applications, pictures are not unlike the commonly employed verbal overview. Overviews, here, are defined as simplified summaries of the main ideas of a passage. With this definition in mind, one has only to refer to an illustrated textbook (e.g. Lefrancois, 1978) or a daily newspaper to find examples of pictures serving in an overview capacity. Pictorial overviews often act as devices which reiterate the main elements of relevant textual material.

Ideally, studying an overview should provide the learner with a tool which can transform the confusing and difficult to remember verbal input into a more memorable state. Having been provided with the main ideas of the passage the learner should be able to sort and organize the contents of the learning passage in a fashion which is more meaningful. This, in turn, should improve both overall learning and retention.

Verbal overview research, much like pictorial research, has also proven to be inconclusive (Hartley & Davies, 1976). There is as yet no firm evidence that verbal overviews are effective facilitators of learning from prose text. Nonetheless, verbal overviews are relatively simple to construct and remain a favourite instructional aid of classroom practitioners. In view of this popularity and practicality, research should begin to explore new ways of optimizing their effectiveness.

Brody and Legenza (1980) compared the effects on learning of prose text of two types of pictorial aids. One of these types was an overview and the other was a picture illustrating a specific activity mentioned in the passage. They found that the pictorial overview was more effective in facilitating learning than the picture portraying a specific activity. However, they did not compare that overview to a similar verbal overview or to a control condition which had no aid whatsoever. In other words, the favourable results achieved may not have been because of the pictorial nature of the overview. Rather, it could merely have been because of the overview information presented.

A more rigorous examination of the effects of the pictorial overview seems warranted. The current study further inquired into the effects of pictorial overviews on learning from prose but did so by providing a comparison with matching verbal overview treatments. In this manner, it was possible to get a clear view as to whether or not the pictorial nature of the overview was differential in its effect than that of a verbal counterpart.

Picture Position

The inconclusive results experienced in both pictorial and verbal overview research may be due in part to the emphasis which has been adopted by many researchers. Researchers have tended to focus on the question of "what happens if I use this adjunct learning aid?" rather than the more complex and more important question of "how and under what conditions does this adjunct aid work?" One way in which adjunct learning aid researchers in other areas of concern have attempted to answer this latter question is to consider the effects of positioning of the learning aid.

Rothkopf (1970) has developed a theory which can help explain the operative effects of adjunct aids. According to Rothkopf, a student cannot properly learn unless s/he actively incorporates the new material into his/her cognitive structure. He terms such activity "mathemagenic", meaning "activities that give birth to learning" (1971, p. 288). Rothkopf's (1971) underlying philosophy regarding the processing of written text is that the student's

> ... activities determine to a very important degree what the effective stimuli will be; i.e. the student is the final determinator of the nature of internal representation of the text. The nature of the internal representation, in turn, determines what is learned (p. 322).

The operative task, in the Rothkopfian sense, will be to somehow influence student activity so that the internalized representation of the text is as strong and enduring as possible.

Most of Rothkopf's work in this regard involves the analysis of the effects of interspersed questions in prose text (e.g. 1966, 1971). Two important findings have resulted from his work. First, questions placed before a target passage are inferior to those placed after a passage in terms of overall learning. Second, close analysis reveals that learners from pre-conditions tend to learn only intentional information, whereas those in the post-conditions are able to learn both intentional and incidental material. Rothkopf hypothesizes that by administering a suitable stimulus after a target passage one can build in covert or overt searching of just-read material, thus strengthening the memory trace, which will allow better and more durable retention.

Such an effect is not as potent for stimuli placed in the pre-condition.

Little research has been done regarding the positioning of pictorial aids. Brody and Legenza (1980), in their study, provide some support for Rothkopf's ideas, finding that a pictorial adjunct in the post-position is more effective than that adjunct in a pre-condition. Conversely, Bransford and Johnson (1972), in a study on the contextual prerequisites for understanding, provide evidence that the positioning of an appropriate pictorial orienter after a passage has no effect on comprehension and recall, whereas positioning it beforehand has a marked effect on overall understanding and recall. The inconclusive results of these studies may be explained by radical differences in experimental materials. Bransford and Johnson used an especially ambiguous passage, whereas Brody and Legenza used a natural non-ambiguous passage. In view of the unusual nature of the Bransford and Johnson passage, and the fact that their study was concerned more with the investigation of prior knowledge than pictures per se, the author favors the results of the Brody and Legenza work. As Brody and Legenza point out, the pictorial aid stimulates mathemagenic activity in the post-condition. It causes the learner to review covertly the just-read verbal material and attempt to tie it in with the picture. This additional cognitive processing may have been responsible for improved learning.

The positioning of the pictorial adjunct learning aid is an important variable to explore. Knowledge of the relative effectiveness of various placements of the aid can allow the researcher to identify where that aid is most advantageous. Positioning also permits the researcher to gather inferential evidence as to the type of cognitive processing which may be most effective in facilitating learning. That is, does the aid cause more

efficient encoding of the information or does it act as a stimulant for complementary review?

Statement of the Problem

The overriding purpose of this study was to attempt to extend the findings of existing literature to adult prose processing. Specifically, the study (1) investigated whether or not pictorial overviews have a facilitative effect on learning; (2) compared the effectiveness of pictorial overviews to matching verbal overviews; (3) examined the effects on learning of manipulating the position of the overviews; and finally, (4) evaluated the effects on learning of the two types of overviews over time.

CHAPTER 2

Literature Review

Much of the research with prose text can be broken down into two main categories. There are researchers, especially in recent years, who have begun to think of learning from prose in terms of the effect of the internal structure of the passage. On the other hand, the traditional approach seems to have been to take the passage and its idiosyncratic structure as a constant and attempt to add external aids to improve its overall effectiveness as an instructional tool.

The former group of researchers (e.g. Mandler & Johnson, 1977; Meyer, 1975), although they have developed well-substantiated approaches to the analysis of prose materials, do not offer much in the way of assistance to one who might wish to design an instructional passage. As one reviewer puts it, "the representation [of the structure of the prose passage] that is obtained is an extremely complicated, informal graph or tree structure which defies application to studies of curriculum and instruction" (Shavelson & Stasz, 1977). At this point, this internal emphasis does not appear to be a useful approach for the course designer, who is typically very much constrained by economic and temporal factors.

Conversely, the research that has been done in the realm of external aids to prose learning has come up with many techniques which are practical and have potentially direct application to instructional design problems. Advance organizers (e.g. Ausubel, 1960; Mayer & Bromage, 1980), contextual organizers (e.g. Bransford & Johnson, 1972; Schallert, 1976), goals and objectives (e.g. Gagne & Rothkopf, 1975; Morse & Morse, Note 2), graphic aids (e.g. Rigney & Lutz, 1976; Main, Note 3), mathemagenic activities

(Rothkopf, 1970), outlines (e.g. Staley & Wolf, Note 4), and typographic aids (e.g. Glynn, 1978) are all examples of this very wide area of research activity.

One valuable external aid to prose learning which has received relatively little research attention in the past two decades, however, is the pictorial adjunct.

Pictures as Adjunct Aids

Some research on pictorial aids has been attempted although until very recently there seemed to be little real interest in this area. In the early 1970's, several researchers (e.g. Holliday, 1973; Carroll, Note 5) came to the realization that in spite of the fact that images were fast becoming the replacements for written words, little seemed to have been done to study this form of communication. As Gombrich (1972) points out, it is now

> ... all the more important to clarify the potentialities of the image in communication, to ask what it can and cannot do better than the spoken or written language. In comparison with the importance of the question the amount of attention devoted to it is disappointingly small (p. 82).

Of particular importance to instructional designers, who are typically restricted to a heavy emphasis on prose materials, is whether or not the image can have any effect on the learning of material presented in a prose text format.

Pre-1970 Research. Prior to 1970, the research done on the effects of pictures on the comprehension of prose material was not at all encouraging

(Levin & Lesgold, 1978). Miller (1938) studied the effects of illustration on learning with 600 primary school children. His subjects were assigned into two groups, one which received textbooks with illustrations and the other which redeived the same textbooks without illustrations. After a full semester, subjects were tested to see if there were any differences between the two groups. The data gathered showed that children who read text without pictures performed equally as well as those who had used illustrated texts. Vernon (1953, 1954) conducted a number of experiments with children of several age groups. She too found that the use of illustrations neither helped nor hindered the acquisition of knowledge from text. Weintraub (1960) used second grade children as subjects and found that those treated with textbooks which had the illustrations covered actually scored better than those who were exposed to both pictures and text.

Some comparisons using orally presented textual materials were also conducted. Magne & Parknas (1963), in the third of a series of experiments, measured retention of learning material that had been presented via a filmstrip to one sample group of children (11-12 years old) and via a standard oral lecture to another. They found evidence which corroborated the earlier findings. Baker & Popham (1965) used a slide-tape instructional program to investigate the effects of pictorial embellishment on the learning of textual material. There was no significant advantage found for the group that was treated with the slide-tape version of a prose text.

Motivational Effects of Pictures. In spite of the generally nonsupportive results that had been reported previous to the 1970's, there was a glimmer of hope. Certain researchers had found some evidence that pictures did increase the motivation of students to read textual materials

(e.g. Whipple, 1953; Schonell, 1961). These encouraging results had intuitive support as well, and resulted in the growing employment of pictures in prose materials. However, the question still remained as to whether or not illustrations in textbooks were actually beneficial to the process of learning the accompanying verbal material (Weintraub, 1966).

Deleterious Effects of Pictures. There was a growing suspicion amongst educational researchers that pictures, especially when employed in children's textbooks, actually tended to distract attention from the accompanying prose (e.g. Vernon, 1953; Chall, 1967; Samuels, 1967). In a very controversial review of pictorial research to that time, Samuels (1970) concluded with the statements that:

> 1. The bulk of the research findings on the acquisition of a sight vocabulary was that pictures interfere with learning to read.
>
> 2. There was almost unanimous agreement that pictures, when used as adjuncts to the printed text, do not facilitate comprehension (p. 405).

These conclusions were supported by Concannon (1975), who added that it was not yet time to give up on pictorial aids. Her suggestions included a call for more effective experimentation across a wider range of age levels and an increased awareness of individual differences. Concannon argued that both better quality research and a greater quantity of research were required before a final decision regarding the use of pictorial aids in prose text could be made.

Pictorial Research in the 1970's. These findings and comments stimulated a flurry of activity in the 1970's (Levin & Lesgold, 1978). Researchers, who could not understand how something so intuitively effective had proven to be so ineffective under research conditions, began to look closer at pictorial adjunct aids.

The bulk of this research has been in the area of studies on children's learning. Lesgold, Levin, Shimron and Guttman (1975) used first grade children to study the effects of "imposed" pictorial treatments. Children were first asked to listen to a story. They were then asked to either construct a depiction of the story, assemble the depiction using already cut-out components, watch an experimenter construct a depiction, or color in geometric shapes not related to the story (the control group). The findings of this study were not supportive of the pre-1970's research in that with the exception of the personal creation task, the pictorial treatments were clearly beneficial to subjects in terms of increasing their memory of stories. One very extensive study (Rohwer & Harris, 1975) focussed on the effects of illustrations on the learning of prose text for both high and low socio-economic status (SES) fourth grade children. These researchers assigned subjects to oral, print, pictorial, print plus pictorial, oral plus pictorial, oral plus print, and finally, oral plus print plus pictorial treatment conditions. They found that although the high SES group seemed to benefit little from the pictorial adjuncts, the low SES groups evidenced significantly superior performances when treated with these aids. The oral plus pictorial treatment appeared to be most optimal for this facilitation effect (see also Matz & Rohwer, Note 6). Jahoda, Cheyne, Deregowski, Sinha and Collingbourne (1976), in a study using older children from various

cultural regions, found that presenting instructional textual material to subjects in both pictorial and textual modes was more effective than simply presenting it in either pictorial or textual forms. Guttman, Levin and Pressley (1977) conducted a study which examined developmental differences among first, second and third graders. In all instances it was found that pictorial illustrations used with verbal materials produced learning that was superior to a control group not exposed to illustrations.

One of the major arguments raised against these apparent facilitative effects of pictures on learning from prose was that the picture merely acts as a redundancy of the information that is given in the text (Levin, Bender & Lesgold, 1975; Ruch & Levin, 1977). In order to test this argument, Ruch and Levin (1977) performed a study using third grade children who were assigned to conditions of text only, repetitive text, and pictorial text. The condition with the pictorial adjunct was not significantly better than the repetitive condition when learning was tested with verbatim items. However, when learning was assessed using comprehension questions, the pictorial text condition was significantly superior to all other conditions. The implication here is that pictures offer more than an improvement in the quantity of learning. They may facilitate an improvement in the quality of that learning.

To the best of the author's knowledge, the research that has been done with adult learners (as defined in this paper) is non-existent. However, during the past decade, several studies have been undertaken which used college undergraduates as subjects (Snowman & Cunningham, 1975; Royer & Cable, 1976; Schwartz, Kulhavy & Finlay, Note 7). Unlike the majority of the child studies undertaken, these studies have concerned themselves with

written rather than oral text. Snowman and Cunningham examined the effects on learning of pictorial and written (questions) adjunct aids interspersed through text. They attempted for the first time to see if there was a mathemagenic effect of self-generated pictorial aids and, if so, whether or not it was superior to written questions in the facilitation of learning. The results seemed to be generally in accordance with other mathemagenic studies (e.g. Rothkopf, 1966; Frase, 1968; Rickards, 1976) which indicate that verbatim post-questions are superior to verbatim pre-questions. More important, it was shown that a self-generated pictorial adjunct aid was equally effective as the post-questions in the post-condition.

A second study which concerned itself with undergraduates (Royer & Cable, 1976) studied the effects of five versions of an initial passage on the comprehension of a subsequent abstract passage. These five conditions were characterized as abstract with illustrations, abstract with analogies, concrete, unembellished abstract or a control passage. The former three conditions were significantly more effective than the latter two in facilitating recall of the ensuing abstract text. Of particular importance here is the fact that in these three superior groups the common denominator seems to be an imagery-generating capability. None of these three was found to be significantly different from any of the others, but all performed better than comparison groups which had no imagery-generating capability.

Finally, Schwartz, Kulhavy and Finlay (Note 7) investigated the effects on learning of spatially organized verbal material embedded in a map-like pictorial adjunct aid. They attempted to determine whether or not

such a representation could serve as a framework for storing related information from an accompanying text. The passage utilized presented a story regarding the sites depicted in the pictorial aid. These researchers found that, when associated with spatially-related map features, the factual recall of discourse was significantly enhanced. The results of the study offer evidence that redundant approaches to the presentation of textual material act as "coordinates" which make it easier to recall that information from memory.

Limitations of Pictorial Research. There are some major observations which can be made regarding the accumulated literature on pictorial adjuncts during the 1970's: (1) very few studies have been done which address the problem of facilitating adult learning from prose; (2) little effort has been made to determine how pictures work to improve learning; (3) passages used are inevitably of the fictional story-like variety; generally very easily represented in whole or in part by specific pictorial representations; (4) memory tends to be checked by the recall of factual material alone; (5) with a few notable exceptions, learning tends to be assessed only by an immediate posttest; and finally, (6) primarily with the children's pictorial research, the majority of the studies have employed oral rather than written prose.

ADULT LEARNING

The current study took the above limitations into account and attempted to develop a unique approach to the examination of a pictorial adjunct aid. To begin with, the sample selected came from a population of adults involved in continuing education programs. If, as the research indicates (Levie, 1973), adults are more adept as discerning and interpreting relevant visual material, then the use of pictorial adjunct aids may be even

more appropriate for adult learners than it is for children.

PICTURE FUNCTIONING

Second, this study examined pictorial illustration from a functional point of view. Denburg (1976-7) asserts that enough time has already been spent providing evidence that illustrations are effective as facilitators of learning. What is needed now is more effort to determine how pictures facilitate learning from prose. The current study employed pictures in two different positions around a written prose passage in an effort to derive some indication of the manner in which illustrations affect learning behavior.

PASSAGE CHARACTER

Unlike the majority of pictorial research that is done in the area of prose learning, the current study chose a print, non-fictional, natural prose text to serve as the main experimental passage. This passage was produced so that it was not easily adaptable to pictorial representation. As a result, the passage was difficult and unfamiliar (see Table 1) but well suited for the study of the effects of pictorial adjuncts on learning (Royer & Cable, 1975; Levin, 1979).

ASSESSMENT OF LEARNING

Another of the limitations of pictorial research to date is the fact that most studies measured learning in terms of factual recall alone. Many researchers have come to realize that perhaps the most important factor in determining how much we retain from a prose passage is comprehension (e.g. Royer & Cable, 1975) rather than mere factual regurgitation. In the current effort, total free recall and comprehension were measured along with factual recall to ensure that if differences did occur, the researcher

Table 1

Absolute and Relative Frequencies for Subjects on a Self-reported "Familiarity with Passage Content" Question

Scale		Absolute Frequency	Relative Frequency (%)
Expert Knowledge	7	0	0
	6	0	0
	5	2	1.6
	4	13	10.7
	3	24	19.7
	2	27	22.1
Not Familiar	1	44	36.1
No Response		12	9.8

stood an excellent chance of detecting them. It is revealing to note that in the Ruch & Levin (1977) study, pictorial facilitation was unobservable on the strictly verbatim portion of the dependent measure, and yet the results of the pictorial group were significantly superior to all other treatment groups on the comprehension portion.

RETENTION ACROSS TIME

Although delayed posttesting has clearly been ignored by most researchers in the pictorial domain (Levin & Lesgold, 1978), it remains, in this writer's opinion, an essential ingredient in any prose learning investigation. It is of little value to the practicing educator to discover that a given aid has only an effect upon immediate learning. The practitioner is interested in long-term influences to a far greater extent. Several recent studies in the pictorial domain have shown facilitative effects only on the delayed posttest (Peeck, 1974; Haring & Fry, 1980; Ally, Note 1). One other study in which subjects were directed to use imagery to aid in encoding also found facilitative effects only in the delayed condition (Kulhavy & Swenson, 1975). With this recent evidence in mind one can only speculate on how the results of the Snowman and Cunningham (1975) study would have turned out had those researchers considered learning over a time interval. The results in that study indicated a parity between verbal and pictorial questioning strategies, but only examined learning immediately after the learning task. In order to explore further this important topic, the current study was designed as a repeated measures paradigm.

Picture Position. Very few researchers have concerned themselves with the effects on learning of pictorial adjunct aids in various positions around a prose passage. In an unpublished study reported in Concannon (1975),

Lavelle (Note 8) compared the effects on comprehension of five different treatments: a prose passage with color illustrations, with black and white illustrations, with illustrations before, with illustrations after, and finally, with no illustrations. There were no significant differences among these treatment groups. Particularly notable in this study was the fact that the effects on learning were measured by considering responses to factual, interpretive, and evaluative questions.

Snowman and Cunningham (1975) took this study one step further, and focussed exclusively on the effects of pictorial and written adjunct aids with respect to their physical locations around a prose text. These researchers were attempting to duplicate the findings of Rothkopf (1970) regarding the facilitative effects of interspersed questions. Snowman and Cunningham specifically employed verbal and pictorial questions as the two forms of adjunct aid. They found that both the post-verbal and the post-pictorial groups performed significantly better than the two pre-conditions and the control. One of the major recommendations of this work was that:

> ... a replication may... further clarify the present findings comparing pictorial aids to written aids. Given a reading passage that could potentially produce more variance, it would be interesting to see if pictures produce a stronger mathemagenic effect or if they act at the same level as questions as they did in the present study (p. 30).

The results of the Snowman and Cunningham study clearly support those of Lavelle (Note 8). Pictures seem to be no more effective than their verbal counterparts.

Brody and Legenza (1980) also attempted to study pictures in a mathemagenic framework. This time the pictures that were used were not subject-generated. They were, in fact, realistic pictures which were simply positioned before and after a prose passage. The findings of this study support those of Snowman and Cunningham (1975) in that the pictures in the post-positions were significantly more effective than the pre-condition pictures in facilitating learning. The major limitation of the Brody and Legenza work is that it does not provide a matching verbal treatment for the pictorial adjuncts. It is not logical to conclude, as they have, that pictorial adjuncts facilitate learning when placed in the post-position. The fact remains that it may simply be the verbal information represented by the picture rather than the unique characteristics of the pictorial mode that caused the positive results.

In summary, the research in the area of picture position is clearly very meager. There are indications that pictures can act only as effectively as prose counterparts in encouraging mathemagenic activity leading to improved learning. Pictorial superiority may be demonstrated, however, if such studies were replicated and examined over time. Also, only Lavelle (Note 8) considered other than factual questions in the dependent measure. A more in-depth look at the comparative effects of pictorial aids and similarly designed verbal aids might suggest differences which have so far been obscured by inappropriate dependent measures.

Picture Processing. Salomon (1972, 1978), among others, has become concerned about the actual cognitive processing that goes on when one internalizes media representations. He speculates as to the types of covert operations that are being stimulated when the viewer is confronted with a

visual array. Salomon (1972) lays down certain conditions under which it is likely that a given visual input will in fact be internalized by an observer. To begin with, there must be a perceived need to process the information. Second, the observer must be capable of internalizing the representation. S/he must be familiar with the symbol system that is being used (i.e. visually literate). Finally, the incoming representation should in some way be organized so that it matches the way we might represent the embodied information to ourselves (see also Levie, 1978).

Salomon feels that a "presentation can be said to accomplish a supplanting function when it replaces the covert operation which the learner would have to activate on his own" (p. 401). He goes on to hypothesize that:

> ... a learner who is exposed to a film (or any other medium) which supplants a mental process, or image, given that the previous conditions have been met, is very likely to imitate, internalize, and use as a generalized schema the process which he observes (p. 401).

In terms of the pictorial representation used in the current study it would be expected that if the representation met the conditions itemized above, then it should be internalized by the subjects and used to structure the embodied information. The pictures should become "not only vehicles for information but 'tools of thought' as well" (Salomon, 1972, p. 418).

Salomon (1978) explains a concept of "notationality", (based upon Goodman, 1968), which acts as a warning to those who do not carefully consider the actual structure of the incoming pictorial representation. In simplified terms, if one were to exemplify a notational symbol system, one would think of a piece of written prose. On the other end of the spectrum,

a non-notational symbol system is exemplified by a painting of the "gardens at Givenchy" by Monet. "Pictures... are non-notational inasmuch as their visual surfaces are not composed of readily identifiable inscriptions assignable to characters in a notational schema" (Gardner, Howard, & Perkins, 1974, p. 32). Salomon (1978) suggests that when life-like incoming (non-notational) representations are perceived, it is possible that they are not as deeply processed as their notational counterparts because less intellectual effort is needed for encoding. This line of thought led the researcher of the current study to ensure that the pictorial representations employed were positioned somewhere between the extremes of the notational continuum to attempt to maximize the encoding effort of the subjects.

Paivio (1971) has proposed a specific explanation of the processing of pictorial information which has gained more and more support in recent years. In his view, there exist two memory systems, one for verbal symbolic processes and the other for non-verbal imagery processes. This hypothesis makes the underlying assumption that pictures are encoded both as visual images and as verbal codes, whereas words are not always encoded in a dual manner. Concrete words (words which have an easy visual referent) are encoded in a similar fashion to pictures. Abstract words (no easy visual referent), on the other hand, are only encoded verbally. Paivio emphasizes that information which has imagerial attributes will be more richly endowed and hence more thoroughly processed. This extra processing is expected to improve the strength of the memory trace.

Paivio's (1971, 1975) ideas make good intuitive sense as well. As any practitioner is likely to point out, the greater the variety of ways in which a given bit of information is presented, the better are its chances

of being recalled. The results reported by Paivio are supported by another body of research on "elaboration" (for an excellent review, see Reder, 1980). The notion of elaboration is that "the more extra processing one does that results in additional, related or redundant propositions, the better will be memory for material processed" (Reder, 1980, p. 7).

Paivio's dual-coding hypothesis seems to have received considerable support from the pictorial research conducted during the past decade, as there now seems to be little doubt that pictures can facilitate learning from prose materials (Levin, 1979). The current study will further examine the validity of this hypothesis.

Overviews as Adjunct Learning Aids

Overviews are simplified summaries of the main ideas of a passage. According to a recent review (Hartley & Davies, 1976), very little research has been conducted on overviews, primarily because their value has been for the most part taken for granted. Most of the research related to their use was done using instructional film as the learning medium. Lathrop and Norford (1949) did an extensive study using ninth grade students to determine whether or not summaries or introductions would have any facilitative effects on learning of material presented in films. In neither case were significant results achieved. These researchers were able to conclude, however, that summaries and introductions, in almost all cases, made small positive contributions (in one case an introduction actually produced an adverse effect on learning). Measurement of learning in this early study was carried out through the administration of a factual multiple-choice test.

It is felt that outline studies are potentially relevant to considerations of overviews, due to the fact that outlines are, in actuality, simply skeletal overviews. Northrop (1952), with a huge sample from a population of military recruits, studied the effects on learning of organizational outlines in instructional films. For film of the type where the contents were not inherently well organized, the addition of audio and visual outlines resulted in significant improvements in the amount of material recalled. A more detailed outline was not significantly superior to a less detailed outline in the facilitation of learning. This study also concluded that adding outlines or organizational materials to films already well organized may even reduce learning. These and one further film-related study (Wulf & Kraeling, 1961), reported in Hartley and Davies (1976), all seem to support generally the use of overviews as instructional aids to learning, although these researchers can only claim "small indications" of such facilitative effects.

More recent work has been done using outlines before prose material instead of before filmed material. This research, too, has been minimal, but evidence has been found to show that when outlines accompany a prose passage at the time of encoding, learning is facilitated (Staley & Wolf, Note 4). These researchers used an outline which was skeletal in nature and which contained a title and six major headings. The actual words used in the outline were not repeated in the passage. Although both an outline before encoding and an outline during retrieval resulted in greater immediate and delayed recall than the no-outline condition, the highest recall was associated with the outline available at recall. This finding is supported by Glynn and DiVesta (1977).

A study which purportedly tested advance organizers amongst other types

of aids (Santiesteban & Koran, 1977) actually used a verbal overview instead of the "advance organizer" as conceived of by Ausubel (1968). None of the treatment groups (advance organizer/overview, objectives, and questions were the treatments) performed significantly better than any of the others or the control. In fact, there was a slight indication that the advance organizer/overview group may even have performed worse than the other treatment groups.

One of the few studies to have considered a pictorial overview as a possible adjunct aid is that of Reynolds (1966). In that study, an integrated perceptual structure was employed in lieu of the typical organized verbal structure (e.g. organizer, overview, etc.) and was compared with what were essentially a set of control treatment conditions. This strategy was used to ensure that the effects found for the pictorial treatment group would be most likely due to the nature of the illustration. This pictorial overview was a simple map which was vaguely related to the substance of the sentences to be examined. Embedded within this diagram were the main ideas of the eight sample sentences which served as the instructional materials. As Reynolds summarizes, the consistently superior learning (there were seven recall trials) of this pictorial overview group "was not attributable to the simple map components... but rather to the organization of the various components into a single structure" (p. 388).

The current study employed pictorial overviews that followed these same general guidelines. Major concepts buried in the instructional passage were extracted and embedded in a diagram containing pictorial representations vaguely related to the subject matter. It was predicted that the organization of the main concepts in an integrated pictorial platform would help improve retention of the information presented in the passage.

The Reynolds (1966) study notwithstanding, the fact remains that so little has been done to determine the effects of overviews on prose learning, that no substantive conclusions can yet be made. The current study extended the literature in this regard by providing more tangible information on the learning effects of overviews.

Subject Aptitudes

In spite of the fact that subject aptitudes may have substantial effects on subsequent performance of learning tasks, most research in the realm of prose processing has rarely taken aptitudes into account (Zimmer, Glover, Ronning & Petersen, 1979). Studies that have reported the effects of different subject aptitudes are rare, and those that have (e.g. Todd & Kessler, 1971), seem to have been virtually ignored.

Reading ability is an aptitude which has been isolated as an important contributor to overall criterial variance amongst subjects (Bernard, Note 9). In the case of adult subjects, this variable becomes even more important because of widely variant backgrounds and experience. The current study, which deals with adult processing of prose text, tested the respective reading abilities of its subjects, using the Nelson Denny Reading Test (Nelson & Denny, 1973).

Hypotheses

The primary purpose of this study was to examine the effects of pictorial and verbal overviews on the retention of prose materials. A secondary purpose was to investigate these effects in terms of the position of the overview around a prose passage. Finally, the effects of these various treatments of overviews were examined for their durability over time. The following hypotheses were generated from the above literature

review to guide the experiment:

1. It was expected that the pictorial overview treatment groups would display greater overall learning than either the verbal overview treatment groups or the control group. The dual-coding of the main ideas of the learning passage in the pictorial treatment groups was expected to ensure this superiority.
2. It was expected that the post-pictorial treatment group would prove to be the best overall performer of all experimental groups. This was expected for two major reasons. The dual-coding mentioned above would be operative, thereby strengthening the memory storage of each subject. Also, the pictorial overview in this position would act as a stimulant to mathemagenic activity (Rothkopf, 1970). Two previous pictorial studies provide some support for this prediction (Snowman & Cunningham, 1975; Brody & Legenza, 1980).
3. The pictorial groups were expected to show the least loss of memory on the delayed posttest. The concrete pictorial aid was expected to act as a mnemonic retrieval device as well as an encoding device. The post-pictorial group, again, was expected to stand out as the best overall performer, due to the additive effects of dual-coding and mathemagenic processing discussed above.
4. A final prediction was made regarding the type of information that would be recalled. It was expected that the pictorial treatment groups would perform better on the comprehension type questions than the verbal groups (Ruch & Levin, 1977).

CHAPTER 3

Method

Sample

The experimental sample for the immediate posttest consisted of 122 subjects, 98 of whom were enrolled at Champlain College, St. Lambert, and 24 who were enrolled at Concordia University, Montreal. The Champlain group was made up of three intact classes of 18, 40 and 40 subjects. The Concordia group was one intact class of 24 subjects. All subjects were continuing education students currently undergoing instruction in a variety of courses (including "Introduction to Adult Education", "English Composition", "Abnormal Psychology", "Personality Psychology", and "Warfare").

On the delayed posttest, this number was reduced to 94, due to student absence. There were 73 returnees from Champlain and 21 from Concordia.

Subjects ranged in age from 17 to 62 years with a mean age of 28 years (see Tables 2 and 3). The sample contained 50 males and 72 females (see Table 4). Ninety-four subjects listed their mother tongue as English, 16 as French, and 12 listed another language besides English or French (see Table 5). The mean score assessed by the Nelson Denny Reading Test was 33.7 (see Tables 6 and 7) which places this sample as a whole on the 37th percentile in reading ability.

Experimental Design

The design of this experiment constituted a 2x2x2 factorial with repeated measures on the third factor (see Figure 1). Type of adjunct aid

Table 2

Absolute and Relative Frequencies for

Age of Subjects

Experimental Group	Age (Years)	Absolute Frequency	Relative Frequency (%)
Pre-verbal	17-20	12	50.0
	21-30	8	33.3
	31-40	3	12.5
	41-50	1	4.2
	51-62	0	0.0
Pre-pictorial	17-20	6	25.0
	21-30	8	32.0
	31-40	2	8.0
	41-50	5	20.0
	51-62	3	12.0
Post-verbal	17-20	11	44.0
	21-30	8	32.0
	31-40	2	8.0
	41-50	3	12.0
	51-62	1	4.0
Post-pictorial	17-20	10	41.7
	21-30	3	12.5
	31-40	4	16.7
	41-50	3	12.5
	51-62	3	12.5

(cont.)

Table 2 (continued)

Absolute and Relative Frequencies for

Age of Subjects

Experimental Group	Age (Years)	Absolute Frequency	Relative Frequency (%)
Control	17-20	5	20.8
	21-30	14	58.3
	31-40	3	12.5
	41-50	0	0
	51-62	0	0
Total Sample	17-20	44	36.1
	21-30	41	33.6
	31-40	14	11.5
	41-50	12	9.8
	51-62	7	5.7
	Missing	4	3.3

Table 3

Means and Standard Deviations of the Experimental Sample: Age

Experimental Group	Subject Age	
	Mean	Standard Deviation
Pre-verbal	24.3	6.7
Pre-pictorial	32.5	14.1
Post-verbal	26.8	11.9
Post-pictorial	31.5	15.1
Control	25.0	5.4
Total Sample	28.0	11.7

Table 4

Absolute and Relative Frequencies for Sex of Subjects

Experimental Group	Sex	Absolute Frequency	Relative Frequency (%)
Pre-Verbal	Male	9	37.5
	Female	15	62.5
Pre-Pictorial	Male	9	36.0
	Female	16	64.0
Post-Verbal	Male	8	32.0
	Female	17	68.0
Post-Pictorial	Male	12	50.0
	Female	12	50.0
Control	Male	13	54.2
	Female	11	45.8
Total	Male	50	41.0
	Female	72	59.0

Table 5

Absolute and Relative Frequencies for

Mother Tongue of Subjects

Experimental Group	Mother Tongue	Absolute Frequency	Relative Frequency (%)
Pre-verbal	English	20	83.3
	French	1	4.2
	Other	3	12.5
Pre-pictorial	English	21	84.0
	French	3	12.0
	Other	1	4.0
Post-verbal	English	19	76.0
	French	4	16.0
	Other	2	8.0
Post-pictorial	English	16	66.7
	French	4	16.7
	Other	4	16.7
Control	English	19	79.0
	French	3	13.0
	Other	2	8.0
Total Sample	English	94	77.0
	French	16	13.0
	Other	12	10.0

Table 6

Means and Standard Deviation of

the Experimental Sample:

Nelson Denny Reading Test Scores

Experimental Group	Nelson Denny Reading Test	
	Mean	Standard Deviation
Pre-verbal	32.5	17.8
Pre-pictorial	36.1	17.1
Post-verbal	30.5	13.8
Post-pictorial	31.6	13.1
Control	37.5	11.1
Total Sample	33.7	14.9

Table 7

Absolute and Relative Frequencies and Percentiles for Nelson Denny Reading Test Scores

Experimental Group	Score Level	Percentile Level	Absolute Frequency	Relative Frequency (%)
Pre-verbal	0-15	1	6	25.0
	16-30	2-26	7	29.2
	31-45	27-66	6	25.0
	46-60	67-91	4	16.7
	61-71	92-99	1	4.2
Pre-pictorial	0-15	1	3	12.0
	16-30	2-26	8	32.0
	31-45	27-66	5	20.0
	46-60	67-91	6	24.0
	61-71	92-99	3	12.0
Post-verbal	0-15	1	1	4.0
	16-30	2-26	13	52.0
	31-45	27-66	7	28.0
	46-60	67-91	3	12.0
	61-71	92-99	1	4.0

(continued)

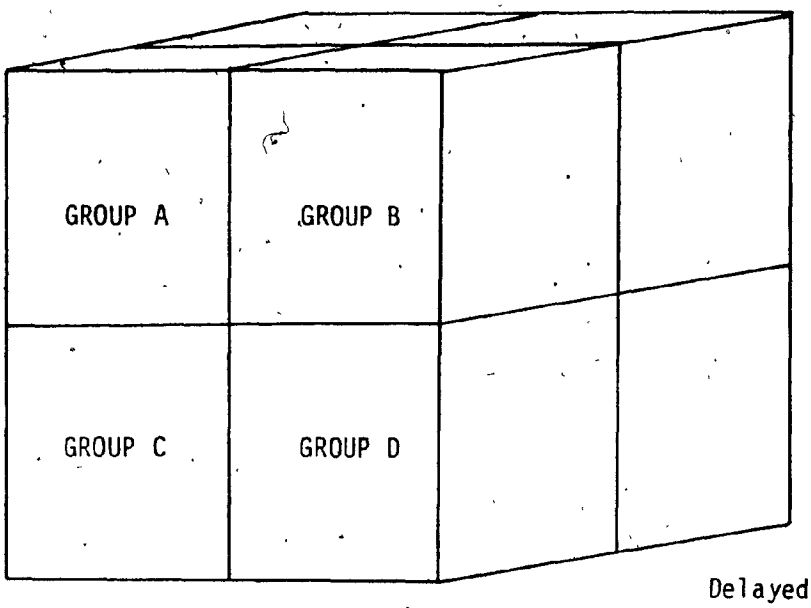
Table 7 (continued)

Absolute and Relative Frequencies and Percentiles

for Nelson Denny Reading Test Scores

Experimental Group	Score Level	Percentile Level	Absolute Frequency	Relative Frequency (%)
Post-pictorial	0-15	1	4	16.7
	16-30	2-26	6	25.0
	31-45	27-66	11	45.8
	46-60	67-91	3	12.5
	61-71	92-99	0	0.0
Control	0-15	1	0	0.0
	16-30	2-26	5	20.8
	31-45	27-66	14	58.3
	46-60	67-91	4	16.7
	61-71	92-99	0	0.0
Total Sample	0-15	1	14	11.5
	16-30	2-26	39	32.0
	31-45	27-66	43	35.2
	46-60	67-91	20	16.4
	61-71	92-99	5	4.1
	Missing	-	1	.8

TREATMENT GROUPS



CONTROL GROUP

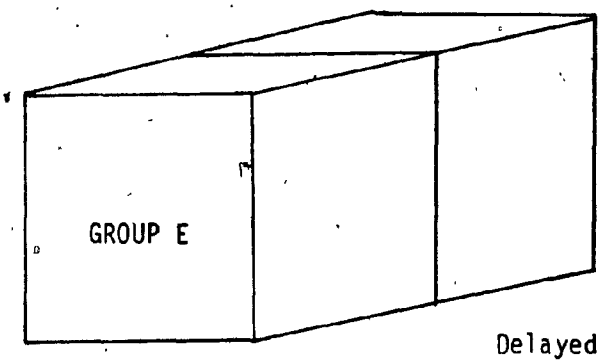


Figure 1. The experimental design.

(pictorial overview vs. verbal overview) and adjunct aid position (pre- vs. post-) were the between-group factors. Retention interval (immediate vs. delayed) was the within-group factor. The dependent measure consisted of two versions of a mixed free recall and multiple-choice test for the immediate retention interval and two different versions of the same multiple-choice test for the delayed retention interval. The dependent measure was designed to assess student performance in terms of recall, knowledge and comprehension.

Instrumentation

Dependent Measure. Subjects were tested both immediately after reading the experimental passage and two weeks later. In each case, they were examined by a 20-question multiple-choice test (Appendix G). Two different randomized versions of the test were produced for each of the retention intervals in order to counterbalance the questions. Each test consisted of two major divisions. Ten questions were knowledge type (Bloom, 1956), with stems which directly cued subjects to specific information contained in the text. Ten other questions attempted to assess the degree to which subjects were able to understand the essence of the passage; these were classified as comprehension type (Bloom, 1956) questions. All multiple-choice questions consisted of a main stem with four options including only one correct choice.

A free recall question was produced and administered to all subjects as a part of the immediate posttest. This question preceded the administration of the multiple-choice test and was worded in such a way that subjects were asked rather than obliged to "write down all that you can remember" (Appendix F).

Scoring of the recall protocols was carried out by the main experimenter. A scoring key was produced for this purpose by following a two-step procedure. First, subjects from the same population as the experimental sample were procured to norm the experimental passage for "idea units" (Appendix H). Idea units are here defined as "a single complete idea or block of information consisting of a sentence, clause or phrase" (Dean & Kulhavy, 1981). Second, two judges were contracted to produce composites of the tasks completed by these subjects. Finally, with these two composites, the chief experimenter compared and produced a main marking key. This whole procedure resulted in the identification of 167 idea units (Appendix J).

A Cronbach α test was used to assess the internal reliability of the multiple-choice test after the pilot study, one month before the main experiment. A pool of 36 questions was created by the author and used during the pilot. The reliability of the total 36 questions was calculated to be .70. The reliability of the 20 questions ultimately selected for the main experiment was calculated to be .77. Content validity of the final test was confirmed by two subject matter experts.

The reliability coefficients for the 20-question test used during the main experiment were calculated to be .55 on the immediate posttest and .87 on the delayed posttest. Another unusual development occurred during the administration of the test to subjects who had not viewed the experimental material beforehand. This group was comprised of students who had been absent from the initial phase of the experiment. The mean score achieved by this group ($n = 15$) was 7.0, two points above the score which would be expected by chance. These rather remarkable results will be discussed later in this paper. The mean difficulty indices for the test

were .42 for the immediate posttest and .36 for the delayed posttest. This indicates that the test should have been effective in spreading students out along a distribution of scores (Gage & Berliner, 1979). It also suggests that the test was in fact slightly more difficult than average.

Nelson Denny Reading Test (Nelson & Denny, 1973). In view of the fact that the experiment was concerned with the learning of prose text material, the Nelson Denny Reading Test was administered. It was felt that these test results would serve as good predictors of subsequent reading performance. Due to a time limitation, only the vocabulary section (Special Adult Cut-time version - 7½ minutes) was completed. Nelson & Denny (1973) report that the scores of a norming group of some 450 grade 12 students show that the vocabulary section corresponds very well with the accompanying comprehension section ($r = .696$). More importantly, the vocabulary test seems to be an excellent predictor of total reading ability ($r = .930$).

Materials

Main Passage. The 1610-word passage, produced by the chief experimenter, was typed double-spaced on seven 8½ x 11 inch pages of white paper (Appendix C). Information for the passage content was extracted from several contemporary educational psychology textbooks (Hilgard & Bower, 1975; Lefrancois, 1979; Rogers, 1969) and combined to formulate a comparative passage which discussed the similarities and differences of three general areas of learning theory; that is, Behaviorism, Cognitivism, and Humanism. The passage was constructed by selecting six different

attributes and then discussing the three learning theories with respect to each of those attributes, one attribute at a time. There was no attempt whatsoever to divide the passage into three sections, one for each learning theory group. In fact, every effort was made to ensure that there was as much intermingling as possible. It was hoped that such a construction strategy would further encourage subjects to use the overviews to help internalize the mass of incoming material. For those receiving the overview in the post position, it was expected that they might be encouraged to review and reorganize the just-encoded tangle of information.

In total, approximately one third of the written material was directed toward each learning theory. The main body of the passage was identical in all four treatment conditions and in the control condition.

The readability level of the passage was assessed, using the Dale and Chall (1948) readability formula, to ensure that it was consonant with that of the subjects in the sample. The passage was found to lie within the Grade 13-15 category, which matched the expected level of the sample.

Verbal and Pictorial Overviews. The verbal overview was a set of three concise prose paragraphs which stated briefly the main ideas, in turn, of each of the three major areas of concern in the passage. The pictorial overview was a set of three stylized black and white diagrams which contained, in verbal form, the main points of each of the learning theories (one learning theory per diagram) embedded, in no particular order, around a relevant representation. These exact verbal implants were underlined in the verbal overview to ensure that learners were equally alerted to the importance of the various noted terms. Every effort was made

to ensure that the two types of overview reflected the same main ideas, and did not provide additional information from the passage content. The pictures chosen for each theoretical area were selected due to their general relevance to the gist of the particular learning theory. The pictures were drawn and organized in a framework which was intended to emphasize the comparative relationship between the three groups. The main features of the key character in each sketch were in common in order to facilitate such comparison (Szlichcinski, 1979). It was hoped that differences that arose between the effects of these two types of overview would be based on the way that each communicated the information to the reader (Appendix B).

As a final precaution, to avoid possible "order" effects on learning, the sections of the two overviews were counterbalanced before being assigned to each treatment group.

Placebo "overviews" were produced to ensure that the total amount of time spent studying the main experiment by each subject was not varied from condition to condition. That is, for example, when subjects in the pre-pictorial overview condition were being asked to study the picture, the subjects in the post-pictorial condition were spending the same time studying a placebo. In that manner, they were both equally occupied before they began to read the main passage.

The two placebos produced were simple prose passages about the same length as the verbal overview. They were constructed to be neutral in character and as such were not expected to provide any useful information in addition to the main passage, nor material which would distress or otherwise distract the learners.

Interpolated Task. In order to ensure that subjects in the experiment were not using merely short-term memory to respond to posttest questions, an interpolated task was administered immediately following the post-passage treatment, just preceding the posttest. This task consisted of a set of arithmetic problems which proceeded from very simple operations to more complex ones (Appendix E). It was designed to capture subject interest and quickly get them immersed in processing something totally irrelevant to the topic of the reading passage. Subjects would thus be inadvertantly obliged to "shift" all of the newly acquired passage information into long-term memory.

Experimental Package. For the main experiment, each subject received an envelope containing the Nelson Denny Reading Test booklet and the experimental package. Each part of the experimental package was clearly marked on a blank cover sheet as "BOOKLET I", "BOOKLET II", and so on, up to the seventh booklet. The contents of each booklet are indicated below:

BOOKLET	CONTENTS
I	Instructions for the package (Appendix A).
II	Pictorial overview, verbal overview, or placebo (Appendix B).
III	Main passage (Appendix C).
IV	Pictorial overview, verbal overview, or placebo (Appendix D).
V	Interpolated Task (Appendix E).
VI	Test Part 1 - Free Recall (Appendix F).
VII	Test Part 2 - Multiple-choice (Appendix G).

The contents of BOOKLET II and BOOKLET IV were specifically determined by the treatment condition randomly assigned to each subject.

Procedure

Pilot Study. The pilot study was conducted approximately one month prior to the main experiment. This study was used to try out experimental procedures and materials and to assess the reliability of the multiple choice examination to be used in the posttest in the main experiment. Particular attention was paid in this study to establishing the timings necessary for the various tasks. The subjects for this pilot were adults enrolled in an introductory Educational Technology course at the Sir George Williams campus of Concordia University in Montreal. Although it was expected that this particular group might have more prior knowledge about the topic of the experimental passage than the subjects to be used in the main experiment, it was felt that this knowledge would not be so great as to provide a distorted view of what was likely to happen. Accordingly, this pilot group did perform in a highly similar manner to the main experimental groups.

Primary Experiment. The experiment took place during normal class time on three successive evenings for the initial phase of data collection. Two weeks later, on the same evenings, delayed posttesting took place.

The initial phase began with the researcher providing a brief general introduction to the research area that he was currently investigating. Subjects were advised at that time that they had the right not to participate in the study. Only one subject out of the total possible (n = 123) declined the chance to participate.

Packages were distributed in accordance with a process of block randomization which was employed to sort the subjects from each class into the five experimental conditions (i.e. pre-verbal, pre-pictorial, post-verbal,

post-pictorial, and control). This process ensured that when expected subject numbers did not appear, the experimenter at least maximized the numerical equality of treatment conditions for those who did take part.

The Nelson Denny Reading Test was administered first using the directions laid down in the "Examiner's Manual". Demographic data (age, sex, and mother tongue) was also gathered along with the Nelson Denny test. Upon completion of this test, subjects were orally briefed on what was about to happen specifically during the experiment. The experimenter emphasized in his commentary that subjects should not be concerned about what everybody else was doing because each person would be doing something slightly different. This measure proved effective in discouraging unnecessary questions and interactions. At this point the experimenter also explained that the systematization and rigid, step-by-step format of the ensuing experiment were necessary for the purposes of treating all groups in the same way. Subjects were then directed to read Booklet I. Having completed this task, they were provided with an opportunity to ask questions. From that point on, any questions asked were handled on a personal basis by the chief experimenter or one of the two monitors present.

Subjects were directed through the remainder of the experimental passage in a step-by-step fashion. They were given one minute and fifteen seconds to study the contents of Booklet II (pictorial overview, verbal overview or placebo). Before beginning Booklet II, subjects were informed that the main topic of the experimental passage to follow was "Learning Theories". Booklet II completed, the experimenter instructed subjects that they had a maximum of 15 minutes to read and study the contents of Booklet III (main passage). It was reiterated that for control purposes subjects were

permitted to study each page as long as they wished, but once they had turned the page they were not to turn back. The "time to go" was written clearly on the chalkboard at the front of each class. Subjects who finished early were asked to wait quietly while the remainder of the class was still working. When all were finished, subjects were given one minute and fifteen seconds to study Booklet IV. The interpolated task and the posttest booklets followed. Subjects were given one minute for the interpolated task, and ten minutes for the free recall portion of the test. There was no time limit placed on respondants for the multiple-choice test and subjects were permitted to leave as they finished. As subjects turned in their experimental materials before leaving, they were advised that the experimenter would be returning in two weeks' time with the results and a detailed explanation of the study. Subjects were not advised that there would be a delayed posttest.

Two weeks later, the experimenter returned and administered the delayed posttest. When the subjects were finished, the experimenter distributed lists of the results from the first session, and provided an explanation of what had gone on.

During the first evening of delayed posttesting, another independent group of subjects, also at Champlain College, was being asked to norm the experimental passage. This was done by handing out the passage to subjects with directions to identify "idea units" (Appendix H). A monitor was always present to guide students through the task. To gain their fullest support, the importance of their contribution to the study was strongly emphasized.

CHAPTER 4

Results

The purpose of this study was to determine the relative effectiveness of verbal and pictorial modes of overviews in different positions around a prose passage. In addition, these treatments were examined over a time interval of two weeks.

Regression Analysis

Multiple regression analysis was used to determine the relative effectiveness of age and the Nelson Denny Reading Test (NDRT) as predictors of subject performance. This analysis was also used to assess whether or not the variance accounted for (r^2) by either (or both) of these variables was homogeneous across groups. The outcome of this analysis is detailed in Tables 8 and 9. Age was clearly not a significant predictor of either immediate (IPT) or delayed (DPT) posttest scores, $F(1,116) = .20$, $p > .05$ and $F(1,88) = .49$, $p > .05$. In neither case did age account for greater than one percent of the variance.

The NDRT was found to be an important predictor for both the IPT scores, $F(1,116) = 39.7$, $p < .001$, and the DPT scores, $F(1,88) = 43.7$, $p < .001$. The NDRT accounted for approximately 26 and 34 percent of the variance, respectively. The variance accounted for by the NDRT was also reasonably homogeneous across groups. On the basis of these results the NDRT was used as a covariate when ANOVA was indicated as a consequence of the overall repeated measures test.

Table 8

Results of the Regression Analysis:

Immediate Posttest for Age

and Nelson Denny Scores

Experimental Condition	n	Age		Nelson Denny Reading Test	
		r^2	α	r^2	α
Pre-verbal	24	.18	$p < .18$	.34	$p < .03$
Pre-pictorial	24	.02	$p < .96$	.30	$p < .01$
Post-verbal	25	.00	$p < .94$	.33	$p < .00$
Post-pictorial	23	.01	$p < .86$	.20	$p < .04$
Control	22	.16	$p < .07$	.21	$p < .26$
Total Sample (N)	118	.00	$p < .28$	.26	$p < .00$

Table 9

Results of the Regression Analysis:

Delayed Posttest for Age and

Nelson Denny Scores

Experimental Group	n	Age		Nelson Denny Reading Test	
		r^2	α	r^2	α
Pre-verbal	18	.18	$p < .29$	.49	$p < .01$
Pre-pictorial	19	.07	$p < .74$	.41	$p < .00$
Post-verbal	17	.01	$p < .91$	.28	$p < .04$
Post-pictorial	18	.02	$p < .59$	.41	$p < .01$
Control	18	.10	$p < .18$	.28	$p < .08$
Total Sample (N)	90	.01	$p < .27$	.34	$p < .00$

Repeated Measures Analysis

Program BALANOVA (Concordia University general analysis of variance program) was employed as an overall test of the experimental design. Due to the fact that cell sizes in the design were not equal, an unweighted means analysis was performed. The means and standard deviations of the four treatment groups are listed in Table 10. The results of the BALANOVA repeated measures analysis are detailed in Table 11. As can be seen, there was a significant main effect over time, $F(1,70)=7.06$, $p<.01$. Figure 2 illustrates the changes in mean value over time. The remainder of the main effects and interactions reveal no significant results. However, although the position/time interaction was not significant, it was felt that it nonetheless warranted further analysis (see Table 11).

Position/Time Interaction

Independent analyses of variance were run at each time interval in an attempt to bring into relief the actual position/time interaction. There were no significant differences between pre- and post-treatment conditions ($F(1,95)=.785$, $p>.05$, and $F(1,71)=.68$, $p>.05$). The fact that these F-ratios never approached significance led the researcher to look more closely at the possible effects over time. Figure 3 graphically illustrates the changes in mean value over time for both pre- and post-treatment conditions. A dependent t-test was employed to analyse the changes. Both the pre- and post-positions were found to be marginally significant over time ($t=-1.85$, $p<.07$ and $t=-1.77$, $p<.09$). The slight trend toward significance evidenced in the weak position/time interaction was thus more influenced by time than position effects.

Table 10

Means and Standard Deviations for Experimental Groups on Immediate and Delayed Posttests

Experimental Group	Immediate Posttest $\bar{X}$	SD	n	Delayed Posttest $\bar{X}$	SD	n
Pre-verbal	7.7	3.5	24	9.6	4.2	18
Pre-pictorial	8.6	3.1	25	9.4	3.5	20
Post-verbal	7.9	3.2	25	9.8	4.4	17
Post-pictorial	8.8	2.7	24	8.9	3.6	19
Control	8.8	3.0	24	9.5	4.3	20
Total Sample	8.3	3.1	N = 122	9.3	3.9	N = 94

Table 11

Analysis of Variance Summary Table

for Dependent Variable

(BALANOVA - Repeated Measure ANOVA)

Source	df Between	df Within	SS	MS	F ratio	Sig. level
T	1	70	30.34	30.34	7.06	$p < .01$
F	1	70	.01	.01	.00	$p < .98$
P	1	70	.00	.00	.00	$p < .99$
TxF	1	70	.39	.39	.09	$p < .76$
TxP	1	70	12.66	12.66	2.95	$p < .09$
FxP	1	70	.06	.06	.00	$p < .96$
TxFxP	1	70	5.19	5.19	1.21	$p < .28$

T = Time interval

F = Form of Overview

P = Position of Overview

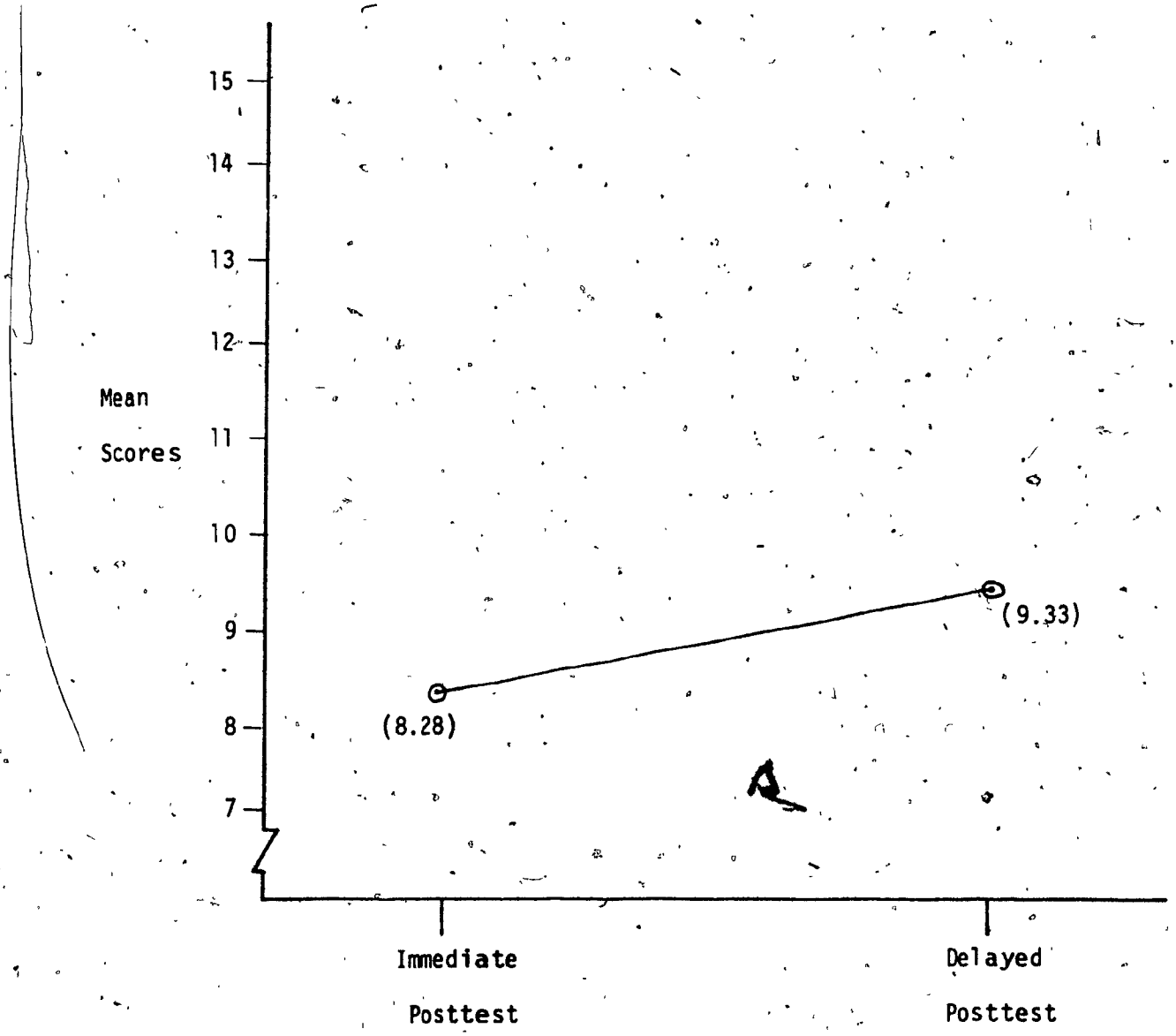


Figure 2. Comparison of total sample mean scores over time.

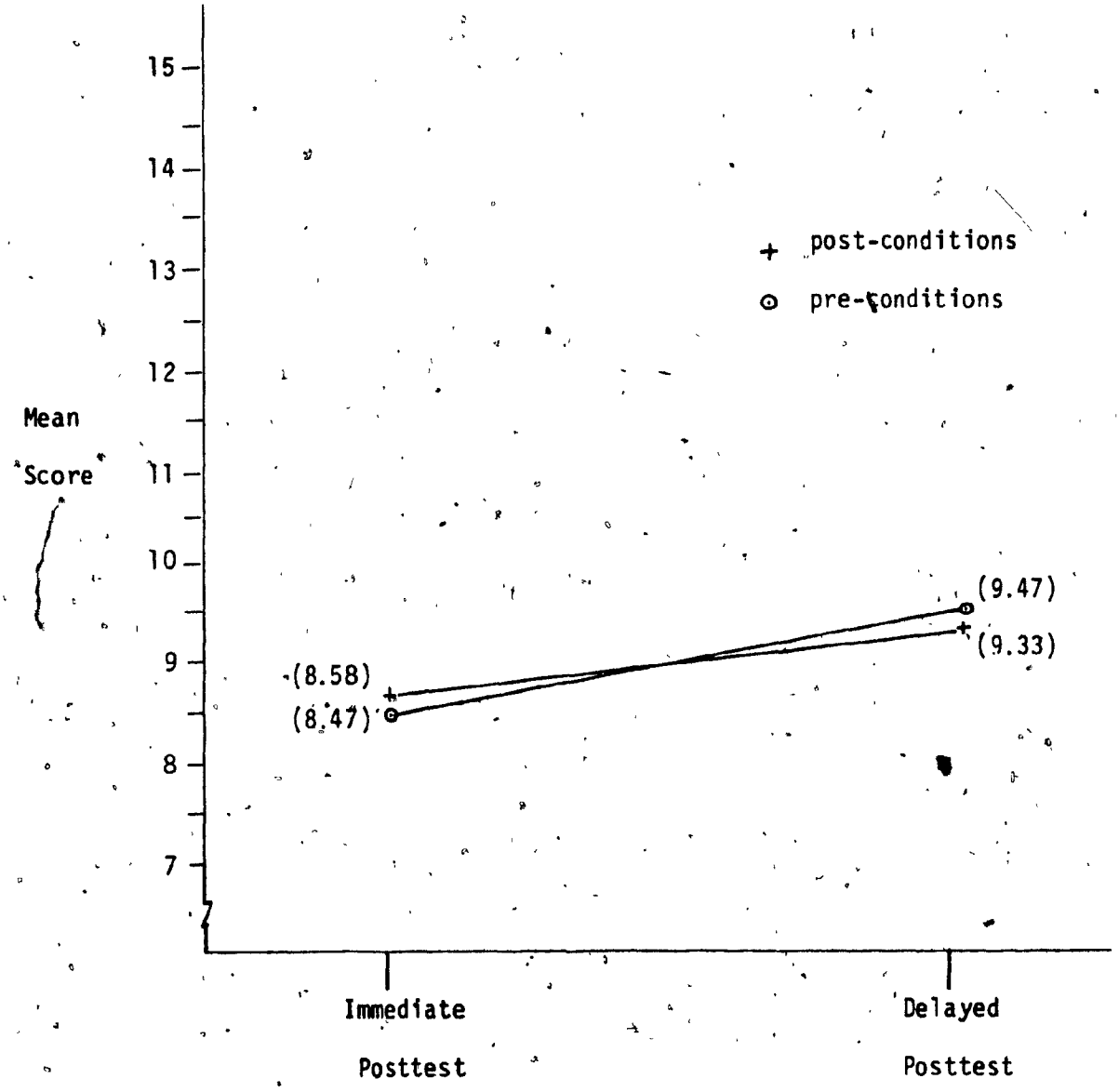


Figure 3. Comparison of mean scores of pre-condition treatment groups with post-condition treatment groups over time.

Dunnett's Test

The Dunnett Test, a specialized multiple-comparison test, was utilized to compare the pre- and post-position groups with the so-far untreated control group. The results of this test indicated that there were no significant differences between the treatment groups and the control group on either the immediate or delayed posttest scores. It appeared that the treatments applied had no facilitative effects greater than the condition which had no treatment whatsoever.

Dependent Measure

As mentioned in Chapter 3, the multiple-choice test portion of the dependent measure included both knowledge and comprehension scores. The fact that these scores correlated so highly with the total scores on both the immediate and delayed posttest (see Table 12) led the researcher to discontinue further inquiry along those possible alternatives. The total scores were the only ones examined in this analysis.

The free recall protocols were scored in accordance with the guidelines laid down in Chapter 3. The standard deviations found for the experimental groups and the whole sample were excessively large (see Table 13). This finding, the generally low scores, and an obvious lack of subject cooperation in this task, combined to convince the chief researcher to exclude the free recall scores as valid measures of subject performance.

Table 12

A Summary of the Correlation Coefficients: Total Scores, Knowledge Scores, Comprehension Scores on both Immediate and Delayed Posttests

	Total Posttest Score	
	Immediate	Delayed
Knowledge Score	.89	.90
Comprehension Score	.87	.90

Table 13

Mean Scores and Standard Deviation:

Free Recall Protocol

Experimental Group	Means	Standard Deviation	n
Pre-verbal	7.3	4.8	24
Pre-pictorial	8.0	4.7	25
Post-verbal	7.3	4.9	25
Post-pictorial	7.1	4.5	24
Control	7.8	5.6	24
Total Sample	7.5	4.9	N = 122

Summary of Results

The Nelson Denny Reading Test was found to be a highly significant predictor of both immediate and delayed posttest scores, whereas age was found to be a non-significant predictor. The NDRT was therefore designated for use in further analyses of variance as a covariate.

No significant main effects were identified for either of the independent variables in this experiment (overview type, overview position). However, the repeated variable, time interval, did evidence a strongly significant main effect. There were no significant interactions found between any of the experimental variables. Nonetheless, one of the significance levels, the overview position/time interval interaction, did approach the critical value of $p < .05$. Results of further analysis simply provided more support for the conclusion that time was the only significant factor in this experiment.

CHAPTER 5

Discussion

This study found that experimental groups who received pictorial treatments did not perform significantly better than matching verbally treated experimental groups or a control group in their overall learning from learning from an accompanying prose passage. No evidence was found to support the notion that pictures could function as stimulants for mathemagenic activity, nor was there any indication that pictures were effective over time. Finally, pictorial treatments did not have differential effects on the type of learning that occurred.

Pictorial Effects on Learning from Prose

In spite of the protestations to the contrary, (e.g. Cole, 1977; Duchastel, 1981), it is this researcher's opinion that there is little doubt that pictures can have impressive facilitative effects on children's learning from prose materials. The few undergraduate studies that have been conducted (e.g. Snowman & Cunningham, 1975; Royer & Cable, 1976) seem to suggest that what applies to children may also apply to young adults still involved in the formal schooling system. However, these results, although encouraging, are still inconclusive, primarily because of their scarcity.

The intuitive use of pictures as facilitators of learning from prose materials has so far been upheld by research conducted on children and undergraduates. Nonetheless, there is no evidence to suggest that pictures offer the same benefits for adults not still involved in the formal schooling continuum.

Paivio's Dual-Coding Hypothesis. As outlined during the literature review, Paivio (1975) maintains that there are additive learning effects in force when both imagerial and verbal coding take place. Assuming that subjects in the present experiment actually employed the pictorial adjuncts to assist their encoding of the information in the passage, the hypothesis of this study based on Paivio's work cannot be supported. Pictorial overviews apparently perform no better than their verbal counterparts as facilitators of learning from prose text.

Mathemagenic Activity

Unlike the findings of two other similarly concerned studies (Brody & Legenza, 1980; Snowman & Cunningham, 1975), the current study found no evidence of differential mathemagenic activity. The positioning of the overviews, pictorial or prose, seemed to have no differential effects on learning. It should be re-emphasized that there were major differences between these two previous studies and the current study. To begin with, the pictorial adjuncts used in the Brody and Legenza study were realistic, and specifically portrayed the activities described in the passage. The current work utilized abstract, stylistic diagrams which simply provided main level ideas and the "gist" of the passage. Both Brody and Legenza and Snowman and Cunningham employed undergraduate students in their respective studies, and used very straightforward, uncomplicated experimental passages. A final distinction to be made is that Snowman and Cunningham used pictorial adjuncts which took the form of a question asking subjects to "mentally imagine" or "visualize" certain referenced bits of information. Images were not provided for the subjects, but were self-generated.

The results of the current study support those of Lavelle (Note 8), who also found no significant differences between the effects on learning of illustrations placed before and after a main passage.

The literature relevant to pictorial aids and mathemagenic activity is nowhere near conclusive. The stimulation of such activity appears to be dependent upon the type of pictorial adjunct and the type of accompanying prose passage. The current study differs from previous work in that it examined this question with an adult sample, a difficult passage, and an image which did not directly reiterate the contents of the accompanying passage.

Pictorial Influences over Time

If relevant pictorial aids are used in conjunction with prose materials it would be expected that the dual-coding (Paivio, 1975) would create a stronger memory trace. This, in turn, should result in better memory over time. Schwartz and Kulhavy (Note 7) support this idea, suggesting that the use of two forms of encoding should result in deeper processing or a richer recall network. Winn (1980) argues that if a picture representing the learned information can be reproduced at recall it will be able to assist the learner to remember the elements of that information and the relationship between them. It would, therefore, be advantageous for the designer of textual materials to include a picture at the time of encoding.

In spite of the intuitive strength of these viewpoints, and a meager but supportive body of research (e.g. Peeck, 1974; Haring & Fry, 1978; Ally, Note 1), the current study did not bear out the notion that pictorial aids facilitate learning over time. There is, however, great disparity

between the conditions of learning in this temporally based research. The two key factors appear to be the specific form that the pictorial adjunct takes and the link that that picture makes with the accompanying passage.

The study of the effects of pictorial aids over time is an important, but, strangely, an often ignored research area. The inconclusiveness of the few results reported so far indicate that more research is necessary.

Measurement of Learning

Some feel that one of the major reasons why well designed studies fail to find significant results is the fact that the wrong type or level of learning was tested (Schmid, Note 11). Significant results have been found in some cases (e.g. Ruch & Levin, 1977) only due to the fact that the researchers had the foresight to consider more than factual learning. Other studies have been less diligent (e.g. Snowman & Cunningham, 1975; Haring & Fry, 1979; Brody & Legenza, 1980) and have produced results which, due to the specificity of the dependent measure, only assess one level or type of learning. The full significance of these studies cannot truly be known, because subject performance was inadequately assessed.

The current study attempted to measure free recall of passage contents, knowledge of these contents, and finally, the comprehension of the passage. It was determined that neither the form nor the position of the overview had any differential effect on what was learned.

It is felt that a "multi-barrelled" dependent measure of this sort is a highly recommendable strategy, as it will help ensure that any

differences that do exist between treatment groups will be identified. In the current case, assuming effective experimental control, it is possible to conclude that there is little evidence of differential learning on three levels, that is, knowledge, comprehension, or free recall. Future research would be well advised to continue this approach to the assessment of learning in experimental conditions.

Subject Variability

In view of the generally supportive body of research in the pictorial domain, the non-significant results of this study must be interpreted carefully. One of the factors which might have contributed to the non-supportive outcome was that of subject variability.

Age. Continuing education programs are well known for their enrollment of adults who vary greatly in age. The sample in the current study ranged in age from 17 to 62 years, a spread of 45 years. The possibility that age as a summary variable may have a strong effect on subject performance was statistically rejected as the result of a regression analysis. In addition, there exists a growing body of research (e.g. Nolan, Havemeyer & Vig, 1978; Harker, Note 10) which maintains that age has little or no effect on learning as long as time limits are not enforced on the recall of the instructional material. In the current study, a time limit was imposed on the free recall protocol due to the experimental circumstances. However, virtually all subjects had completed working when this limit was reached. There was no time limit set for completion of the multiple-choice test.

Sex. Sex was not expected to have any influence on experimental results. To this researcher's knowledge, there is no evidence which supports

the contention that sex types perform differentially when learning from written prose materials. Furthermore, the current study displayed a fairly even split between males and females over the whole sample and within individual experimental groups.

Mother Tongue. Mother tongue was considered to be a possible interfering variable in light of the multi-lingual nature of the subject sample. Indeed, 22% of the sample consisted of subjects whose first languages were not English. This would not prove to be a problem if all of these subjects spoke English fluently. However, there was ample evidence to indicate that this large group included a full range of linguistic capability. The various degrees of ability at the lower end of the performance scale complicated clear interpretation of any effects on final subject performance. These effects are virtually undetectable due to the unequal distribution across groups of persons with widely variant degrees of proficiency in English. It is highly possible that this factor contributed to the pronounced within group variance in the current study.

Reading Ability. Allied with mother tongue as a contributer to extreme within group variability was the reading ability of the sample. The sample mean score was determined to be 33.7, which places it on the 37th percentile in reading ability. The sample as a whole, therefore, consisted of a below-average group of readers. This by itself is not remarkable. What is noticeable is the extreme variance in reading ability found within groups. It is likely that the very wide range of reading abilities (subjects are distributed between the 1st and 91st percentiles) may have helped precipitate the non-significant outcome.

The regression analysis reported in Chapter 4 offered strong evidence supporting the impressive predictive capacity of the Nelson Denny Reading

Test on subject performance on a prose learning task. This result lends further credence to the contention that the results of prose learning experiments which have not taken account of subject reading abilities must be suspect. It is therefore recommended that future studies in any area of prose learning investigation take account of and control for reading ability. In addition, in view of the lack of consideration of individual differences in general (Levin & Lesgold, 1978; Zimmer, et al., 1979) it is suggested that researchers begin to pay more attention to subject variability. This is particularly important for research being conducted in continuing education programs, since these programs tend to attract students of varying age and ability.

Conditions of Learning

As mentioned much earlier during the literature review, Salomon (1972) discussed three conditions which are necessary before a visual image will be effectively internalized. The first two of these conditions are particularly relevant to the current study. The initial condition is that of perceiving a need to internalize the image. Second, the learner must be capable of such internalization.

Need. If material to be learned is not even obliquely relevant, the learner may have difficulty working up the requisite interest to study effectively. In the current case, the learning material was chosen in order to minimize the effects of prior knowledge. It was therefore not a concrete, easily recognizable passage, nor was it in any direct way related to the subjects' areas of study. It may be that, as some researchers point out (e.g. Bower, 1981), the "mood" of the subject sample when confronted with such materials was such that it affected their overall performance on the

posttest. Subjects may have behaved in an atypical fashion, thus adversely affecting results.

Unforeseen circumstances obliged the researcher to lengthen the initial experimental session to approximately one hour and ten minutes. The subjects in this experiment were drawn from a population of continuing education students who had in most cases been working during the day. It is very possible that the problem of maintaining interest was aggravated by fatigue. Salomon's first condition of matching the subjects' need for visual aids may not have been met in the current study.

Learner Capability. Another condition set down by Salomon was that the learners must be visually capable of interpreting the imagerial input. If the subjects in this experiment were unable to properly utilize the pictorial overview to organize their thoughts, then their performance would have been unaffected by the treatment. It is possible that these subjects were unable to interpret the comparative nature of the overview. It is a stronger possibility that they were unable to employ the pictorial aids in the fashion for which they were intended. This eventuality would lend support to the point of view that adults may have already developed idiosyncratic learning techniques (Kulhavy & Swenson, 1975). For them to take this new learning tool (the pictorial overview) and use it to integrate and organize the contents of the experimental passage may have been too much to ask unless some form of training was conducted first. As Salomon (1972) puzzles:

> ... if training in verbal skills is expected to improve thought processes, assuming that one uses verbal mediation... why should training in visual media fail to do the same

thing, given that one also uses visual thinking...?
(p. 418)

In the current study, the subjects were advised to "use the overview to assist you to remember the contents of the package". One possible explanation for the lack of significant effects of this treatment could be that these instructions were not thorough enough to allow the adult subjects to modify their ingrained ways of handling pictures in a prose context.

Perhaps future research in the area of the effects of pictures on learning from prose should place more emphasis on the preparation of subjects to utilize the pro-offered image in the way it was intended to be used.

Adult Learners

The vast majority of pictures in prose research studies have primarily made use of children and undergraduates as subjects. These samples have thus consisted of persons who are still very dependent and wholly conditioned to responding submissively to whatever task the class instructor might ask of them. With adult learners, however, this state of affairs does not exist. It has been pointed out that as one ages, the individual self-concept moves from a dependent state to one that is self-directing (Knowles, 1970). In addition, adults are much more oriented towards the immediate application of learning rather than a postponed application (Kidd, 1973). It follows that if the learning material does not show immediate promise, the chances are that it will quickly be perceived by adult learners as irrelevant and pointless. Cooperation often granted by undergraduates and children may not be so easily attained with adult samples.

If this was the case in the current study, then the results would be further confounded by the number of individuals who "submitted" to the experimental treatments but were unwilling to fully cooperate with the researchers. Compliance with requests to "use the enclosed overview to assist you to remember" and "please write down all that you can recall" may, in fact, have been minimal.

Experimental Materials

Overviews. The overview, defined in this study as "a brief summary of the main ideas of a passage", was utilized in both a pictorial and a verbal mode. The research available on verbal overviews (e.g. Lathrop & Norford, 1949; Northrop, 1952; Wulf & Kraeling, 1962; Santiesteban & Koran, 1977) has been virtually unanimous in reporting non-significant effects of this aid on learning from prose. On the other hand, the studies that have employed pictorial overviews (e.g. Reynolds, 1966; Bransford & Johnson, 1972; Brody & Legenza, 1980) have reported significant differences in favor of the pictorial condition over matching verbal and control conditions.

Neither verbal nor pictorial overviews evidenced significant effects on learning in the current study. This was expected for the verbal overview, in light of the meager amount of supportive literature reported above. However, the non-significant effect found for the pictorial overview runs contrary to the existing literature.

The pictorial overviews employed in the current study were designed to fulfill a retentional role (Duchastel, 1978). Specifically, these overviews were to have acted as transformational images (Levin, 1979). Levin claims that this type of retentional image is appropriate for

facilitating memory of difficult-to-remember material such as "... medical and other scientific texts, where easily identified concepts, principles, and functions have to be associated with unfamiliar technical terminology" (p. 21). The current study employed such a passage with a pictorial overview especially designed for its ability to change "... the existing content... into a form that promotes better long-term memory for that content" (Levin, 1979, p. 22). In spite of the modelling process used, the transformational image utilized in the present study was ineffective as an adjunct to a difficult scientific (psychological) passage.

The results of the current work suggest that the transformational function of pictorial aids may not be applicable to continuing education populations. Such adults may simply be "too set in their ways" of handling illustrations in a verbal context to be able suddenly to adopt an unfamiliar strategy. It is conceivable that with full cooperation and full understanding of the role that a retentional pictorial aid should play, learning may be enhanced. It is also possible that pictorial overviews of the type utilized in the current study may prove to be more effective with more homogeneous samples of adults, or with younger groups of learners. Finally, such overviews may not be useful when employed with difficult learning material, but may prove to be very effective with less complex text. All of these hypotheses remain to be tested.

Dependent Measures.

MULTIPLE CHOICE TEST

The multiple choice test had a low internal reliability ($r = .55$) on the immediate posttest. Two factors may have caused this phenomenon.

First of all, the time at which the initial multiple choice test was administered was not ideal. It took place during an evening class after approximately three quarters of an hour of concentrated experimental activity including a reading test, a difficult-to-read psychological passage, an interpolated task (short math quiz), and a free recall protocol. Subjects were visibly fatigued after completing the free recall portion of the initial posttest.

Second, when the researcher returned for the administration of the delayed posttest, subjects seemed more willing to cooperate. It is likely that they then felt a committment to "finish the job" that had begun with the initial experimental session. In addition, the delayed session only involved the multiple-choice portion of the package. It was a single, easy to complete task. Subjectively speaking, the enthusiasm exhibited by the subject sample for the delayed posttest was markedly more positive than that displayed for the initial test.

It is possible that the initial phase of the experiment was frustrating enough to cause a substantial number of subjects to pay minimal attention to their answer selections on the immediate posttest, hence the poor reliability coefficient of the initial measure. On the other hand, the delayed posttest was well received. A more enthusiastic attitude plus a much less draining session precipitated a greater reliability coefficient, and, remarkably, an increased overall mean score.

MEAN SCORE IMPROVEMENT

These were decidedly unusual results. The subject sample was administered a difficult reading passage along with a follow-up posttest on one day and then, two weeks later, they were asked once again to try the test. Mean scores typically decline over time. However, in this case

they actually rose. Critics of this study may argue that "order" or "test-retest" factors were operative here, thus accounting for the difference. However, the delayed posttest was a different randomly ordered version of the immediate posttest. It is felt that this control measure, the fact that the learning materials were difficult, unfamiliar, and irrelevant, and the fact that the delayed posttest was unannounced should have precipitated a decline in overall scores.

There are two possible explanations for the significant improvement in performance. First of all, there is a certain amount of evidence that the level of cooperation during the initial experimental session was much less than that in the final session. As reported earlier, the reliability coefficients which were calculated at each time interval on the same test with the same subjects were nowhere near equivalent. The initial indication of the coefficient was that the test was a poor evaluation tool; after a two-week delay, the coefficient calculated suggested an excellent evaluation instrument. The human variable may be the only logical explanation of this unusual turn of events. In addition, informal subjective appraisal of subject attitudes during each session also pointed to a considerable difference in cooperative mood. The lengthy initial session may have built up resentment resulting in poorer support.

One major contributor to the less than satisfactory cooperation experienced in the immediate testing condition was the free recall protocol. Informal feedback from subjects, both personally and on their free recall answer sheets, confirmed the strong deteriorative effect the free recall test had on subject morale. In fact, as a result of the strong negative

response to the free recall task on the immediate posttest, the free recall was deleted from the agenda at the second time interval.

A second possible explanation for the increase in scores over time may be the nature of the subjects. Adults are more experienced learners than children or undergraduates. Experience may have conditioned the adult to re-think information inputs which were originally not altogether clear. Covert post-session reconsideration of the learning passage and its significance (coupled with the ever-present possibility that intellectual interaction between adult students undergoing coursework together did occur over the two-week time interval) may have been enough to cause the increment in mean scores. An interesting speculation would be to consider what might have happened had a comparative sample of undergraduates been similarly examined.

CHANCE SCORE

Another atypical result of the current study was the mean score that was achieved on the multiple choice portion of the posttest by subjects who had not read the experimental passage. The mean score was calculated at 7.0 ($n = 15$). Total mean score on the immediate posttest was 8.3, and on the delayed posttest was 9.3. Clearly, there appears to be very little difference between those who read the passage and those who did not.

This chance score offers disconcerting evidence that the dependent measure was not sufficiently sensitive to distinguish those who had read the passage from those who had not. It is little wonder that the control group, which received no treatment, was able to score at least as well as, and in some cases better than, some treatment groups.

Educational Implications

Educational Technologists are called upon to perform many roles. One of these is that of an instructional materials designer. It behooves the Educational Technologist to be aware of the potential effects of adjunct aids on learning so the s/he may be best able to carry out this role. Illustrations are often used in text for children, and have recently been attributed with facilitative effects on the learning of prose text material. The current study examined these effects on the adult learning of prose material and produced results which did not support the research done with children. The Educational Technologist would be wise to note the potentially enormous differences between child and adult learners. If illustrations in text are useful to children, it does not follow that they will also prove useful for adults. Blind acceptance and generalization of children's research findings may prove costly both in terms of time and money.

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APPENDICES

APPENDIX A

Experimental Booklet I - Instructions

Copy No. _____

BOOKLET

I

Student No. _____

Date _____

INSTRUCTIONS

This study is being conducted for the purposes of furthering our understanding of adult learning. We greatly appreciate your cooperation!

This package consists of seven (7) separate booklets of material. You will be guided through these booklets by the researchers in timed steps.

You are asked to follow the researchers' directions closely. They will advise you when to start each booklet and when the time allotted for study of the material has expired.

When you have completed a task, close the booklet, turn it upside down on your desk, and wait for the others to finish. A monitor will collect your booklet. Please do not look through subsequent booklets in the package until the researcher in charge of the study gives the go-ahead.

Do not be concerned with what others may be doing, as everyone in the room will be doing something slightly different.

Do you have any questions regarding these instructions?

APPENDIX B

Experimental Booklet II -

Pre-passage Treatments

94

Copy No. 1

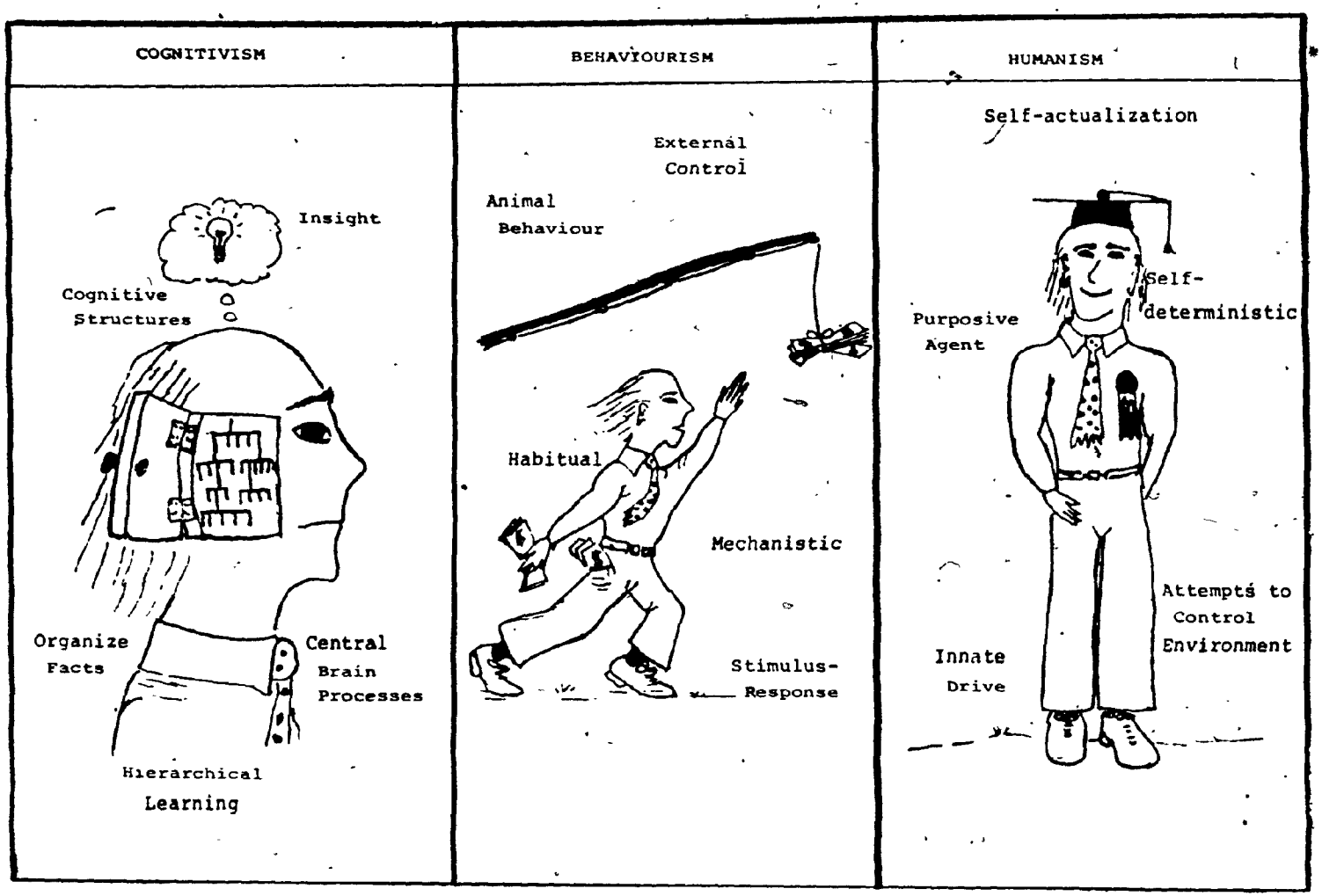
BOOKLET

II

Directions

Please study the enclosed material carefully. It is intended to assist you to remember the contents of the main passage.

The terms and phrases that are embedded in the pictures are the principle ideas of the various theoretical areas.


COGNITIVISM
BEHAVIOURISM
HUMANISM
Insight
Cognitive Structures
Organize Facts
Central Brain Processes
Hierarchical Learning
External Control
Animal Behaviour
Habitual
Mechanistic
Stimulus-Response
Self-actualization
Purposive Agent
Self-deterministic
Attempts to Control Environment
Innate Drive

Directions

Please study the enclosed material carefully. It is intended to assist you to remember the contents of the main passage.

The underlined terms and phrases are the principle ideas of the various theoretical areas.

COGNITIVISM

Cognitivism denotes an emphasis on such topics as cognitive structure, central brain processes and insight. Proponents of cognitive psychology contend that, unlike other animals, humans can gather and organize facts in such a way that learning can take place. Several practical hierarchical learning theories have been proposed by members of this group of psychologists.

HUMANISM

Humanists see the human organization as a purposive agent who learns through experiential events which occur due to his/her attempts to exert control on the environment. The human is seen to be self-deterministic in nature. An integral Humanistic belief is that humans are endowed with an innate drive for self-actualization and achievement.

BEHAVIOURISM

Behaviourism includes those theoretical positions which consider human behaviour to be essentially mechanistic in nature. Often referred to as "stimulus-response" theorists, Behaviourists view the human organism as being totally subject to external control. They see behaviour exhibited by humans to be habitual. In order to study human behaviour these theorists focus on animal behaviour.

Directions

Please read through the enclosed material at your normal reading rate.

The Study of Learning

The study of how people learn is important for a very good reason. We are now in a rapidly changing world which demands more and more from everyone throughout his/her lifetime. One has only to look at the widely variant fields of the automechanic and the corporate executive. In the past, the mechanic had only to learn the basic operation of one vehicle to be able to understand all others. Today, with technological improvements, it is very rare that one can find a mechanic who is fully capable of handling all types of automobiles. Different engines, different parts, new solid state components, etc., have resulted in the demand for automobile specialists rather than generalists. The corporate executive today only handles a single specialized area of concern because it takes all that s/he can do to keep up with the developments in that one area. In the past, one person was able to hold down any number of top executive positions because there was just not that much change in the various areas of concern.

There was a time when most people were able to get by with learning their trade once. Today, with increased life-spans and the ever-changing nature of many jobs, this is no longer the case. Re-learning has become a necessity rather than a luxury for the vast majority of our population. It follows that the more that is learned about learning the more possible it will be to foresee problems and to help out people being overwhelmed by the onrush of technology.

APPENDIX C

Experimental Booklet III - Main Passage

Copy No. U

BOOKLET

III

Directions

Please read through the following passage carefully and at your normal reading rate. The passage is seven (7) typewritten pages long.

While studying, please do not underline or take notes. Also, once you have finished reading a page and have turned to the next page you are asked to NOT turn back.

Upon completion of your reading and studying of the final page you are asked to insert your finishing time in the indicated space on that page.

Following this passage you will be asked to write down everything that you can remember from the passage. You will also be asked to complete a short multiple-choice test to find out how well you have learned the contained information.

GOOD LUCK!

A LEARNING CONTROVERSY

One of the principal concerns in the field of psychology is the question of how humans learn and what factors influence learning. Many theories, or attempted explanations, have come forth during the long history of interest in this question. Today, however, only three major theoretical positions remain. The purpose of this passage is to outline and contrast the key attributes of these approaches to the study of learning.

Two traditional viewpoints are readily discernible among scientists who study learning. One of these is that of the Behaviourist, who maintains that complex learning phenomena can be reduced to simple stimulus-response relationships. Another viewpoint, that of Cognitive psychology, proposes that there is much more to learning than merely chains of stimulus-response connections. The Cognitivists feel that there is such a thing as "insight" which allows the human organism to make "cognitive leaps" when confronted by a new situation. Both types of learning theorists suggest methods for controlling human learning behaviour.

In recent years a new position has evolved which further complicates the learning issue addressed by the Behaviourists and Cognitivists. This viewpoint is that of the Humanists, who reject outright the principles of Behaviourism and Cognitivism as being "dehumanizing". Rather than emphasizing the influence that the environment exerts on the human organism, the Humanists emphasize the control that the human attempts to exert on the environment.

Both the Behaviourists and the Cognitivists have often used animals to test their theories of human behaviour and learning. The Behaviourists are particularly noted for their use of this experimental approach. Fundamental to their use of animals is the assumption that the basic laws of learning are the same in rats, dogs, pigeons, monkeys and humans and that common underlying principles apply to a wide range of species. Few would question the learning similarities within species, but the Humanists strongly oppose the notion that principles of animal learning can be applied to humans. Accordingly, they see the human organism as being far too complex to be studied with animal methodologies and stress the inviolable "inner space" of the individual. The generalizing of animal learning behaviour to humans is considered an affront to human dignity. For these reasons the Humanists focus exclusively on human subjects in their deliberation and research on human learning behaviour.

Behaviourists see the learner as a mechanistic entity in that s/he is totally unresponsive until an environmental stimulus is applied. The learner is viewed as a receiver of various types of input (stimuli) which produce an appropriately programmed and predictable output (response). Behaviourists imply that the learner is passive although a better term may be "reactive" since the learner does neither more nor less than continually react to environmental events that are occurring. It is a completely determined system with no freedom of behaviour. This orientation to learning theory predisposes one to think in terms of mechanical models, physiological mechanisms, biological

processes, or any system that is conceived in the image of the physical sciences.

Cognitive theories of learning are at odds with Behaviourism on several major points. Cognitivists see humans as purposive agents. Humans are active rather than reactive and as such, are not constrained to behave reflexively and automatically, but instead take some initiative in controlling their destiny. Understandably, Cognitivists reject the deterministic models of the physical sciences as being far too restrictive. In their view, the mind operates on a different set of principles than those evidenced in the physical world.

The Humanists are similar to the Cognitivists in this regard, also seeing the human organism as a purposive agent. It is their belief that human beings have a natural potentiality for learning; humans are born curious about their world and ambivalently eager to develop and achieve. Humans possess an inner directing need to improve themselves in the direction of healthy, competent and creative functioning. Like the Cognitivists, the Humanists include insight and initiative in the natural repertoire of the human organism.

The Behaviourists and the Cognitivists provide different answers to the question: what is learned? Behaviourists argue that "habits" are learned. This is a commonsense answer, since few would deny that smooth-running skills are developed through practice. On the other hand, Cognitivists maintain that "cognitive structures" are what is learned. This is also a very commonsense answer. If we can locate a corner store from one starting point, we can find it from another because we "know

where it is"; we have learned and organized a set of interrelated facts. A smooth-running skill illustrates a learned habit; knowing alternative routes illustrates cognitive structure. If all habits were highly mechanical and stereotyped, variable non-habitual behaviour would force us to admit cognitive structures as part, at least, of what is learned. But the stimulus-response psychologist is nonetheless satisfied that s/he can deduce from the laws of habit formation the behaviour that the Cognitivist believes supports his/her interpretation.

The Humanists have an altogether different idea of "what" is learned. They stress two types of learning, relevant and irrelevant. Irrelevant learning is that which is acquired for no apparent reason. It is learning "from the neck up" and involves little feeling or personal meaning. The Humanists see true relevant learning as being the acquisition of knowledge which has a quality of personal involvement. This is experiential learning which is self-initiated, pervasive, and is evaluated by the learner. Humanists do not view habits or facts as true learning. The essence of learning to the Humanist is whether or not the information to be acquired has meaning. Little attempt is made to specify the mechanics of this learning since the goal of the Humanist is to increase awareness of the elements which are involved in the meaningful and significant acquisition of knowledge.

The Behaviourists and the Humanists have long been locked in debate over the question of external control versus self-determinism. B.F. Skinner, a well-known reinforcement Behaviourist, has pleaded for

abandonning techniques of aversive control (e.g. punishment) and for consciously and openly applying techniques of positive control for the betterment of society. His novel "Walden Two" (1948) details a utopian society which was created through the application of behaviour technology. Skinner's primary antagonist, a prominent Humanist named Carl Rogers, raises two points of disagreement with this proposed approach to societal control. He argues that Skinner does not take account of the potential abuse of power. Skinner assumes that techniques of social control will be used in the best interests of society. Rogers does not believe this to be possible due to man's inherent nature. Second, Skinner claims that, if behavioural scientists experiment with society, eventually the practices which make for the greatest biological and psychological strength of the group will presumably survive. Rogers contends that a society's goals should be concerned primarily with the process of becoming, achieving worth and dignity and being creative - in short, the process of self-actualization. The conflict herein described is between a position that favours human control through the thoughtful application of a science of behaviour and one which seems to assert that science should enhance our capacity for self-determination. The Cognitivists would clearly be more supportive of Skinner's argument than that of Rogers as they too seek to find a method for controlling human learning behaviour. Evidence of this is provided by the applications of hierarchical learning theories to instruction such as D.P. Ausubel's coding systems and Jerome Bruner's discovery learning.

When confronted with a novel problem, how does the learner reach a solution? The Behaviourist would see the learner assembling his/her habits from the past appropriate to the new problem, responding either according to the elements that the new problem has in common with familiar ones, or according to the aspects of the new situation which are similar to situations met before. If these do not lead to a solution then the learner would resort to "trial and error". The Humanist, in different terminology, would agree with this last statement. A major tenet of Humanism is "learning by doing". The Humanist would expect the learner's innate desire for learning, for discovery, for enlargement of knowledge and experience to be the energizing force behind his/her approach to a problem. The learner may use a "trial and error" approach until the problem at hand is satisfactorily resolved. The Cognitive psychologist, too, would agree in part with the Behaviourist position. However, s/he would be apt to point out that, granted the learner had all of the prerequisite experience and knowledge of the parts of the problem, there would still be no guarantee that s/he would be able to access the necessary information. The learner may be able to solve the problem presented in one form but not in another. According to the Cognitivist, the preferred method of presentation permits a perceptual structuring leading to "insight", that is, to the understanding of the essential relationships involved.

The Behaviourist tends, by preference, to look at the past history

of the learner for the sources of solution while the Cognitivist, by preference, looks to the contemporary structuring of the problem. The Humanist would look to the innate desire of the learner to motivate his/her approach.

In stark contrast with the Behaviourists, the Cognitivists more freely infer central brain processes such as memories or expectations as integrators of goal-seeking behaviour. The "understanding" of a situation is viewed as an appropriate descriptor of human problem-solving success. Conversely, the Behaviourists prefer to find movement intermediaries to serve as integrators and would never make use of a vague, unobservable concept such as "understanding". Humanists are generally unconcerned with the details of what is actually happening to the human organism when it is problem-solving. They are interested only in bringing to light the importance of the proper conditions for such behaviour to naturally occur.

END

Please record your finish time _____

APPENDIX D

Experimental Booklet IV - Post-passage Treatments

Copy No. _____

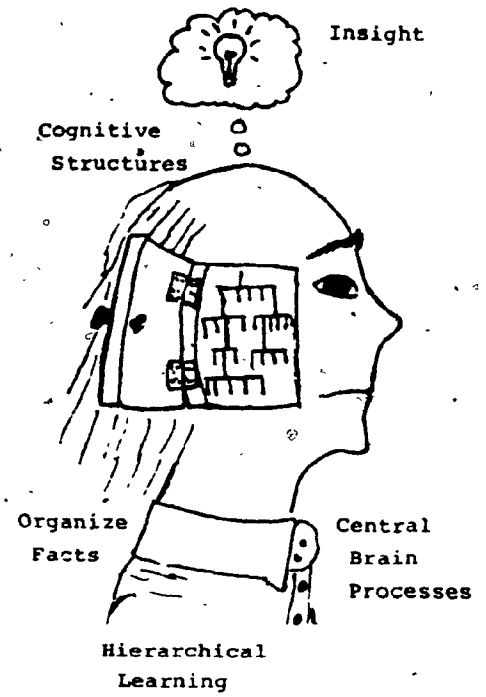
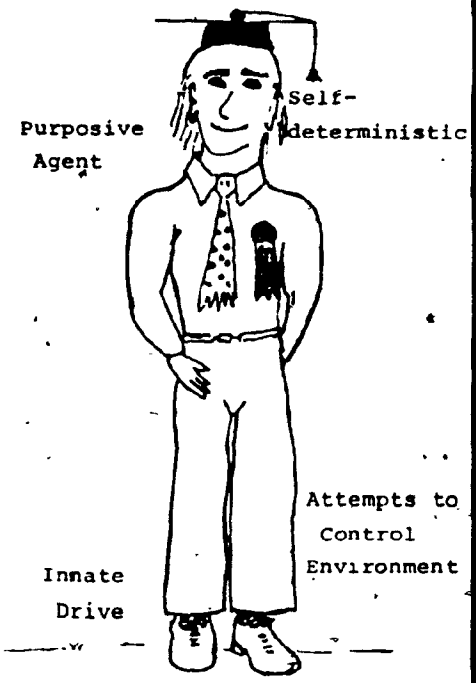
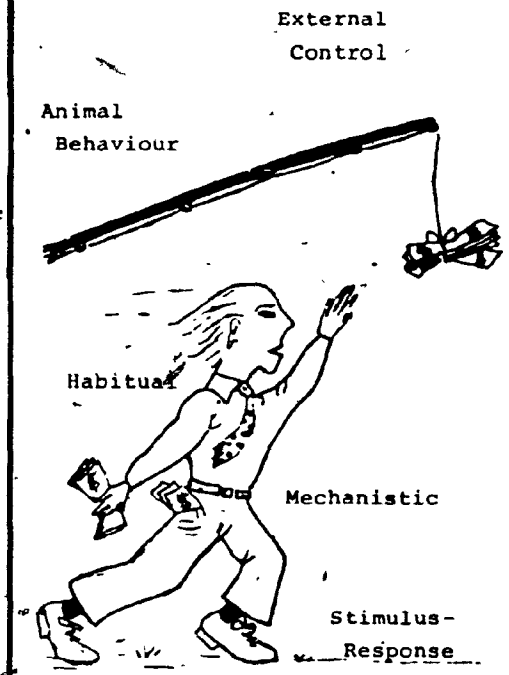
BOOKLET

IV

Directions

Please study the enclosed material carefully. It is intended to assist you to remember the contents of the main passage.

The terms and phrases that are embedded in the pictures are the principal ideas of the various theoretical areas.

COGNITIVISM	HUMANISM	BEHAVIOURISM
		

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Directions

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The Study of Learning

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There was a time when most people were able to get by with learning their trade once. Today, with increased life-spans and the ever-changing nature of many jobs, this is no longer the case. Re-learning has become a necessity rather than a luxury for the vast majority of our population. It follows that the more that is learned about learning the more possible it will be to foresee problems and to help out people being overwhelmed by the onrush of technology.

A New Approach to Problem Solving

There are a growing number of problems in modern educational systems which are only aggravated by attempts at their resolution. One explanation is that educators have taken an overly microscopic view of problems and have moved to better things by improving parts of the system with little consideration of the effects of such improvements on the accomplishment of overall system objectives.

The "Systems Approach" is an approach to problem-solving which stresses that "the whole is greater than the sum of its parts". Proponents of the Systems Approach maintain that it is futile to attempt to resolve system ills by merely improving individual components. They believe that the goals of the system must always be kept in mind as one analyzes a problem. If this is not done, unexpected effects of any modification are probable and the initial difficulty may even be magnified. The system must always be regarded as a whole and not simply as "the sum of its parts".

For example, in the desire to increase the rate of instruction a certain elementary school implemented a computer-aided instruction (CAI) segment. Inadequate analysis of the overall effects of such a move resulted in some students finishing the CAI segment quickly and then sitting around performing morale-destroying "busy" work while waiting for the remainder of the class to catch up. Had the analysts regarded the system as a whole, this problem would have been noticed before the implementation of CAI and a more effective alternative could have been designed.

APPENDIX E

Experimental Booklet V - Interpolated Task

Copy No. 121

BOOKLET

V

Math Quiz

Please carry out the following arithmetic calculations (without calculator!) :

1. Add:

16	45	251	2117
9	15	386	1973

2. Subtract:

(a) 15 from 27 ? _____

(b) 19 from 115 ? _____

(c) 75 from 139 ? _____

(d) 10 from 5 ? _____

3. Multiply:

(a) 16 by 10 ? _____

(b) 15 by 15 ? _____

(c) 110 by 10 ? _____

(d) 136 by 24 ? _____

4. Divide:

(a) 45 by 9 ? _____ (b) 2482 by 24 ? _____

APPENDIX F

Experimental Booklet VI - Free Recall Test

Copy No. _____

BOOKLET

VI

TEST - Part 1

Let us assume that the reading of the main passage "A Learning Controversy" was an in-class assignment on a course that you are now taking. Let us also assume that, before this class, one of your friends advised you that she would be unable to make it but wanted you to be able to tell her about it so that she would not fall behind.

Please write down here, in complete sentences, all that you can remember from the passage so that you would be able to provide a thorough briefing about the contents when your friend returned.

APPENDIX G

Experimental Booklet VII - Multiple Choice Test

Copy No. _____

BOOKLET

VII

TEST - Part 2

Directions

This part of the test consists of twenty (20) multiple-choice type questions which were derived from the main passage.

You should find an answer sheet attached to the back of this booklet. You are asked to use this sheet to respond to the questions.

Please answer all questions. If you don't know or are unsure which of the options is the correct one, you are asked to select the one which you believe is most likely to be correct.

EXAMPLE:

Q# 45. The Prime Minister of Canada is named:

a. John Denver
b. Margaret Thatcher
c. Pierre Trudeau
d. Peter Lougheed

Clearly, the correct answer is (c) and you would indicate this by circling (c) beside the appropriate question on your answer sheet:

45. a b (c) d

Should you make a mistake and wish to change your answer, simply cross out your original selection with an "X" and then circle your new choice:

45. (a) b (X) d

Before you begin... DO YOU HAVE ANY QUESTIONS?

1. The idea that science should enhance our capacity for self-determination is proposed by the:

   a. Behaviourists and Cognitivists.
   b. Cognitivists.
   c. Cognitivists and Humanists.
   d. Humanists.

2. Which of the following is an important difference between the Humanists and the more traditional approaches to learning theory?

   a. Humanists emphasize the control that the human exerts on the environment rather than vice versa.
   b. Humanists make the assumption that the focus of concern should be on internal processes.
   c. Traditional approaches focus all of their attention on animal learning behaviour.
   d. Traditional approaches view the external environment as being the major factor in learning.

3. D.P. Ausubel is a theorist whose work provides evidence of the:

   a. Behaviourist belief that humans are born curious.
   b. Cognitivist desire to manipulate human learning behaviour.
   c. dependency of human organisms on external stimuli.
   d. need for instructional programming of stimuli.

4. The Cognitive psychologist would suggest that the degree to which a person can solve novel problems depends to a great extent upon:

   a. the configuration in which the problem is expressed.
   b. the level and quality of background experience.
   c. whether or not a given problem has personal meaning.
   d. whether or not the learner has specific relevant experience.

5. An instructor organizes his lessons so that all of the simple material precedes the complex. He hopes that students, thanks to this sequencing, will come to perceive the complex concepts before they are expounded upon in class.

   This instructor has adopted _____ viewpoint.

   a. a Behaviourist
   b. a Cognitivist
   c. either a Behaviourist or a Cognitivist
   d. either a Cognitivist or a Humanist

6. Which of the theories of learning behaviour would visualize a human being as a system such as those conceived in the image of the physical sciences?

   a. Behaviourists
   b. Behaviourists and Cognitivists
   c. Cognitivists and Humanists
   d. Cognitivists.

7. According to the Humanists, society's goals should be primarily concerned with the process of human:

   a. improvement.
   b. learning.
   c. self-actualization.
   d. control.

8. Which of the following correctly states a similarity between Cognitive and Behaviourist theorists?

   a. Both emphasize exclusively animal behaviour.
   b. Both seek to somehow methodically control human learning behaviour.
   c. Neither stresses the insightful characteristics of human learning behaviour.
   d. neither considers the study of reactive processes to be useful.

9. A man is locked up and left alone in a prison cell. Outside the cell, well beyond arm's reach, are the keys to the cell. After several hours of internment, the worried inmate gets up from the hammock he had been resting on and paces his cell. Suddenly, it dawns upon him that the rope suspending his hammock could be fashioned into a noose to draw in the keys.

   This case provides an excellent example of the occurrence of:

   a. operant external controls.
   b. man's innate drive to influence the environment.
   c. cognitive restructuring leading to "insight".
   d. man's natural problem-solving instinct.

10. B.F. Skinner proposes a utopian society which can be created through the application of:

    a. cognitive learning techniques.
    b. experiential learning techniques.
    c. techniques of aversive control.
    d. techniques of positive control.

11. A major spokesman of the Humanist realm of though is:

    a. C. Rogers.
    b. B.F. Skinner.
    c. D.P. Ausubel.
    d. J. Bruner.

12. A keynote to the Behaviourist tradition is the belief that complex learning phenomena can be:

    a. broken down into simple stimulus-response chains.
    b. deduced from the organism's attempts to control the environment.
    c. facilitated by a restructuring of the material to be learned.
    d. illustrated by simple portrayals of central brain processes.

13. Which learning theorists disregard attempts to specify the mechanics of learning?

    a. Behaviourists.
    b. Behaviourists and Cognitivists.
    c. Cognitivists and Humanists.
    d. Humanists.

14. Humanists view the human organism as a(n):

a. innately driven entity easily represented by a mechanical model.
b. innately driven entity fully capable of taking initiative.
c. mechanistic entity fully capable of independent thought and activity.
d. mechanistic entity capable only of reactive behaviour.

15. A major distinction between Cognitivist and Behaviourist orientations is the fact that:

a. Cognitivists believe that the human organism is capable of insightful behaviour.
b. Cognitivists emphasize the natural influence of the environment on human learning behaviour.
c. Behaviourists emphasize that humans naturally act to influence their surroundings.
d. Behaviourists sometimes use human subjects for experimentation.

16. If a Behaviourist were to describe a learned behaviour he would likely refer to such behaviour as:

a. cognitive structure formation.
b. fact accumulation.
c. habit formation.
d. response structuring formation.

17. Behaviourists and Cognitivists are alike in that both:

a. are concerned with the specifics of human problem-solving behaviour.
b. attempt to provide the ideal environmental conditions for learning behaviour.
c. infer central brain processes as integrators of problem-solving behaviour.
d. refer to movement intermediaries as integrators of learning behaviour.

18. Variable non-habitual behaviour would force one to admit that _____ must account for part of what is learned.

a. cognitive structures.
b. individual personalities.
c. innate drives.
d. stimulus-response connections.

19. The employment of propaganda techniques is an extreme form of conditioning people to react in certain ways to certain stimuli. The Nazi party in Germany during World War II was a master of this device.

Which learning theorists would likely be most <u>opposed</u> to such techniques?

a. Behaviourists.
b. Behaviourists and Cognitivists.
c. Humanists.
d. Humanists and Cognitivists.

20. A sports writer asked a famous mountain climber why he would risk his very life to climb treacherous Mount Everest in the Himalayas. The climber responded calmly, "Because it's there."

This person and others of his demeanor provide some evidence supporting the underlying beliefs of which theorists?

a. Behaviourists.
b. Behaviourists and Humanists.
c. Cognitivists and Humanists.
d. Humanists.

END
***

ANSWER SHEET

Student No. _____

Date _____

Question No.					Question No.				
1.	a	b	c	d	11.	a	b	c	d
2.	a	b	c	d	12.	a	b	c	d
3.	a	b	c	d	13.	a	b	c	d
4.	a	b	c	d	14.	a	b	c	d
5.	a	b	c	d	15.	a	b	c	d
6.	a	b	c	d	16.	a	b	c	d
7.	a	b	c	d	17.	a	b	c	d
8.	a	b	c	d	18.	a	b	c	d
9.	a	b	c	d	19.	a	b	c	d
10.	a	b	c	d	20.	a	b	c	d

Please indicate with a check mark (✓) how well you knew the contents of this passage before you read it.

1	2	3	4	5	6	7
Not at all			Fairly well			Very well

APPENDIX H

Instructions - Idea Unit Identification

AN ANALYTICAL TASK

Instructions

You have been chosen to carry out an analystical task which is essential for the proper interpretation of some of the results of this study. What we would like you to do is to divide a specially designed psychological prose passage into "complete idea units".

An idea unit can consist of a whole sentence, a clause or a phrase. It carries a single complete idea. Although an idea unit sometimes relies on another idea unit for reference (e.g. when using pronouns such as "he", "she", "her", "their", etc.), an idea unit can normally stand on its own because it does convey a complete idea.

The procedure that you should use goes as follows: as you read through the passage slowly and carefully, enclose each idea unit in parentheses ( ). It may happen that one idea unit is embedded within another. In that case, just use double parentheses where necessary. The following is an example of what you are being asked to do:

(The officer,(while having his tea,) spotted movement in the yard outside.) (He rose quickly) and (strode to the door,) (his pistol in his hand.) (The landlord began to tremble uncontrollably.)

You may have divided this sentence differently, so please just consider what YOU feel constitutes a complete idea. Simply do the best that you can for each sentence and then move on to the next in line.

On the following page you will find a sample psychological paragraph on which you can practice before proceeding on to the main passage. Please use a pencil for your work.

Before you begin, ARE THERE ANY QUESTIONS? If so, please raise your hand and a monitor will come to your assistance. If not, then carry on with the practice paragraph.

Practice Passage

They classify extrinsic reinforcement into five categories: consumables, manipulatables, visual and auditory stimuli, social stimuli, and tokens. It is interesting, and potentially valuable, to consider the use of each of these in the classroom. Consumables are relatively inconvenient. A teacher walking around a classroom, dispensing these as she observes desirable student behaviour, might occasion some concern among parents. Manipulatables, which include objects such as toys or trinkets, can be employed successfully, particularly with young children. Auditory and visual stimuli that are reinforcing are less likely to be readily available to a teacher. Such reinforcers are defined as signals that have been given reinforcing properties. For example, if a teacher told students that she would ring a bell every time she was happy with them, the bell would be an auditory reinforcer.

Excerpt from Guy Lefrancois'
"Psychology for Teaching"
(1979).

Now that you have had a little practice in isolating idea units, DO YOU HAVE ANY QUESTIONS?

If not, then please carry on to the main passage.

If so, please raise your hand and the monitor will assist you.

APPENDIX J

Idea Unit Scoring Key

Free Recall Marking Guide

(One of the principal concerns in the field of psychology is the question of how humans learn) and (what factors influence learning.) (Many theories, or attempted explanations have come forth during the long history of interest in this question.) (Today, however, only three major theoretical positions remain.) (The purpose of this passage is to outline (and contrast the key attributes of these approaches to the study of learning.))

(Two traditional viewpoints are readily discernible) (among scientists who study learning.) (One of these is that of the Behaviourist) (who maintains that complex learning phenomena can be reduced to simple stimulus-response relationships.) (Another viewpoint, that of Cognitive psychology,) (proposes that there is much more to learning than merely chains of stimulus-response connections.) (The Cognitivists feel that there is such a thing as "insight") (which allows the human organism to make "cognitive leaps") (when confronted by a new situation.) (Both types of learning theorists suggest methods for controlling human learning behaviour.)

(In recent years a new position has evolved) (which further complicates the learning issue addressed by the Behaviourists and Cognitivists.) (This viewpoint is that of the Humanists) (who reject outright the principles of Behaviourism and Cognitivism as being "dehumanizing".) (Rather than emphasizing the influence that the environment exerts on the human organism,) (the Humanists emphasize the control that the human attempts to exert on the environment.)

(Both the Behaviourists and the Cognitivists have often used animals) (to test their theories of human behaviour and learning.) (The Behaviourists are particularly noted for their use of this experimental approach.) (Fundamental to their use of animals is the assumption that the basic laws of learning are the same in rats, dogs, pigeons, monkeys and humans) (and that common underlying principles apply to a wide range of species.) (Few would question the learning similarities within species,) (but the Humanists strongly oppose the notion that principles of animal learning can be applied to humans.) (Accordingly, they see the human organism as being far too complex to be studied with animal methodologies) (and stress the inviolable "inner space" of the individual.) (The generalizing of animal learning behaviour to humans is considered an affront to human dignity.) (For these reasons the Humanists focus exclusively on human subjects) (in their deliberation and research on human learning behaviour.)

(Behaviourists see the learner as a mechanistic entity) (in that s/he is totally unresponsive until an environmental stimulus is applied.) (The learner is viewed as a receiver of various types of input (stimuli)) (which produce an appropriately programmed and predictable output (response) .) (Behaviourists imply that the learner is passive) (although a better term may be "reactive") (since the learner does neither more nor less than continually react to environmental events that are occurring.) (It is a completely determined system) (with no freedom of behaviour.) (This orientation to learning theory predisposes one to think in terms of mechanical models,) (physiological

mechanisms,) (biological processes,) (or any system that is conceived in the image of the physical sciences.)

(Cognitive theories of learning are at odds with Behaviourism on several major points.) (Cognitivists see humans as purposive agents.) (Humans are active rather than reactive) (and as such, are not, constrained to behave reflexively and automatically,) (but instead take some initiative in controlling their destiny.) (Understandably, Cognitivists reject the deterministic models of the physical sciences) (as being far too restrictive.) (In their view, the mind operates on a different set of principles than those evidenced in the physical world.)

(The Humanists are similar to the Cognitivists in this regard) (also seeing the human organism as a purposive agent.) (It is their belief that human beings have a natural potentiality for learning;) (humans are born curious about their world) (and ambivalently eager to develop and achieve.) (Humans possess an inner directing need to improve themselves) (in the direction of healthy, competent and creative functioning.) (Like the Cognitivists,) (the Humanists include insight and initiative in the natural repertoire of the human organism.)

(The Behaviourists and the Cognitivists provide different answers to the question: what is learned?) (Behaviourists argue that "habits" are learned.) (This is a commonsense answer,) (since few would deny that smooth-running skills are developed through practice.) (On the other hand, Cognitivists maintain that "cognitive structures" are what is learned.) (This is also a very commonsense answer.) (If we can locate a corner store from one starting point,) (we can find it from another) (because we "know where it is";) (we have learned and organized

a set of interrelated facts.) (A smooth-running skill illustrates a learned habit;) (knowing alternative routes illustrates cognitive structure.) (If all habits were highly mechanical and stereotyped,) (variable non-habitual behaviour would force us to admit cognitive structures as part, (at least), of what is learned.) (But the stimulus-reponse psychologist is nonetheless satisfied) (that s/he can deduce from the laws of habit formation) (the behaviour that the Cognitivist believes supports his/her interpretation.)

(The Humanists have an altogether different idea of "what" is learned.) (They stress two types of learning,) (relevant and irrelevant.) (Irrelevant learning is that which is acquired for no apparent reason.) (It is learning "from the neck up") (and involves little feeling or personal meaning.) (The Humanists see true relevant learning as being the acquisition of knowledge) (which has a quality of personal involvement.) (This is experiential learning which is self-initiated,) (pervasive,) (and is evaluated by the learner.) (Humanists do not view habits or facts as true learning.) (The essence of learning to the Humanist is whether or not the information to be acquired has meaning.) (Little attempt is made to specify the mechanics of this learning) (since the goal of the Humanist is to increase awareness of the elements which are involved) (in the meaningful and significant acquisition of knowledge.)

(The Behaviourists and the Humanists have long been locked in debate) (over the question of external control versus self-determinism.) (B.F. Skinner, (a well-known reinforcement Behaviourist,) has pleaded for abandonning techniques of aversive control (e.g. punishment)) (and

for consciously and openly applying techniques of positive control for the betterment of society.) (His novel "Walden Two") ((1948)) (details a utopian society) (which was created through the application of behaviour technology.) (Skinner's primary antagonist, (a prominent Humanist named Carl Rogers,) raises two points of disagreement with this proposed approach to societal control.) (He argues that Skinner does not take account of the potential abuse of power.) (Skinner assumes that techniques of social control will be used in the best interests of society.) (Rogers does not believe this to be possible) (due to man's inherent nature.) (Second, Skinner claims that, (if behavioural scientists experiment with society,) eventually the practices which make for the greatest biological and psychological strength of the group will presumably survive.) (Rogers contends that a society's goals should be concerned primarily with the process of becoming,) (achieving worth and dignity) (and being creative) - (in short, the process of self-actualization.) (The conflict herein described is between a position that favours human control) (through the thoughtful application of a science of behaviour) (and one which seems to assert that science should enhance our capacity for self-determination.) (The Cognitivists would clearly be more supportive of Skinner's argument than that of Rogers) (as they too seek to find a method for controlling human learning behaviour.) (Evidence of this is provided by the applications of hierarchical learning theories to instruction) (such as D.P. Ausubel's coding systems) (and Jerome Bruner's discovery learning.)

(When confronted with a novel problem,) (how does the learner reach a solution?) (The Behaviourist would see the learner assembling his/her habits from the past appropriate to the new problem,) (responding either according to the elements that the new problem has in common with familiar ones,) (or according to the aspects of the new situation which are similar to situations met before.) (If these do not lead to a solution) (then the learner would resort to "trial and error".) (The Humanist, (in different terminology,) would agree with this last statement.) (A major tenet of Humanism is "learning by doing".) (The Humanist would expect the learner's innate desire for learning, (for discovery,) (for enlargement of knowledge and experience) to be the energizing force behind his/her approach to a problem.) (The learner may use a "trial and error" approach) (until the problem at hand is satisfactorily resolved.) (The Cognitive psychologist, too, would agree in part with the Behaviourist position.) (However, s/he would be apt to point out) (that, granted the learner had all of the prerequisite experience and knowledge of the parts of the problem,) (there would still be no guarantee that s/he would be able to access the necessary information.) (The learner may be able to solve the problem presented in one form but not in another.) (According to the Cognitivist,) (the preferred method of presentation permits a perceptual structuring leading to "insight",) (that is, to the understanding of the essential relationships involved.)

(The Behaviourist tends, (by preference,) to look at the past history of the learner) (for the sources of solution) (while the Cognitivist, (by preference,) looks to the contemporary structuring of the

of the problem.) (The Humanist would look to the innate desire of the learner to motivate his/her approach.)

(In stark contrast with the Behaviourists,) (the Cognitivists more freely infer central brain processes) (such as memories or expectations) (as integrators of goal-seeking behaviour.) (The "understanding" of a situation) (is viewed as an appropriate descriptor of human problem-solving success.) (Conversely, the Behaviourists prefer to find movement intermediaries to serve as integrators) (and would never make use of a vague, unobservable concept such as "understanding".) (Humanists are generally unconcerned with the details of what is actually happening to the human organism when it is problem-solving.) (They are interested only in bringing to light) (the importance of the proper conditions for such behaviour to naturally occur.)