THE EFFECTS OF TWO METHODS OF PICTURE-ORIENTED INSTRUCTION ON THE COMPREHENSION AND RECALL OF GRADES 8 AND 11 SOCIAL STUDIES TEXT

by

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Abstract

Two non-traditional picture related methods of instruction were developed for this study: a picture-oriented method and an altered-pictures method. They were designed to determine whether either method was more effective than traditional content area instruction in helping students to remember and understand social studies text. In addition to the immediate effects on text comprehension and recall, the delayed effects of these two pictorial methods were examined. Also investigated were the effects of individual imagery ability and gender on a student's potential to profit from such methods. The teachers giving conventional instruction focused students' attention on the text passages only, although pictures did accompany the text. In the picture-oriented method of instruction teachers directed attention to both pictures and text, developing picture/text integration. Finally, teachers using the altered-pictures method of instruction discussed the meaning of mnemonically recodable elements which had been added to the pictures. In both the grade 8 and 11 samples the two experimental groups outperformed the conventional groups on measures of immediate and delayed recall. For the grade 8 sample, it was found that the altered-pictures method of instruction resulted in superior recall compared not only to that level of recall produced by the conventional method but also to that produced by the other experimental method (picture-oriented). In addition, when considering immediate with delayed performance two weeks after instruction, the grade 11 students who received the altered-pictures instruction outperformed the conventional group. For both grade samples, an additional finding was that males outperformed females in their overall recall (both immediate and delayed measures) regardless of imagery ability or type of instruction received. At both grade levels, no particular type of instruction was of benefit to one gender more than to the other, and students of high or low imagery ability were able to profit similarly from all forms of instruction.

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Acknowledgements

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CHAPTER I.

Introduction

1. Statement of the Problem

The need to investigate what methods of instruction are most effective at the high school level in enhancing learning from illustrations in content area textbooks has been determined from the literature. Research in the areas of how the brain works, and the effects of text illustrations on memory has suggested that pictures may have untapped potential for enhancing learning. Four questions were asked in addressing this problem.

a) Methods of instruction

In an attempt to address the concern of educators to develop effective methods of content area instruction, and to expand the relatively neglected area of picture/text strategies research, two non-traditional methods of picture-oriented social studies instruction were developed for this study. They were designed to determine whether either method is more effective than traditional content area lesson instruction in helping students to remember and understand what they read.

b) Delayed comprehension and recall effects

There are few picture-related studies (see chapter 2, section 3a, Effects of pictures on recall) that have adequately tested the effects of pictorial methods on delayed comprehension and recall. The present study was directed at determining what these effects might be on comprehension and recall two weeks after exposure to the picture-oriented instruction.

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c) Imagery ability effects

A third question investigated the effect of individual imagery ability on a student's potential to profit from the two different types of picture-oriented instruction. This was prompted by a desire to explore whether or not students could benefit from picture-oriented instruction with some control on their imagery abilities.

d) Gender effects

Finally, whether or not both males and females could profit from these methods was examined, as there is some evidence that gender may play a part in a student's ability at different ages to use pictorial methods.

3. Rationale for the Study

Research concerned with visual memory has found that not only may pictures be remembered better than words (Dilley & Paivio, 1969; Levie, 1973; Levin, 1974), but memory capacity for pictures may be unlimited (Haber, 1970; Standing, 1973). Consistent with this finding, some researchers in the field of mental imagery suggest that the process of generating mental images may be an integral part of cognition (Kosslyn, 1981). It must be said that there has been considerable controversy (Gardner, 1985) about this position. But if it has validity, then the development of instruction which recognizes this component of cognition may be an aspect of educational research generally overlooked.

Even in the absence of instruction, the literature on the influence of illustrations on learning from reading suggests that the mere presence of illustrations has, in general, a postitive effect on comprehension and recall (Anglin, 1986; Dean & Kulhavy, 1981; Levie & Lentz, 1982). At the same time, there is evidence of the failure of pictures to produce any positive learning benefits. In the review by Levie and Lentz (1982), about 15% of the studies reported no significant picture effects on the comprehension and recall of the accompanying text.

One possible explanation for this phenomenon, and an important issue that emerges from the literature, is that students may fail to make effective use of illustrations (Moore & Skinner, 1985; Brody, 1984). Most people are convinced that the understanding of pictures requires only a small amount of invested mental effort; pictures tend to be perceived as "easy media" (Salomon, 1984). As a result, pictures may tend to be processed superficially. Possible undervaluation by the subject of pictures' perceived informativeness is a neglected aspect of research on the effectiveness of illustrations (Weidenmann, 1989).

There is a need to address this failure-of-pictures problem for two reasons. First, of concern to educators, there is a now well-known picture-superiority effect (Haring & Fry, 1981; Levie & Lentz, 1982; Levin, 1981, Levin, Anglin, & Carney, 1987; Readence & Moore, 1981) that should be capitalized upon by developing special forms of picture-oriented instruction. It would be unfortunate to ignore the powerful potential pictures offer as a means to improved learning. Second, of concern to publishers, the failure of pictures to yield any positive benefits is a serious problem when one considers that illustrations in textbooks are expensive to produce, especially if in colour. Publishers may want to reconsider the role of illustrations in textbooks, and perhaps redesign their texts in a way, for example, that would maximize the potential of the illustrations to increase prose comprehension and retention.

Representational pictures of the sort most often found in social studies texts may be particularly susceptible to the undervaluation and superficial processing that Weidenmann (1989) refers to. Also, the accompanying text increases the likelihood that students will give pictures only a quick inspection in order to concentrate on the medium perceived as the most informative: that is, the text.

a) Developing methods of instruction

In a recent survey of grade 5 and 6 social studies textbooks and teachers' manuals, Hunter, Crismore, and Pearson (1987), found no consistent pattern in the type of reference made to illustrations in the body of the text, or in the amount of direction given to teachers in manuals as to how to use the illustrations.

Another survey conducted indicated that while the role of illustrations is frequently suggested in manuals and guidebooks accompanying textbooks, explicit suggestions are seldom included for guiding their use during teaching (Evans, Watson, & Willows, 1987). Whether teachers have these suggestions in their teachers' manuals or not, the question that arises is, "What do they actually do with regard to illustrations in the classroom?" When teachers were interviewed in an attempt to answer this question, they most often mentioned the attention-getting and motivational aspects of illustrations, and admitted to using illustrations less than 10% of their teaching time. Under observation Evans and others (1987) found that teachers allocated very little time to illustrations, causing the authors to conclude that "some counterbalance appears necessary (Evans, Watson, & Willows, 1987, p. 92).

More instruction than simply drawing students' attention to illustrations appears to be required in order to gain positive learning benefits. Studies have shown, for example, that even when students are given a direction to attend to the illustrations, this is not enough to increase comprehension and recall for the accompanying text over and above what is achieved with the mere presence of illustrations alone (Hayes & Readence, 1982. 1983; Moore & Skinner, 1985).

Social studies is an area of instruction that may especially benefit from the use of effective picture-oriented learning strategies. In an extensive review of research directed at improving reading in the social studies Wade (1983) concluded that 1) treatments that were multidimensional had a higher success rate than those that consisted of only one or a few activities or materials, and 2) for successful treatments, the teacher played an active role in the classroom rather than relying on written overviews and exercises used by the pupil alone or in small groups. Of relevance, however, is the fact that very few of the studies reviewed resulted in positive gains, or gains that could be sustained over a period of time, and none of the studies reviewed made use of textbook illustrations as instructional aids.

A "visually structured" lesson, designed for a previous study (McComb, 1987), did appear to have value for enhancing the subjects' comprehension and recall of grades 5 and 7 social studies content beyond the comprehension and recall of the subjects exposed to the presence of pictures but receiving text-processing instruction only. This study examined the effect of just one method of picture-oriented

instruction.

Might other forms of picture-oriented instruction promote understanding and memory of the accompanying prose? In order to answer this question and to gain a clearer understanding of what might be the most effective forms of picture-oriented instruction for use with social studies texts, further investigation was required. It has been shown, for example, that picture strategies used in vocabulary and foreign language learning produce dramatically superior results over other more traditional methods of instruction. Could these mnemonic methods be adapted for prose learning? There has been, in fact, some interest in this area. A few researchers have attempted to adapt mnemonic methods to prose learning, using specially designed pictures (Levin, Shriberg, & Berry, 1983; Mastropieri, Scruggs, & Levin, 1987; Mastropieri, & Scruggs, 1989).

Levin (1981) has made distinctions among various picture types based on the functions they are intended to fulfill. Pictures which are "conventional" may serve representational, organizational, and interpretive functions. Based on their analysis of more than 100 studies, Levin, Anglin and Carney (1987) conclude that even though pictures serving conventional functions are facilitative of prose learning, pictures serving "unconventional" or transformational functions can be even more beneficial. Representational pictures represent the text content and serve mainly to make the text more concrete; these pictures may have an indirect influence on the recall of the accompanying prose. Transformational pictures, on the other hand, are designed to impact on students' memory directly.

Transformational pictures are "unconventional" in the sense that they are conspicuously absent from most textbooks. Based on a growing body of imagery research findings, these pictures are transformed or altered in specific ways. Levin, Anglin, and Carney (1987) explain the three principles used in designing such pictures. First, the critical information to be learned is targeted, and then **recoded** into a more concrete, memorable form. Second, the separate pieces of information are **related** in context, and finally, the student is provided with a systematic means of **retrieving** the information.

The effectiveness of transformational pictures is supported by a number of imagery research findings. First, it has been demonstrated not only that bizarre imagery may improve memory

performance (Einstein & McDaniel, 1987), but also that the recall of pictures may be improved if a picture contains a discordant element (Molitor, Ballstaedt, and Mandl, 1989). Second, it has been found that recall may be enhanced if imagery encoding occurs before verbal processing (Kosslyn, Holyoak, & Huffman.) A third finding is that cued recall is better after subjects image items interacting in a meaningful way, rather than as separate units (Bower, 1970; Begg, 1972). Finally, retrieval of information may be enhanced if verbal information is attached to visual (Reed & Hoffman, 1986).

Teachers, under the time constraints they normally face, do not have time to design special pictures for all their students' texts. But, might mnemonically based methods be used in conjunction with the pictures already present in social studies texts? Given that visual aids, including pictures, may account for as much as one quarter of the material contained in content area texts (Friedman & Tinzman, 1985), there appears to be a need to develop instructional strategies that will make use of the actual textbook illustrations. In a nonmnemonic condition students relate the content represented in the picture to explanation or information in the text. In a mnemonic condition the picture is altered or transformed to include mnemonic links between the picture and the accompanying text. Would a mnemonically based (transformational) picture/text method of instruction be as effective as the nonmnemonic, (representational) visually structured lesson in promoting comprehension and recall?

b) Delayed effects of illustrations

There is also a need to determine the extent to which the effects of visual instruction are sustained over time. In many of the studies comparing long-term retention of pictures and words, evidence suggests that there may be differential forgetting rates for pictures and words (Paivio, 1975; Yarmey & Barker, 1971) with high levels of picture retention (relative to words) even after considerable delays. Although the effects of the **presence** of pictures on recall up to 55 days after initial exposure has been investigated (Anglin, 1987), the effects of picture-oriented **instruction** on comprehension and recall have not been examined beyond a period of two weeks (McComb, 1987). The need to explore the difference between immediate and delayed performance in picture/text studies is important since

there is a tendency for pictures to help more in delayed comprehension and recall than in immediate comprehension and recall. Levie and Lentz (1982) noted this phenomenon in 19 out of 24 studies reviewed, although in many instances recall was tested after very brief delays. Peeck (1989) draws attention to the unfortunate preference for immediate testing in studies of text illustrations, a surprising practice, since it is the long-term effect that would presumably interest educators most.

c) Imagery ability effects

There is evidence that some students may be more likely to profit from pictorial or imagery instruction than others. Although there is a lack of research in this area, some studies have found that females report greater degrees of vividness than do males (White, et al., 1977; Sheehan, 1967).

d) Gender differences

Differences in imagery use may be compounded with age and gender differences. Waber (1979), for example, postulates that females are less lateralized than males because they reach puberty earlier than males. Ernest and Paivio (1971) have suggested that in some instances females may be able to use imaginal processes where males do not. The lack of research in this area indicates a need to examine this issue more carefully.

The developmental differences in the ability to use imagery have been investigated to a greater extent (Hishitani, 1985; Pressley, Carriglia-Bull, Deane, 1987; Richardson & Harris, 1985). More research is needed at different grade levels, however, to clarify how students of different ages are able to profit from picture/text strategy instruction. Imagery and paired-associate research has found positive learning effects with the use of imagery, or pictures alone, or pictures with verbal labels using college age students as subjects (Gati & Tversky, 1987; Reed & Hoffman, 1986; Srivastava & Purohit, 1983). Other studies concerned with the potential of illustrations to aid in the recall of prose materials (Anglin, 1987; Childers, 1984) have found positive effects with university undergraduates. Findings from these

studies with older students suggest that pictorial instruction with younger learners warrants investigation. A number of researchers have investigated the facilitation of prose learning through mnemonic strategies with intermediate grade students (Levin, Shriberg, & Berry, 1983; Mastropieri, Scruggs, & Levin, 1987). While a few studies have explored various effects of the **presence** of pictures with high school students (Hayes & Henk, 1986; Wjodarski, 1985), there are few, if any, studies with students from the grades of 8 to 12 as subjects which have investigated the effects of pictorial **instruction** in content area reading. In order to ensure that the social studies topic chosen for instruction in this study would not be a topic encountered before in prescribed textbooks, and in order to compare a junior with a senior high school grade level, grades 8 and 11 were selected for investigation.

3. Purpose of the Study

One of the major goals of educators and educational researchers is to maximize learning. The overwhelming majority of studies of memory development conducted during the past 15 years have focused on the developmental changes in the memory processes learners use naturally (Kail & Hagen, 1977). However, students can use strategies other than those used on their own. Little attention has been paid to student's use of strategy under instructional conditions (Pressley et al., 1989). It was, therefore, the purpose of this study to help clarify whether such instruction might improve understanding memory. Since a considerable body of research has shown that pictures may be retained more clearly and for much longer periods than words, pictures may have been neglected as useful tools for comprehension and memory enhancement. What this study examined, then, is whether or not students can achieve better comprehension and recall of a social studies text passage if, instead of traditional teaching, they were exposed to picture-related methods of instruction.

Traditional instruction in the social studies classroom may resemble a guided reading lesson, with the teacher directing the reading of a passage through appropriate questions and instructions (Gee & Rakow, 1987; Gee & Forester, 1988). Evidence based on eye movement data suggests that students

may attend to illustrations only in an incidental or superficial fashion (Reinking, 1986; Vacca, 1981; Van Perreren, 1983; Fineman, 1981), and most of the teacher's instructional time may be spent focusing students' attention on the written text (Evans, Watson, & Willows, 1987). The conventional method in this study is modelled after what is known about these traditional methods of teaching.

Three methods of instruction were designed for the study: 1) a conventional method, 2) a picture-oriented method, and 3) an altered-pictures method. A number of general learning principles and procedures were incorporated into all three methods of instruction. These features were based on studies which suggest positive learning benefits associated with their use. These procedures included having the teacher: 1) activate students' existing schemata, 2) elicit students' predictions about the reading material, 3) set a purpose for reading a passage, 4) provide students with written structures for note-taking, and 5) provide students with the opportunity for review or rehearsal of the text content.

In all three methods designed for the study, pictures accompanied the text. In the conventional and picture-oriented methods of instruction, the pictures appeared unaltered, and were representational in their function. The pictures represented the text content and served primarily to make the text more concrete. In the altered-pictures method of instruction, the pictures were altered or transformed primarily as a means to make them more memorable.

In the conventional method of instruction the teacher did not draw students' attention to the pictures, but focussed instuction solely on the written text. In the picture-oriented and altered-pictures methods of instruction, the students were required to engage in deeper, more elaborate picture processing. The teacher, in these methods, used the pictures to :

a) focus students' attention first on more concrete pictorial material rather than more abstract, written material,

b) activate existing schemata,

c) supply structures or "pegs" that helped organize and link text content,

d) provide review frameworks to recall and rehearse the text.

In addition, in the altered-pictures method of instruction the pictures were used to recode

targeted to-be-learned information, relate elements in context, and provide a systematic means of information retrieval.

It was the purpose of this study to determine whether or not students who were subjected to either of these two forms of picture-related instruction would achieve better comprehension and recall of the accompanying social studies passage than those students who received instruction that was focused solely on the written text. Also investigated was whether students of different imagery abilities and different gender could benefit equally from the picture-oriented methods of instruction.

Specifically, for both grades selected, grades 8 and 11, the questions posed in this study were: 1) Would students who are exposed to either a picture/text lesson or an altered pictures/text lesson demonstrate superior overall comprehension and recall of a social studies passage over students receiving traditional or text processing instruction only, on immediate and delayed comprehension/recall measures measuring comprehension and recall of the text content only?

2) Would students of high imagery ability differ from those of low imagery ability in their overall comprehension/recall performance (includes immediate and delayed performance), or comparative comprehension/recall performance (compares immediate with delayed performance)?

3) Would female students differ from male students (of the same grade level) in their overall comparative comprehension/recall performance ?

4) Would there be an interaction between treatment condition and imagery ability levels as observed on measures of both immediate and delayed comprehension and recall? That is, would the overall or comparative comprehension/recall performance of students of either low or high imagery ability levels be affected depending on the type of instruction received?

5) Would there be an interaction between the treatment condition and gender as observed on measures

of both immediate and delayed comprehension/recall? Would one particular type of treatment, for example, result in superior overall comprehension and recall or different comparative comprehension and recall for one gender compared to the other?

6) Would students of one gender of a certain imagery ability level perform differently on the immediate and delayed measures of comprehension and recall (when considering both their overall comprhension/recall and comparative or patterns of recall) than students of the other gender of a different level of imagery ability?

7) Would students of a certain imagery ability or gender receiving conventional or one of two types of picture-oriented instruction differ in their overall comprehension/recall performance or their comparative comprehension/recall performance (when comparing delayed with immediate performance) on a social studies lesson? That is, would there be an interaction among the type of instruction received, imagery ability, and gender for the immediate and delayed comprehension/recall measures (when considering both overall performance, and comparative patterns of comprehension/recall)?

4. Definitions

For the purposes of this study, a number of frequently used terms are defined as follows:

comprehension/recall: this is defined as the amount of information remembered, and/or understood as demonstrated on both an immediate and delayed three-page test.

delayed comprehension/recall: this was the comprehension and/or recall measured approximately two weeks after exposure to the treatment lesson, and consisting of the same test measure items as on the immediate comprehension/recall test; the format, and item order was altered, however.

overall comprehension/recall: for the purposes of this study overall comprehension/recall refers to an overall comprehension and recall score obtained by adding the immediate score with the delayed score, and taking the average.

comparative comprehension/recall: for the purposes of this study comparative comprehension/recall is a difference score obtained by subtracting the delayed comprehension/recall score from the immediate comprehension/recall score. The resulting score reflects the trend or pattern of comprehension/recall when comparing performance at immediate testing with performance two weeks later at delayed testing.

conventional treatment: there was one control treatment where students received traditional instruction; they were directed to read silently sections of a researcher-designed social studies unit interspersed with pre and post questions from the teacher.

picture conditions: there were two experimental treatments, the picture-oriented treatment, and the altered-pictures treatment, in which students received picture-oriented instruction directed at the same researcher-designed social studies unit as used for the conventional treatment. In these two methods of instruction, the teacher focused students' attention on the pictures contained in the social studies unit, and asked questions before and after silent reading that would help to integrate text with picture content.

picture-oriented treatment: in this experimental method the pictures were not altered and were identical to those appearing in the control condition. The lesson was the same as the control condition except that instead of the teacher focusing attention solely on the text, students' attention was directed to the various pictures before and after silent reading of text sections.

altered-pictures treatment: in this experimental method the pictures each included one or two additional

features which interacted with elements already present in the picture. Verbal information to be learned was thus recoded pictorially. The teacher made one brief comment that these features were added as a type of learning strategy. The lesson was the same as the picture-oriented lesson, except that the meaning of these additional features was also discussed.

low imagery ability: for the purposes of this study subjects of low imagery ability were those who had self-rated their ability to see clear and distinct images of various items appearing on Marks' Vividness of Visual Imagery Questionnaire such that their obtained score fell into the group designated as "low". Scores were divided into two groups, high and low, split at the median score for each grade.

high imagery ability: for the purposes of this study, subjects of high imagery ability were those who self-rated their ability to see clear and distinct images on the imagery questionnaire cited above, such that their obtained score fell into the group designated as "high".

mental imagery: this is defined as "the mental invention or recreation of an experience that in at least some respects resembles the experience of actually perceiving an object or an event, either in conjunction with, or in the absence of, direct sensory stimulation". (Finke, 1989, p. 2)

representational picture: this is a picture that depicts the text content, serving mainly to make the text content more concrete. A portion of the text content is "represented" in the picture (Levin, Anglin, & Carney, 1987).

transformational picture: more than just supplementing the verbally presented text indirectly, (as do other picture types), the transformational picture differs in that it is designed to directly affect memory for text content. This type of picture a) recodes critical information into a more concrete (pictorial) and memorable form (novel or unusual), b) relates in context separate pieces of information (linking the

information to be learned with the recoded form); an example used in this study was linking an army general's name, "Kornilov" (the critical information) with a picture of him, sitting in a "corner" (the recoded, concrete, novel form), and c) provides a means of retrieving the critical information when later asked for it (from the concrete picture of the army general in uniform, to the recoded "corner", to the man's name, "Kornilov").

5. Assumptions

It is normally expected that special forms of instruction will produce positive learning gains. Unfortunately sometimes they do not. It is thus important to be aware of some of the occasions in which minimal advantages would be derived from strategy instruction. A number of assumptions were made concerning the absence of these conditions, under which minimal instructional effects would occur.

It was assumed that:

a) students were not already giving a great deal of attention to illustrations or employing any picture-oriented strategies. As a check on this, however, a final item was included on the comprehension/recall measure asking students to list the pictures they remembered, with a brief description.

b) students were not already using a more efficient learning strategy than the one presented to them. Late adolescent learners, for example, may have developed their own more efficient learning devices (Rohwer, 1980).

c) the learning situations were structured so that it was physically possible for the subjects to execute the task required in order for a strategy to be effective. It was assumed, for example, that the students had enough time to complete the lesson tasks required.

(The three assumptions above, related to the students, are adapted from Pressley et al. 1982).

d) the test measures which were required of students in this study were related to the types of tasks

required of students in a regular school setting.

e) the initial and final test instruments used in this study provided an adequate method for assessing immediate and delayed comprehension and recall of information.

f) for the altered-pictures group of subjects, the comprehension/recall measure would adequately detect the comprehension and recall of meaningful information. That is, comprehension of and recall for important information, and not the understanding of and memory for the bizarre features of the pictures, would be adequately tested.

g) the subjects, although not randomly selected, were representative of students at both the grades 8 and 11 level in Vancouver high schools.

h) extraneous variables (such as examination schedules, illness, etc.) which might affect results on the dependent variable measures were controlled, even though random sampling did not occur.

6. Significance of the Study

Although many authors (Borkowski & Cavanaugh, 1979; Bray et al., 1977; Brown, 1975; Campione & Brown, 1978; Royer, 1979) have cautioned that different memory strategy treatments have different effects on different populations and in different situations, this investigation has practical significance for classroom instruction. The study contributes to the fields of memory strategy instruction and illustration research by furnishing new information about the kinds of picture-oriented instruction that might have merit in enhancing comprehension of and memory for content area material.

This study also helps to provide more specific information concerning picture-oriented instruction by controlling certain variables. Unlike some other studies of the past (see Brody, 1981 and

Dwyer, 1971 for reviews), the pictures used in this study had ecological validity, being typical of illustrations found in social studies textbooks. Also, the pictures selected were confined to only one type. Lack of control of picture variables has been noted as a shortcoming of some of the research conducted in the past (Brody, 1981; Molitor, Ballstaedt, & Mandl, 1989; Schallert, 1980). Therefore, in this study, black and white photographs only were included in the teaching materials, in order to avoid confusion over picture type effects. Picture functions were also controlled, so that pictures with only representational and transformational functions were included in an organized fashion according to instructional treatment. In this way useful information related to pictures with certain functions was contributed to the field. The readability of the text passages was another variable that was carefully controlled for each grade, so that passages provided to the students were approximately equal in reading difficulty, relative to each grade level.

Including gender as a variable for investigation helps to furnish further information, in an area relatively uninvestigated, about the types of students that may profit from picture-oriented methods of instruction.

Background knowledge was also controlled in this study to ensure that differences in amount of text comprehension and recall could not be confused with background knowledge differences. This, too, is a variable which has sometimes been overlooked in picture-text studies (see Cronbach & Snow, 1977).

As there is some evidence that imagery ability can affect prose and picture understanding and recall, imagery ability as an influencing factor was examined. Findings in this area may also help to add to the knowledge of what sort of students are most able to profit from picture-oriented methods of instruction.

This study also contributes information about the delayed comprehension and recall of text content following picture-oriented instruction. It has been noted that very few studies in this field have investigated the delayed effects of pictures on subsequent comprehension and recall of text (Levie, 1982; Peeck, 1989).

Finally, this study improves on a previous study (McComb, 1987) by investigating two different types of picture/text instruction. It was demonstrated in the previous study that the picture-oriented method of instruction has value for enhancing the comprehension and recall of prose over and above text-processing instruction only. However, as only one pictorial method was investigated, it was not clear what types of picture/text instruction are of the most benefit for the understanding and recall of prose. This study, by investigating the comprehension and recall effects of two different types of picture/text instruction, helps to clarify this issue.

The control of content variables such as readability of text materials, picture type, and picture function, as well as the control of subject variables such as levels of background knowledge and time of standardized reading testing, for each of the grade level samples also represents an improvement over the previous study. Although a statistical comparison is not made between the two grades in this study, a discussion of differences at each grade level gains more validity because of the control of the variables mentioned.

7. Organization of the Thesis

The thesis is organized in six chapters. Chapter One has presented the problem and the rationale for the study. The questions examined have been outlined, and the terms that are used in the thesis have been defined. Chapter Two presents a review of the related literature concerned with the theoretical aspects of pictures. Chapter Three reviews the relevant research concerned with the practical aspects of picture-oriented instruction. Chapter Four describes the research design and methodology of the study. Included in this chapter are a description of the data analysis, the nature and selection of the samples, the instructional materials, the testing instruments, the procedures of both the pilot and the main studies, and the experimental hypotheses. Chapter Five restates the hypotheses and presents the results of the data analyses. Chapter Six includes a summary of the study and a discussion of the results. Limitations, conclusions, and implications for future research are also discussed.

CHAPTER II.

Theoretical Foundations of the Study

The purpose of this study was to investigate whether or not picture-oriented methods of instruction could facilitate recall of expository prose when compared to a traditional method of instruction. Also examined were the relationships of individual imagery ability and gender on students' ability to profit from these pictorial methods.

This chapter reviews the literature concerned with the theoretical aspects of pictures and includes information about picture perception, memory for pictures, memory models, the related area of visual imagery, and the current neurophysiological findings.

Three activities which occur during picture perception are discussed: attention and scanning, picture interpretation, and perception of global meaning. A discussion of how pictures are remembered or stored includes information about the relationships between the number of eye fixations and recall, the unusual character of picture elements and recall, and the combining of words and pictures and subsequent recall. The processes involved in encoding and storing words and pictures are explained in terms of four memory models: Paivio's dual-coding model (1978), Kosslyn's two-stage processing model (1981), Pylyshyn's single code model (1979), and Nelson's sensory-semantic model (1979). An examination of mental imagery leads to the conclusion that the exact nature of mental imagery has not been clearly delineated but it clearly plays a functional role in human cognition, and there is some suggestion that imagery may resemble the process of visual perception. Finally, neurophysiological findings discussed include information about lateralization as related to visual processing.

1. Perception of Pictures

It has been noted that picture-viewing behaviour (Nesbit, 1981) is distinctly different from the reading process. Reading is a somewhat regimented process of fixating words left-to-right, line-by-line, whereas picture viewing is an unstructured and exploratory process. As defined by Levie (1987) picture

perception is a process that begins with observing that a marked surface contains information about something other than itself - information about the depicted content. Three different types of activity normally occur: attention and scanning, interpretation of important figures and cues, and perception of global meaning.

But first, what are the major theoretical approaches to picture perception? Philosophers, psychologists, art historians, semioticians, educators, and computer scientists have attempted to answer questions about the nature of picture perception. How, for example, does the perception of a picture differ from the perception of the natural environment? How do pictures differ from other types of symbols? And does the process of perceiving a picutre involve extracting meaning from a stimulus or conferring meaning on a stimulus?

According to Gibson (1971), picture perception is a stimulus-driven process in which information is picked up directly from the optic array. In contrast, "constructivists" such as Gombrich (1969) and Gregory (1978) focus attention on the role played by the perceiver. Pictures do not tell their own story; instead, the viewer constructs a meaning based on a wide background of conventions and expectations.

For Arnheim (1974), picture perception is neither an act of direct perception nor a process of decoding preconceptions. It is mainly a matter of reacting to the basic forms and forces present in the picture that have personal psychological meaning. Schemata are the real conveyers of meaning.

Another approach to picture perception is symbol theory. Goodman (1976) proposed a symbol theory which includes a range of concepts that may be used to analyze and compare symbol systems such as words, drawings, graphs, diagrams, music, and number systems. According to Goodman's theory, symbol systems differ in their notationality or the degree to which the elements of a system are distinct and combined according to precise rules. Number systems, for example, are high in notationality (each number is unique, the rules of correspondence are exact. Drawings, however, are nonnotational. The elements of drawings are overlapping, confusing, and lacking in clear syntax. Goodman's approach suggests that an attempt to develop a "grammar of picturing" is nonsensical. In another symbol or

semiotic approach, Knowlton (1966) emphasized contrasts in the form and function of digital signs (words, numbers, etc.) and iconic signs (pictures, statues, etc.). He also made a distinction among realistic, logical, and analogical pictures.

Using computer visual simulation, Marr (1982) proposed a computational theory of vision to show how knowledge about the visual world can be inferred from images of it and what assumptions about the real world are required to perceive these relationships. Marr was important in the field of visual perception, since he was probably the first researcher to realize that a complete understanding of perception could only come about by means of a theory that considered "the actual problems involved in perceiving objects, how these constraints might be counteracted, and how they may be realized in particular mechanisms, ranging from computers to brains" (Gardner, 1985, p. 298). Marr's work represented a break from those researchers who believed in direct perception and entered the realm of cognitive science. He believed that no discipline in itself could explain the process of visual perception adequately. Although a neurophysiologist, he cautioned against excessive concentration on the nature of brain processes alone. Unlike a number of other researchers, Marr was able to move some steps towards an integration of knowledge from the three perspectives of psychology, artificial intelligence, and neuroanatomy.

a) Attention and scanning

A number of researchers have investigated the nature of eye movements during picture viewing. Pictures are scanned in brief fixations, lasting about 300 milliseconds each, separated by saccades or extremely rapid eye movements. The location of a foveal fixation (a small central area about 2 degrees in diameter) influences how a picture is interpreted and what is remembered about the picture (Nelson & Loftus, 1980). Although acuity falls off rapidly from the central area of focus or fovea, certain information can be picked up from peripheral vision. In fact, the gist of an entire picture can be understood even when presented for as little as 300 milliseconds (Levie, 1987). Factors which influence which areas of a picture are fixated include a variety of stimulus variables (Antes, Singsaas,

& Metzger, 1978; Phillips, 1977). It has been found that a discordant element in a picture increases the depth of processing (Molitor, Ballstaedt, & Mandl, 1989). Viewer expectations (Beiderman, Teitelbaum, & Mezzanotte, 1983) are another variable affecting fixations. Whether the viewer's purpose for looking is general exploration or task-oriented search (Yarbus, 1967) also influences a person's viewing behaviour. Finally, viewer characteristics such as age (Mackworth & Bruner, 1970; Phillips, 1985) or intelligence may also be influencing factors. Nesbit (1981), for example, was able to demonstrate, in a study involving university students, that a positive correlation existed between the number of eye fixations a subject gave to a picture and his or her intelligence level.

The visual fixation data of Mackworth and Morandi (1967) also revealed that subjects spent more time fixating on the unpredictable or unusual features of a picture; the peripheral retina quickly screened off the redundant and more predictable features, leaving the fovea free to focus on the unpredictable and unusual stimuli.

The Treisman and Gelade (1980) theory of attention stipulates that although pictorial features such as color and size can be perceived automatically and in parallel, the figures in pictures are perceived one at a time in focused attention. Current research is concerned with the identification of the perceptual processes that occur automatically during the preattentive stages and the determination of how these processes then combine with the more conscious cognitive operations involved in picture perception (Duncan, 1984; Owen, 1985).

b) Interpretation of pictorial cues

Pictures are objects themselves, but they act as surrogates for other objects (Levie, 1987). When a picture is used to represent something viewers know, for example, to disregard features of the pictures-as-object, such as the texture of the paper on which the picture appears, the border around it, its flatness, and its not-to-be-taken-literally quality.

One part of interpreting a picture is the recognition of important figures. The shape of a figure is usually all that is needed for identification (Hoffman & Richards, 1984) although sometimes

the viewer's expectations can hinder identification. Figure-ground discrimination appears to be a fundamental operation of the visual system.

Decoding the pictorial cues that provide information about the relationships among figures, on the other hand, can be a more difficult task. In general, the research on interpreting pictorial cues and features reveals that although some fundamental skills such as object recognition are essentially innate, young children and adults without ample picture-viewing experience have trouble decoding pictorial information that is abstract, complex, or peculiarly culture-bound, especially when the objects and concepts shown are unfamiliar (Hagen & Jones, 1978; Levie, 1987).

It has been demonstrated, however, that many of the skills involved in extracting information from pictures can be taught directly. Modest amounts of instruction have been found to improve a person's responsiveness to pictorial cues depicting texture (Seefeldt, 1979), shading (Yonas, Kuskowski, & Sternfels, 1979), and depth (Leach, 1978). Training procedures have been found to improve the encoding of left-right orientation in pictures (Fisher & Braine, 1981) and, most importantly for the purposes of this study, even improve the ability to draw inferences from pictures (Higgins, 1979).

c) Perception of global meaning

Two kinds of information can be extracted from pictures: "specific feature" information and "holistic" information (Levie, 1987). Specific feature information consists of the particular objects and cues found in a complex picture. The nature of holistic information generally refers to the schema, gist, or global meaning of a picture that can be perceived independently of the specific details. It has been shown that either type of information can be used as the basis for storage and retrieval (Loftus, 1975, 1983). A number of researchers have proposed that the global or holistic information is processed first before the more detailed specific feature information (Navon, 1977; Palmer, 1977). Antes and Mann (1984), however, suggest that the order in which global versus local information is processed may depend on factors such as the size of the image and the relationship between key local features and global meaning.

Neisser (1976) presents a model describing the relationships among global meaning, local detailed information, and eye movements (see Figure 1). Viewers in this model change their hypotheses about global meaning based on their unique schema. Neisser (1976, p. 20) states that because viewers can see only what they know how to look for, "it is these schemata together with the information actually available that determine what will be perceived."

Other research in this area has shown that the ability to perceive parts and wholes in drawings, for example, develops with age (Elkind, Koegler, & Go, 1964; Smith, 1977), and that when people are given a stimulus array capable of more than one interpretation, they tend to perceive the simplest alternative organization or operate under what is called the global minimum principle (Hatfield & Epstein, 1985; Peterson & Hochberg, 1983).

2. Memory for Pictures

Examining the nature of eye movements has led researchers to ask whether the number of eye fixations directed towards a picture influences how well a subject will perform on later measures of recall. Is the number of eye fixations, in fact, a reliable external indicator of internal cognitive processes? How are pictures remembered or stored? How does our ability to remember pictures compare with our ability to remember words? These are questions which have been investigated by a number of researchers.

Loftus (1971) found that the number of eye fixations made by a subject while initially viewing a picture was the best indicator of subsequent picture recognition. It was found that higher-valued pictures both received more fixations and were remembered better than low-valued pictures, but when the number of fixations was held constant, memory performance was independent of value. It was also found that when pictures were viewed for a fixed amount of time, memory performance was a positive function of number of fixations on the picture, and with number of fixations held constant, performance was independent of exposure time.

Also, as previously referred to, unusual elements in a picture can lead to an increase in the

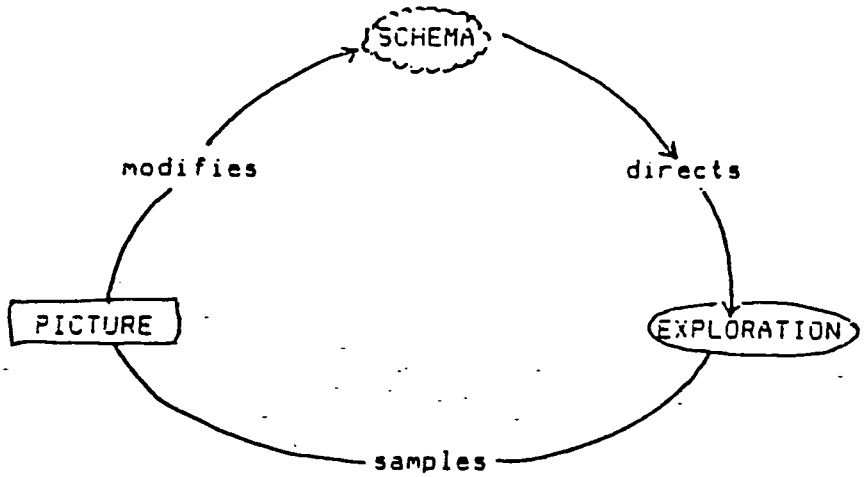

Figure 1. Modification of Neisser's perceptual cycle. An anticipatory schema directs exploration and sampling from the information available in the picture. The resulting sample is used to modify the schema. The modified schema directs further exploration. From Cognition and Reality (p. 21) by U. Neisser, 1976, San Francisco: W.H. Freeman. Copyright 1976 by W.H. Freeman. Adapted by permission.

number of eye fixations (Zusne, & Michels, 1964) and the likelihood of subsequent recall (O'Brien & Wolford, 1982).

Flagg & Weaver (1981) found significant correlations between fixations and recall of factual material with third and fifth grade children. Although the recall of high importance material (main ideas) was not significantly correlated with the percent of time or percent of fixations on the pictures, there were significant correlations between picture usage and recall of details. For both free and probed situations, recall of low importance text (details) was significantly correlated with percent of time spent looking at the pictures and with percent of fixations. Analysis of the eye movement data of the condition with picture identified a wide range of picture usage patterns which crossed boundaries of grade, reading skill, and text category. Eight percent of 48 children ignored the picture completely, 17% looked at the picture both before and after reading but not while reading the passage, 23% either examined the picture completely before or after they read the text through without interruption, and finally, 52% of the children interrupted their reading at least once to scan the picture. Thus, no distinct, homogeneous viewing pattern could be identified.

In a study conducted with college students as subjects, Nesbit (1981) also found a positive correlation between the number of eye fixations, measured unobtrusively, and subsequent recall. An additional finding was that there was no relationship between type of visuals (shaded line drawings, line drawings, and photographs) used and eye movements. One of his more interesting findings, noted earlier, was that the number of fixations given to a picture correlated highly with intelligence level.

Although it has been shown that a brief glance is sufficient to recognize a picture at a later date (Potter & Levy, 1969), longer inspection times are needed when more information has to be extracted than is necessary for simply identifying a picture well enough to distinguish it from others (Potter, 1976). Indeed, as stated earlier, it has been shown that it is not so much the length of viewing time as the number of eye fixations the subject makes during that time that determines what is remembered (Loftus, 1972; Spoehr & Lehmkuhle, 1982).

Related to how pictures are viewed is how pictures are remembered or stored. It has been

pointed out that visual perception is as much concerned with remembering what we have seen as it is with the act of seeing itself (Haber, 1970).

Investigations concerned with visual memory have suggested that the capacity to remember a picture once viewed is quite extraordinary. In an early study, Shepard (1967) showed subjects 612 pictures and used a forced-choice test to measure recognition performance. On a forced-choice test, a test item consists of one study picture paired with one or more distracters. Performance on a two-alternative forced-choice test was 98.5%. Even after showing subjects 10,000 slides over a 5 day period, Standing (1973) reported recognition accuracy of 83%. Because, under normal conditions, the rate of picture recognition has been found to be at such a high level, researchers must often revise their procedures in order to avoid ceiling effects.

Other researchers have demonstrated this picture-superiority effect with recall tests (Childers & Houston, 1984; Ritchey, 1982). Some investigators have argued that pictures can continue to be processed even when they are no longer present. Tversky and Sherman (1975) found that recognition and recall of pictures improved with increased exposure time and with increased time between pictures. Kobayashi (1986) also found that if the interstimulus interval was increased, (from 1 to 5 seconds) the recall memory for pictures was increased.

Related to these findings, are the findings in another area of research in which subjects were shown a series of pictures and asked to recall as many as they could. After a delay, the subjects were asked to recall them once more. Surprisingly, the number of pictures recalled increased with repeated testing, a phenomenon know as "hyperamnesia." Hyperamnesia has been demonstrated for recall of pictures but not words (Erdelyi & Kleinbard, 1978; Madigan & Lawrence, 1980) and for recognition of pictures (Erdelyi & Stein, 1981). A number of explanations are proposed to account for this effect. After a picture is removed from view, information from the image is held for a fraction of a second in a fast-decaying sensory store. Loftus, Shimamura, and Johnson (1985) have shown that, for about 100 milliseconds, as much information can be extracted from the icon (the stimulation that remains following stimulus off-set) as from the picture itself. The nature and locus of this icon, however, are unclear.

Some evidence suggests that the icon is primarily a matter of visible persistence located in the eye, and other evidence suggests that it is a form of memory located deeper in the nervous system (iconic memory).

Other researchers comparing the effects of pictures and words in paired-associate learning have found that the best learning occurs when a pair consists of a pictorial stimulus that is to be associated with a verbal response (Brainerd, Desrochers, & Howe, 1981). Haber and Myers (1982) showed that memory for a picture-word combination was superior to memory for words alone or pictures alone. Kosslyn and Holyoak (1976) demonstrated that more words are recalled if both verbal and pictorial encoding are involved. Others (Pezdek, 1977; Wiseman, MacLeod, & Lootsteen, 1985) have shown that subjects demonstrated superior recall of pictures that were combined or followed with a descriptive sentence. Related to such findings, Haber (1970) proposed that while a person may remember almost any picture ever seen, they may be frequently unable to recall details from a specific picture if asked to do so. Haber suggested that the reason for this inability is that the picture was not originally stored in the form of words. Thus, one of the implications of his research is that if techniques could be found to facilitate an attaching of words to visual images, recall might dramatically improve.

Subject variables that have been studied in connection with picture recognition memory include age, imagery ability, and prior knowledge. A number of developmental studies have reported increases in recognition memory for large numbers of pictures with age, from childhood to early adulthood (Hoffman & Dick, 1976; Pezdek, 1987). In the area of imagery ability effects, Ernest (1977) has found that high imagers surpass low in the identification of fragmented words and pictures. Marks (1973) has used the VVIQ (Vividness of Visual Imagery Questionnaire) to predict recall of high and low imagers for both the identity and location of pictorial information. The level of prior knowledge as a variable affecting the interpretation and amount of information extracted from an illustration has been investigated by Joseph and Dwyer (1984). They presented grade 10 students, who differed in their prior knowledge of general physiology, with a text on the physiology of the human heart illustrated with pictures varying in level of realism and abstraction. Their results revealed that for students with lower

levels of prior knowledge, various types of visuals were equally effective for remembering text, while students with higher levels of prior knowledge appeared to benefit more from realistic pictures.

3. Memory Models

The research findings in the field of picture memory provoke a number of questions. Why are pictures remembered better than words? Are pictures and words encoded and stored in separate memory systems or in a single underlying mental representation? Although the decoding processes in the reading of words and the viewing of pictures have been well researched, there is still little known in cognitive psychology about the higher stages of processing. It has been debated as to whether text and pictures are processed and stored in different memory systems and then in a different format, or whether there exists only one unique memory system where all knowledge is stored in one format independently of its origin from text or picture.

A number or researchers have proposed various models in attempts to delineate the processes involved in the encoding and storage or words and pictures. Four models which have received some prominence are: the dual-code model proposed by Paivio (1971), a two-stage processing model refined by Kosslyn (1981) and his associates, a sensory-semantic model devised by Nelson (1979), and the single code model most actively argued for by Pylyshyn (1981).

The terms "cognitive architecture" or "functional architecture" refer to the basic set of cognitive processes and their organization (Pylyshyn, 1984). Figure 2 illustrates four possible architectures for learning from pictures and text. The suggested models extend from one extreme, of representing picture and text processing as completely independent processes with no shared components, towards representing picture and text processing as processes which share greater degrees of overlapping. A model with all shared processes is not proposed because it is obvious that at peripheral levels of processing, text and picture comprehension are carried out differently. For example, in the encoding processes of text comprehension, the left-to right scanning and lexical access of reading have no counterpart in picture comprehension. Similarly, the process of going from a two-dimensional intensity

array to a representation of objects in particular spatial relations (see, for example, Marr; 1982) with one another has no counterpart in text processing.

A more detailed description of each of these models follows.

a) The Dual Code Model

Paivio's dual code model (1971, 1978) (see the first configuration in Figure 2) assumes two processing systems which function independently, yet interact with each other: a verbal system specialized in processing linguistic information and an imaginal system specialized for processing visual information. Thus, a text is predominantly processed and stored in the verbal system - only the concrete information of the text is visualized and thus also transmitted into the imaginal system. Pictures, on the other hand, are primarily processed and stored in the imaginal system, yet at the same time they enter the verbal system as a partially verbalized "copy." When a concept is registered in both memory systems, it is said to be dual coded. Paivio argues that dual coding is more likely to occur with pictures than words, and since two memory traces are better than one, dual coding explains the pictorial superiority effect. When learning from texts and pictures occurs, for example, pictures can always be retrieved from both memory systems. Paivio (1983) describes ten types of research evidence that may be interpreted as support for the dual-code model based almost entirely on the use of nouns and pictures of concrete objects as learning materials.

Both the approach of dual coding and the interpretation of Paivio's experiments have been stridently attacked. Researchers in the field of computer science, as one example, maintain that all of our knowledge is stored in a unique memory system in a propositional format independent of whether it was decoded as linguistic or visual information (Pylyshyn, 1979, 1981, 1984). The proposition is at a deeper level beyond the linguistic and visual realm, being an amodal, abstract representation of knowledge.

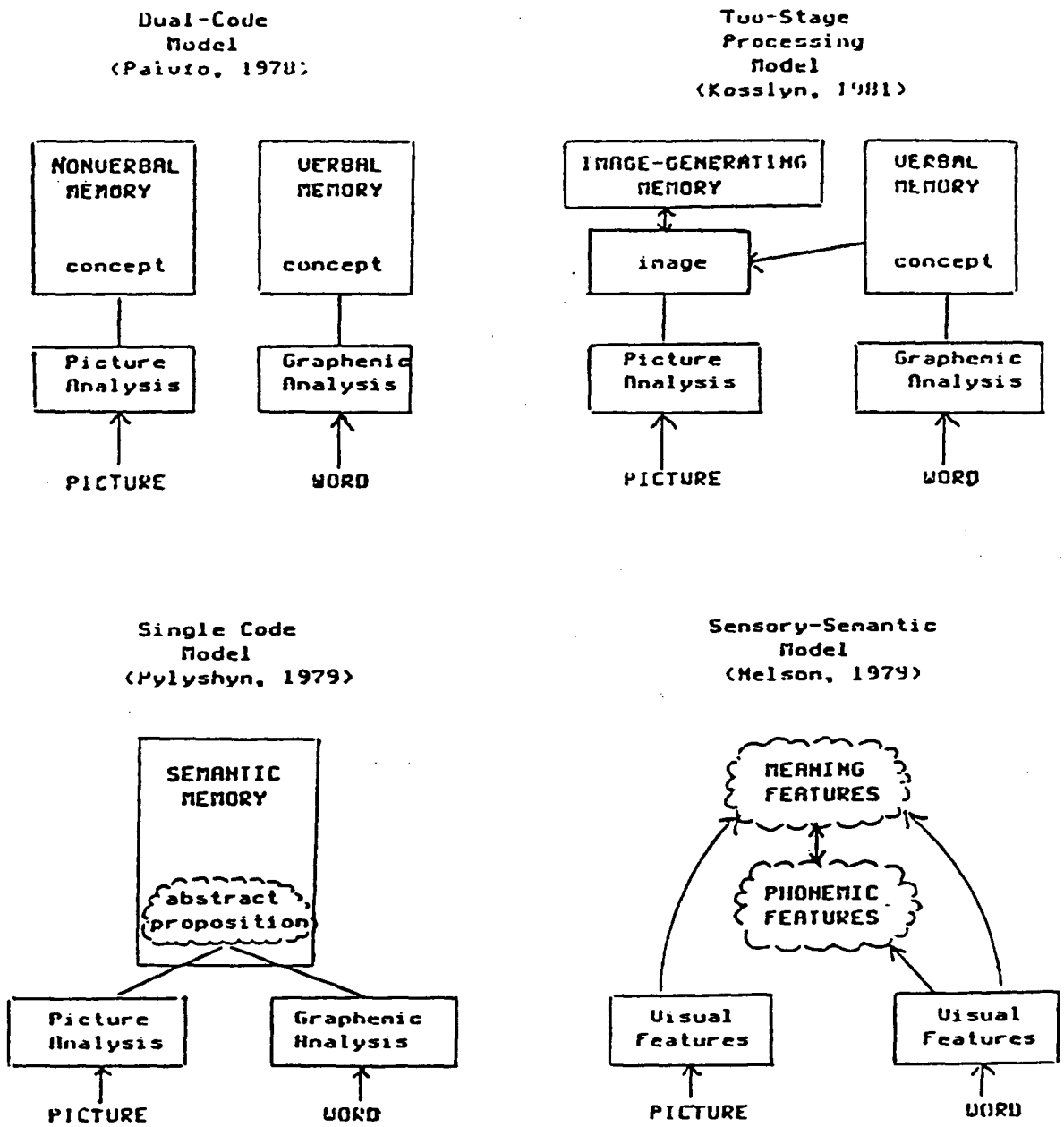

Figure 2. Four possible cognitive architectures or memory models for processing text and pictures.

b) Kosslyn's Two-Stage Processing Model

Kosslyn and his colleagues, through a series of ingenious experiments, have built an impressive file of empirical evidence that favors the existence and flexibility of mental imagery as a basic property of human cognition.

In Kosslyn's model, images have two major components. The surface representation is the quasi-pictorial entity in the active memory that is accompanied by the subjective experience of having an image. The images are likened to displays produced on a cathode-ray tube by a computer program operating on stored data. The images are actually temporary spatial displays in active memory that are generated from more abstract representations housed in long-term memory. These initial abstract representations consist of propositions and other kinds of non-imagistic information, such as that embodied in concepts. Thus, in the generation of imagery, there is an interplay between descriptive (languagelike) and depictive (picturelike) memories. But the quasi-pictorial image is not merely an epiphenomenal concomitant of more abstract nonpictorial processing. Rather, by drawing on long-term memory, one can generate images, chunk them in various ways, subject them to various transformations, and classify them in terms of semantic categories. Kosslyn speaks of a mind's-eye-like device which is necessary to interpret images or parts thereof: indeed, in his view, any representational system must include some sort of interpretive device (Kosslyn, 1978). And he stresses that information is stored in images that are not languagelike but "bear a non-arbitrary correspondence to the thing being represented" (1981, p.46).

To summarize, Kosslyn's model includes a cathode-ray tubelike display medium, techniques for forming an image on the display, and techniques for interpreting and transforming information in such a display.

Kosslyn's model is illustrated as the second example in Figure 2. In comparing the processing of words and pictures in this model, at both the external and at least some internal levels of representation, the processes involved are separate; even the processes that act on those representations, to store, access, and manipulate them, are correspondingly distinct. In the end, however, the final,

internal processing system is amodal, all knowledge ultimately being propositional in nature.

c) The Sensory-Semantic Model

The sensory-semantic model has been proposed by Nelson (1979) and was devised to account for differences in processing pictures and words such as the data that semantic judgments can be made more rapidly with pictures (such as deciding whether two items belong to the same general category such as furniture or clothing), whereas words are more readily accessible to phonemic (name) information (Potter & Faulconer, 1975). In this model, the pictorial superiority effect is attributed to a more distinctive sensory code for pictures (Nelson, Reed, & Walling, 1976) or to a greater likelihood that pictures will be processed semantically (Smith & Magee, 1980). The third example in Figure 2 illustrates this model; it differs from other models in that there is an extra processing level involved in the processing of words compared to pictures.

d) The Single Code Model

The single-code approach proposed by Pylyshyn (1981) is shown as the last model in Figure 2. Advocates of this approach do not regard data such as the pictorial superiority effect as evidence for separate systems, but only as evidence of different activations of a common system in which all information is coded as abstract propositions. As soon as information from text and pictures has been encoded to a certain fairly peripheral level, from there on it follows a common path, regardless of the modality, picture or text, through which it initially came in. Therefore, the level of the diagram marked "internal representation" is completely shared by information gleaned from pictures and text. In Pylyshyn's view, images are merely an epiphenomenon of processing, a cognitive luxury equally controlled by propositions. Proponents of this approach have mainly been influenced by computer analogy in cognitive psychology. Miller (1976) and Johnson-Laird (1983) as well as Anderson and Bower (1973) have aimed their efforts at describing the common mental code that underlies the representation of both pictorial and linguistic information.

e) Other Models

Durso and his associates (1980, 1983) propose a generic-specific memory model in which the the mental representations of pictures contain information specific to each picture, whereas semantic information of a more generic nature is encoded for words. Snodgrass (1984) suggests a multilevel model in which information from separate verbal and nonverbal systems is passed on to a single propositional store. Other researchers feel that dual-code models are actually too narrow. For example, Deffenbacher, Carr, and Leu (1981) provide evidence that human faces constitute a special class of stimuli that might be handled by yet a third memory system. As has been argued by Kolers and Brison (1984), it is likely that knowledge can be represented in a variety of ways, depending on the task, the modality, and the mental operations involved.

The present study is based on the concept that whether mental imagery is an integral and to some extent even a separate entity of cognition (as Kosslyn proposes), or whether mental imagery is simply an epiphemenon of cognitive processing (as Pylyshyn proposes) it clearly has a functional role in human cognition and appears to directly or indirectly influence learning and memory. Finding ways which appeal to or acknowledge mental imagery as a component of thinking, however, may be a neglected aspect of instructional research. This is perhaps not surprising since the concept of mental imagery has only been resurrected, seriously written about, and investigated over the last 20 years (Gardner, 1985).

4. Mental Imagery

It is important to consider just exactly what is meant by the concept of imagery.

a) Imagery: what is it?

Block (1981) asks what does it mean to "have an image" or to read information off an image? For Kosslyn (1981) images are temporary spatial displays in active memory that are generated from more abstract representations housed in long-term memory.

When imagery is posited as a basic property of human cognition, as a primary way in which information can be symbolized or represented, psychologists and cognitive scientists grow cautious. Philosophers, too, raise the problem of what the term imagery means, including various associated expressions such as scanning the image, focusing on particulars of the image, transforming the image, and so on. Since it is clear that there are no pictures (or even any "quasi-pictures") in the mind, Schwartz (1981) asks what is risked by the use of this metaphor. Georges Rey (1981) asks, for example, what kind of space do images, which appear to exist in two dimensions, live in? Shebar (1979) makes a case against thinking of an image as an object, but prefers instead to talk about the habitual and legitimate action of imagining. Pylyshyn (1973), too, has drawn attention to weaknesses in the everyday, uncritical use of the concept; he complains that to talk of "mental images" seems to imply the existence of "mental pictures" which require "seeing" by some internal mechanism. He argues that images may not be pictorial at all, but are probably much more abstract structures (Morris & Hampson, 1983).

One source of imagery theorizing and research has arisen from decades of discussion about the similarity and possible relation between visual imagery and visual perception (Paivio, 1971; Yates, 1966). Recently, the intuitive similarity of visual imagery and visual perception has led to claims by Paivio (1975), Kosslyn and Pomerantz (1977), and others that the images employed during thinking tasks can be equated with perceptions (see also Loftus & Loftus, 1980). Kosslyn's view (1988) is that imagery consists of brain states like those that arise during perception but occurs in the absence of the appropriate sensory input; such events are usually accompanied by the conscious experience of "seeing with the mind's eye," "hearing with the mind's ear" and so on. Farah (1985) has even demonstrated that generated mental images and percepts share a representational structure in the context of a visual detection task. However, the strongest conclusion reached, following extensive reviews of the relevant literature by Finke (1985) and Finke and Shepard (1985), was that "imagery truly does resemble perception in at least some fundamental respects" (Finke, 1985, p.256).

The functional similarity between imagery and perception has been shown by Finke and Shepard (1985) in experiments with skills such as mental rotation and mental scanning which require

imaginal processing. Some empirical findings, however, cast doubt on the suggestion that the processes controlling visual perception also control the generation of images based on information from long-term memory. Results from experiments with blind subjects, in which their reports of imagery resemble those of sighted subjects, suggest that spatial representation must be in a form that is more abstract than would be generated by a system based on the common properties of visual perception and imaginal processes (Adelson, 1979). A more generic level or representation seems to be involved and needs to be explained (Marschark, Richman, Yuille, & Hunt, 1987).

Another source of theorizing and research about imagery has arisen from discussions about the nature of spatial and imaginal phenomena in studies concerning the conscious manipulation of images. Shepard and Metzler (1971) were able to demonstrate through their experiments, for example, that a figure that had been rotated eighty degrees took longer to specify as identical to the target figure, than one rotated fifty degrees. Further experiments involving mental rotation (Koriat & Norman, 1984; Yuille & Steiger, 1982) have been conducted. Experiments which have demonstrated a person's ability to mentally scan scenes (Kosslyn, Ball, & Reiser, 1978; Intons-Peterson, 1983; Mitchell & Richman, 1980) and to make judgments about direction, or location in mental space have also been undertaken.

Perhaps one of the largest areas of imagery research has been concerned with the functional role of images in verbal learning and memory. The effectiveness of imagery mediation has been demonstrated in a variety of learning paradigms (Begg & Anderson, 1976; Bower, 1972; Paivio, 1982; Pressley, 1977; Ruch & Levin, 1979). The focus of this research, however, has been on learning, not on memory, with little attempt made to distinguish between processing and storage.

b) Ongoing debate

As Gardner (1985) points out, probably no research in recent cognitive studies has generated so much controversy as work on imagery. And since Kosslyn has devoted a great deal of time to the development, revision, and popularization of his model, (a model which includes mental imagery as a basic form of representation central to his model), his model has attracted widespread attention and

criticism. Kosslyn has responded extensively to the various lines of criticism and has, in the opinion of many, defended his model satisfactorily. Building on the work of Shepard, Paivio, and other researchers, Kosslyn has made the study of imagery a respectable topic within cognitive science and imagery has now become central in any discussion of cognitive structure. Kosslyn's overall position has been supported by the neurophysiological finding reported by Farah (1984) that at least one of the components of his model, the image-generation component, can be destroyed in isolation by damage to the brain. This finding should be interpreted with caution, however, since damage to a certain area of the brain may only interrupt a complicated neural system or network, and it does not necessarily follow that the damaged area contains the specific deficit-related component.

Yet, it is the idea asserted in Kosslyn's model that there exists a separate form of representation called imagery, that exhibits its own properties and operates independently, which has attracted the most criticism. Anderson (1978) states that for every line of experimentation, one can develop explanations in terms of either propositions or of imagery, and there is no accurate way to determine which is correct. Anderson concludes that "barring decisive physiological data, it will not be possible to establish whether an internal representation is pictorial or propositional" (1978, p.249). Since that time, however, Farah (1984) has produced some neurophysiological evidence for internal representations, pictorial in nature. Johnson-Laird (1983), although not accepting Anderson's argument, feels that it is unlikely that imagery disputes will be settled by psychological experiment. His argument revolves around levels of representation. Although at one level a psychological process may use only strings of symbols, at a higher level it may use various sorts of representation, including arrays, dot matrices, and the similar configurations. For a variety of functions, including problem-solving, it may be feasible that humans use mental images or, as Johnson-Laird denotes them, mental models.

Pylyshyn has probably attacked Kosslyn's ideas more than any other researcher (Pylyshyn, 1979, 1981, 1984) with articles all designed to refute the claim that imagery merits consideration as a separate form of mental representation. In Pylyshyn's view, imagery is simply a product of symbolically encoded rules and propositions and is subject to beliefs and goals. That is, one has a lot of knowledge

encoded in propositions and simply draws on these propositions in order to construct what seems on phenomenal evidence to be an image (Pylyshyn, 1981, 1984). Pylyshyn argues that there are no intrinsic properties of the surface display or so-called image: all are interpreted and subject to alteration.

It is Gardner's (1985) opinion that efforts to explain the results of imagery experiments in terms of a propositional or symbolic code, favoured by Pylyshyn, end up being clumsy and circuitous, whereas the kind of model developed by Kosslyn handles the current results neatly and even predicts interesting new ones.

After an extensive review of imagery research findings over the last 25 years, Marschark and others (1987) avoid trying to resolve what they call the "analog-propositional" debate, and conclude that essentially no data compel them to assume that images are a medium for long-term memory representation. They favour the idea that analog processes, like verbal processes, interact with some more generic semantic memory (Brewer, 1975; Denis, 1982; Marschark & Paivio, 1977; Nelson, Reed, & McEvoy, 1977; Potter et al., 1986; Snodgrass, 1984). This memory retains perceptual (as well as linguistic) information in configurations sufficiently distinct that the redintegration of the information provides the phenomenal experience and empirical effects of imaginal representation (Brooks, 1967, 1968). The form of this conceptual memory is yet to be empirically demonstrated, however, and the possibility remains that in some situations, verbal and imaginal memories may also be available. It is also concluded (Marschark et al., 1987) that in any case, imagery clearly has been shown to have a functional role in human cognition and, directly or indirectly, facilitates learning, comprehension, and memory.

Finally, because theories about information processing and what consitutes imagery are only theories, it is useful to examine some of the current findings in the field of neuroscience that pertain to cognition.

5. Neurophysiological Findings

Complementing the findings from the field of cognitive science, neurophysiological data

provides further information about the nature of cognitive architecture.

Early studies of split brain and other brain-damaged patients seemed to support the view that there are two separate processing systems, one verbal and one visual. More recently, however, rather than concluding that the right hemisphere is specialized for visual processing and the left for verbal, several reviewers prefer to emphasize that lateralization is more a question of degree rather than kind of processing (e.g. Beaumont, 1982; Bradshaw & Nettleton, 1981; Gazzinga & Le Doux, 1978). Gazzinga and Le Doux (1978) maintain that while the left hemisphere does usually appear to develop a special language processing ability this is only partially genetically determined since early brain damage can lead to the right hemisphere taking over language processing. They argue that the right hemisphere is better equipped for manipulospatial tasks, and that this has been a confounding factor in some split-brain studies which have shown better visual processing by the right hemisphere. Bradshaw and Nettleton (1981) claim that the left hemisphere is better at sequential, analytic and time dependent tasks at the sensory (visual and auditory) and motor levels (control of limbs and speech apparatus), so that for example, some musical functions appear to be mediated by the left hemisphere. Spatial aspects, such as position of the limbs, it is claimed, are associated with the right hemisphere. They describe the right hemisphere as possessing considerable powers of comprehension, and conclude that "there is a continuum of function between the hemispheres, rather than a rigid dichotomy, the differences being quantitative rather than qualitative, of degree rather than kind" (p.51).

Both Gazzinga and Le Doux (1978) and Bradshaw and Nettleton (1981) attribute the differences in hemispheric processing of visual and verbal stimuli to the specialization that the left hemisphere has undergone rather than a distinct division of verbal and visual functioning. However, while Gazzinga and Le Doux believe this specialization to be for language production, Bradshaw and Nettleton see it as being for time dependent sequential analysis, which will often include language.

Using data obtained from PET (positron emission tomography), Posner and others (1988) conclude that for operations performed on visual, phonological, and semantic codes with right handed subjects, there is "considerable homogeneity in the neural systems involved" (p. 1630). Their findings

suggest that visual imagery, word reading, and even shifting visual attention from one location to another are not performed by any single brain area. Each process involves a large number of component computations that must be orchestrated to perform the conitive task. In a combined anatomical and cognitive approach, these authors explain the operations involved in visual imagery. Relating their findings to the cognitive scientists who, in their mental models, distinguish between a set of operations involved in the generation of an image and those involved in scanning the image once it is generated, they make a case, instead, for the idea that mechanisms involved in image scanning share components with those in visual spatial attention. Patients with lesions of the right parietal lobe have deficits both in scanning the left side of an image and in responding to visual imput to their left. Although the right hemisphere plays an important role in visual scanning, it apparently is deficient in operations needed to generate an image. Studies of patients whose cerebral hemispheres have been split during surgery show that the isolated left hemisphere can generate complex visual images whereas the isolated right hemisphere cannot.

Other studies recently conducted support the notion that cognitive brain functioning is not rigidly dichotomized, and is more complicated than previously thought. Parella (1989) conducted a study in which he was able to demonstrate that laterality is the product of many task and stimulus characteristics; he concludes that "a framework studying laterality as integrated performance by a subject is necessary" (p. 1139-B). While there is yet much uncertainty regarding whether cerebral specialization depends on the type of task (verbal or spatial) or the manner in which the task is processed (sequential or simultaneous), recent writers and researchers do agree on the following major points: The right hemisphere specializes in processing spatial, visual, movement, and touch stimuli in terms of simultaneous holistic patterns and relationships. The left hemisphere specializes in processing linguistic sequence (Bradshaw & Nettleton, 1981; Kolb & Whishaw, 1980; Springer & Deutsch, 1985). Learning may be accomplished through the left hemisphere, the right hemisphere, or the successful integration of both as a matter of individual differences. The implication asserted (Fountain & Fillmer, 1987) is that neither side of the brain is superior to the other, but rather, that both hemispheres are essential

to integrated thinking.

Summary:

In this chapter, a number of points emerge from reviewing the research related to the theoretical aspects of pictures.

First, there are many different theories about the nature of picture perception, but as yet, no real consensus on whether viewing a picture involves conferring meaning from a stimulus, or conferring meaning on a stimulus, or whether some combination of these two processes are involved.

It is known that during picture perception, three types of activity normally occur: 1) attention and scanning, 2) picture interpretation, and 3) perception of global meaning.

During attention and scanning, pictures are scanned in brief fixations, separated by extremely rapid eye movements called saccades. The gist of an entire picture can be understood in as little as 300 milliseconds (Levie, 1987). Factors that influence what is fixated upon include viewer's purpose (Yarbus, 1967), discordant elements (Molitor, Ballstaedt, & Mandl, 1989), age (Phillips, 1985), and intelligence (Nesbit, 1981).

During picture interpretation, the recognition of cues is a main feature. The decoding of objects is more difficult if information is complex or abstract, or if objects are unfamiliar. It has been found, however, that skills which improve the extracting of information from pictures can be taught (Fisher & Braine, 1981; Higgins, 1979).

During the perception of global meaning, schemata interact with what the viewer sees to produce meaning (Neisser, 1976). Both details and the main idea of a picture can be used for storage and retrieval (Loftus, 1975, 1983), and it has been found that the ability to perceive the details and main ideas of pictures develops with age (Smith, 1977).

Second, studies directed at how pictures are remembered or stored have furnished further information. The number of eye fixations given to a picture correlates not only with the level of recall, but also with intelligence (Nesbit, 1981). Unusual elements in a picture tend to receive more attention

(Molitor, Ballstaedt, & Mandl, 1989), and thus enhance the chances that the picture will be remembered. Our ability to remember pictures may be considerable compared to our ability to remember words or prose (Standing, 1973), but memory for pictures is even further improved if words or verbal material is presented in combination with pictures (Brainerd, Desrochers, & Howe, 1981; Haber & Myers, 1982).

Third, different memory models or "cognitive architectures" (Pylyshyn, 1984) have been proposed in an attempt to explain why pictures are remembered better than words, and what processes are involved in the encoding and storage of words and pictures. These models range from the single code model (Pylyshyn, 1981) where only the preliminary stages of processing are represented as separate, to models such as Paivio's (1971) dual code model where all processing and memory systems are separately represented.

In addition, investigations into the nature of mental imagery have led to a number of findings. Images have been defined as temporary spatial displays in active memory which have been generated from long-term memory representations (Kosslyn, 1981). While it has not been decided whether imagery is a separate entity in memory models or not, it has been demonstrated that mental imagery clearly influences learning (Pressley, 1980; Kosslyn, 1988). The exact nature of mental imagery has not yet been determined, but some researchers claim that imagery resembles the process of visual perception.

Finally, current neurophysiological findings have helped to clarify some aspects of picture processing and storage. It has been found that lateralization is a question of degree rather than kind of processing, a question of quantitative differences rather than qualitative (Beaumont, 1982). Rather than a rigid dichotomy between hemispheres, it is now thought that there is a continuum between hemispheres (Bradshaw & Nettleton, 1981) with both hemispheres being essential to integrated thinking (Fountain & Fillmer, 1987). Visual processing probably occurs in both hemispheres, but with some specialization on the right side (Morris & Hampson, 1983).

Chapter Three will describe the relevant literature related to instruction in three main sections: 1) individual differences, 2) traditional instructional practices, and 3) effective learning strategies.

CHAPTER III.

Literature Related to Instruction

The purpose of this study was to investigate whether or not picture-oriented methods of instruction might facilitate the comprehension and recall of expository prose, compared to traditional methods of instruction. Also examined were the relationships of individual imagery ability and gender on students' ability to profit from these pictorial methods.

There are certain implications for instruction which arise out of the current research on picture theory. Three research areas which offer findings related to picture theory, with direct implications for instruction, are: 1) individual differences, 2) traditional instructional practices, and 3) effective learning strategies.

1. Individual Differences

Some areas relevant to this study where individual differences among students may occur are: a) brain hemisphere preference, b) imagery ability, c) gender, d) level of background knowledge, e) reading ability, and f) age differences.

a) Hemispheric differences

Students do seem to have different learning styles related to their preferred hemisphere of brain processing (Fountain & Filmer, 1987; Morris & Hampson, 1981; Waber, 1979). There seem to be both age (Mackworth & Bruner, 1970; Morris & Hampson, 1981) and gender (Bradshaw & Nettleton, 1983; Knox & Kimura, 1970; Maccoby, 1974; Nebes, 1977) differences in hemispheric preferences. There also seems to be a relationship between academic achievement and hemispheric

preferences at certain ages (Fountain & Filmer, 1987).

In terms of proposed models of cognitive architecture, Farah (1989) points to some interesting implications for learning and instruction. First, if models such as Kosslyn's or Paivio's are correct, independent cognitive processes compete less for processing resources, which means that it might be possible for people to take in more information spread across pictures and text than if all the information were conveyed in just one modality. Second, if either of these models is correct, it also raises the possibility of individual differences in relative ease of learning from pictures and text. If different cognitive processes are involved, then it is possible that people will differ in their abilities to use these processes, and knowledge of a learner's strengths and weaknesses could be used in tailoring instruction for the individual learner.

b) Imagery ability differences

There has been some investigation into various aspects of individual imagery differences which have implications for picture-oriented text instruction.

One individual difference found is in the degree to which a person is able to generate vivid images, measured by tests of vividness of mental imagery. These differences in imagery ability have been found to affect recall for both pictures and prose. It has been shown, for example, that good visualizers are able to recognize and recall pictures more accurately than poor visualizers (Ernest & Paivio, 1971; Marks, 1983), even after both groups are given instructions to use an imagery mnemonic (Delaney, 1978), and Haren (1988) has been able to demonstrate that high imagery ability facilitates recall of main ideas. Related to differences in the proficiency with which people are able to generate images, it has also been documented, some persons may differ in the speed with which they can generate images (Kosslyn, 1983).

Could those students with poorer imagery ability improve with practice training? Although Katz (1987) admits that imagery skills, like other skills, have not been tested systematically, he suggests that training studies involving teaching the component skills of imagery should not only have theoretical

implications as to the base of so-called ability differences but may also have direct educational benefits.

One of the most frequently investigated difference variables in imagery studies has been age. With regard to prose learning, instruction to use mental imagery has only been found to benefit children older than 8 years of age (Pressley, 1976, 1977). Just as there are increases in the range of situations in which children generate images in paired-associate learning during the early grade school years (Rohwer, 1973), there are also age by strategy instructional effects with prose. The progression is from complete failure to benefit from imagery generation instruction to facilitated learning due to imagery with a variety of concrete prose materials (Guttman, Levin, & Pressley, 1977; Pressley, 1977; Ruch & Levin, 1979). Another age related difference found is in the ability of younger and older learners to generate meaningful interactive images (Pressley & Levin, 1978; McGivern & Levin, 1983). The skill to relate information imaginally is a skill that develops with increasing age, or, it could be argued, with practice.

A common thread in research efforts investigating age differences is that a given imagery strategy can significantly improve learning performance at some particular age level, but fail to do so with younger children. This pattern seems to be replicable across many learning situations although the specific ages indexing the shift vary from task to task (Pressley, 1977; Pressley and Levin, 1977, 1978).

Based on these individual difference findings with regard to imagery ability, implications for instruction include the possibility of employing techniques to increase students' imaging abilities with practice, and a consideration of age when employing imagery-based instructional methods.

c) Gender differences

Various aspects of the research on gender differences affecting learning have implications for picture-text instructional methods.

In a study conducted by Marks (1973), it was found that females were more able to accurately recall pictorial information than males. The subjects were first year university students. Ernest and Paivio (1971) obtained the same finding (also with first year university students) in both free recall and

incidental recall of verbal and pictorial stimuli and concluded that in some tasks, "females use imaginal processes to facilitate recall whereas males do not." (p. 71).

In the study conducted by Fountain and Filmer (1987), in both grades 4 and 7 a significantly larger number of females than males had integrated brain preference. At the grade 4 level, all integrated brain preference subjects scored higher on mathematics and basic achievement tests. At the grade 7 level, however, the integrated preference males scored higher than the integrated preference females. Waber (1979) has suggested a maturational reason for these differences. She suggests that females are less lateralized than males because they reach puberty earlier than males. Bradshaw and Nettleton (1983) propose that female specialization for language (sequential) ability is related to the acquisition of language during a time when the left and then the right hemisphere pass through critical stages of neural plasticity, resulting in a predominantly sequential orientation to the world by both hemispheres. This process of development is also related to females' lack of development in the right hemisphere of visual-spatial ability (simultaneous). They further suggest that the more common male propensity for developmental delay is related to the sparing of the right hemisphere for visual-spatial ability.

Maccoby (1974), after reviewing a number of studies, has suggested that a girl's early left-hemisphere dominance (associated with earlier development of verbal skills) orients her toward the use of verbal means of problem-solving. The girl fails to develop alternative forms of thinking as strongly as she might because she does not need them and hence early verbal development operates to inhibit, or shut down, the development of nonverbal thought. However, males later catch up with females in lateralization, and may eventually become more highly specialized in their two hemispheres than females (Knox & Kimura, 1970; Nebes, 1977). Although there is some conflicting evidence and disagreement, others have agreed with this view and concluded that males may eventually be "more rigidly hemispherically specialized than females" (Morris & Hampson, 1981, p. 100).

These gender differences have implications for instruction. One area of instruction that should perhaps be considered is the overemphasis on left hemispheric, basic skills activities in school,

particularly in the early grade levels. If females, in the early grades, were exposed to instruction that activated right brain processes, the possibility of balancing out the advantage males have in visuo-spatial skills could be addressed. Pictorial methods of instruction may be especially valuable for young female learners in developing these otherwise neglected skills.

d) Background knowledge differences

One individual difference variable that is known to be of crucial importance in learning from pictures (Ellis et al., 1975; Joseph & Dwyer, 1984) and prose (Barnitz & Morgan, 1983; Borges & Robins, 1980; Bransford & Johnson, 1972; Davey & Kapinus, 1985) is prior knowledge.

Bellezza (1987, p.38) defines prior knowledge or schemas as "organized knowledge structures in memory that can be thought of as generic concepts representing objects, persons, situations, events, sequences of events, actions, or sequences of actions." A memory schema is activated when information similar to its content is processed by the brain. Once activated, the schema influences the processing of the new information and furnishes a mental context for it.

Bjorklund and Bernholtz (1986) claim that organization in memory is facilitated by a more elaborated knowledge base in one of two general ways: first, by increasing the likelihood that students will identify relations among test stimuli and thus impose strategic organization, and second, by the activating of semantic memory relations among test items, resulting in highly organized retrieval. The results of many studies show that when materials are congruent with schemata that children already possess, memory is enhanced (Collins, et al., 1978; Koblinsky, Cruse, & Sugawara, 1978; Mandler & DeForest, 1979; Mosenthal, 1979) and students have even been found to distort their recall of materials to make them more congruent with the schemata they possess (Brown, 1975). The importance of making materials personally meaningful to students was demonstrated by a study investigating self-reference as a method of making prose more memorable (Reeder, McCormick, and Esselman, 1987). It was found that when students read passages using their self as a referent their recall of prose passages was superior to those given no special processing instructions.

Not only is the recall of materials facilitated by relevant prior knowledge, but comprehension is also improved. Chi (1978) showed that children with strongly developed schemata not only recall but predict and monitor more like older students than their age mates with less developed knowledge.

These results suggest that one way to enhance learning is to train general schemata (Royer & Cable, 1976) and to remind students of schemata they already possess which can aid in interpretation and memory (Arnolds & Brooks, 1976; Brown et al., 1977). With regard to picture-oriented instruction, teachers may want to consider helping students link the content in illustrations with the knowledge already in their possession.

Further implications for instruction arise from the work of Langer (1984). Although the established finding that background knowledge is directly related to comprehension and recall is not surprising, its importance leads Langer (1984) to ask the further question: Can passage-specific background knowledge be reliably estimated prior to reading? As a result, Langer does develop a measure which has implications for instruction. Teachers could use this measure to determine whether, and for whom, direct concept and vocabulary instruction is necessary.

e) Reading ability differences

One of the subject variables that has a bearing on picture\text studies and has implications for instruction is reading ability.

It has been speculated that reading ability can affect students' processing of illustrated text in several ways (Willows, et al., 1971). As noted by Peeck (1987), poor readers may direct more attention to the pictures accompanying text because they lack confidence in their ability to process the text without regularly checking the illustrations for clues to the text's meaning. Rusted and Coltheart (1979) found that "poor readers frequently moved their eyes from the passage to the picture, apparently checking the features in the pictures as they read them. In contrast, the good readers paid little attention to the pictures during their reading" (pp. 521-522). However, in contrast to these findings, there were no systematic relationships found between viewing time and reading level based on the eye

movement patterns registered by Flagg and others (Flagg, Weaver, Fenton, Gelatt, & Pray, 1980). Poor readers might also require the additional motivation that pictures provide in arousing interest in reading the text in the first place.

In a review undertaken by Goldstein and Underwood (1981), these authors conclude that the less competent the reader, the greater the influence picture information will have. In a review by Levie and Lentz (1982), some minimal support is also found for the notion that poor readers are helped more by illustrations than good readers. They report an average prose recall facilitation due to the presence of illustrations of 44% for poor readers and 23% for good readers. However, in only one study (Wardle, 1977) was the suggested interaction between reading ability and the presence or absence of pictures found to be significant.

Quite suggestive that the enhancing effects of pictures may be more pronounced for poor readers, is the finding in Rusted and Coltheart's study (1979) that the correlation between reading ability and text recall that was obtained in the no-pictures control condition appeared absent when children read the text with illustrations. On the other hand, substantial correlations between reading ability and performance were obtained, in other studies, when illustrations were present (Goldberg, 1974; Moore & Skinner, 1985; Peeck, 1972).

In one study, two types of poor readers were identified (Levin, 1973). A "deficit" poor reader comprehends poorly because of lack of decoding or vocabulary knowledge, while a "difference" poor reader has the prerequisite skills but comprehension is poor (p. 611). Both Levin (1973) and Rohwer and Matz (1975) found that difference poor readers, or those subjects that had difficulty deriving meaning from text were helped more by an imagery strategy than other types of readers. Deficit poor readers do not seem to benefit from imagery instruction, nor is the prose learning of average or good readers always increased (Levin & Divine-Hawkins, 1974).

Based on the results of a study by Bjorklund and Bernholtz (1986), these authors note that a number of researchers have suggested that there are differences in the structure of semantic memory or the ease of lexical access between good and poor readers. In this sense, reading ability might be an

indicator of what Davey and Kapinus (1985) call "cognitive style" (p. 147). In a study examining factors affecting recall, cognitive style and reading ability were measured covariates. Their results showed that there was a significant proportion of criterion variance, but cognitive style accounted for little beyond that accounted for by reading ability.

For instructional purposes, then, it remains unclear as to whether the presence of pictures helps poor readers more than good readers to learn from text, but imagery instruction does appear to help readers who have difficulty comprehending text. Finally, as suggested by Davey and Kapinus (1985) reading ability may be closely related to cognitive style, and such information about a student may help teachers to tailor their instruction accordingly.

f) Age differences

A number of age-related differences affecting the processing of illustrated text have also been investigated. These findings, too, have implications for instruction.

With regard to the processing of pictures, there are differences between the way adults and children approach and understand pictures. One important difference is that adults look at pictures in a more systematic and active way (Van Parreren, 1983). They approach pictures with certain expectations (Jorg, 1977) that change and develop in the course of inspection, their eye movement patterns appear to be more meaningful and effective than those of younger children (Mackworth & Bruner, 1970), and they are more capable of systematically and sequentially deploying attention to different parts of the picture (Neisser, 1979). Van Parreren (1983) also points out that adults make far more inferences from what is shown visually: "In the same way as we read between the lines when confronted by a written text, we conclude from that which is visible in a picture states of affairs which cannot strictly be seen in the picture" (Van Parreren, 1983, p. 67). Finally, adults, in comparison with children, do not treat an illustration as an isolated item but apprehend it within a context (by reading the accompanying text, using the caption, and looking at other pictures for example).

Age differences related to motivational-affective roles have been observed in a number of

studies. It has been found that young children prefer realistic pictures with colour and relatively simple design, whereas older students and adults prefer more complex pictures, perhaps because of an increased ability to deal with perceptual complexity (Travers, & Alvarado, 1970).

As mentioned earlier in discussing imagery ability differences, age is a factor influencing the efficacy of imagery training and instruction. The benefits of imagery training first occur between the ages of 7 and 8 and increase gradually until the end of the grade school years (Pressley et al., 1987).

Age differences associated with memory strategies other than the use of imagery, have not been as dramatic (Pressley et al., 1982). Research on age differences in memory performance suggests that the maturing learner becomes increasingly able to use appropriate strategies in order to perform well on various learning and memory tasks (Kail & Hagen, 1977; Pressley, 1982).

In the light of these research findings about age-related differences, several implications for instruction are suggested. First, it may be important for teachers to draw students' attention to the illustrations in their textbooks, particularly for the younger learner. But merely drawing students attention to illustrations may not be sufficient. There is research evidence that benefits are only increased when subjects are made to process pictures more thoroughly (Dean & Kulhavy, 1981; Dean & Enemoh, 1983; Verhaegen,1983). Second, in the designing and implementing of picture-oriented instruction, one important consideration is the matching of the most effective picture type with the age of the learner. Third, with regard to imagery related instruction, age is an important consideration in deciding which strategies can be used. With regard to learning strategies, in general, it may be important for teachers to determine whether students are already using an efficient strategy. Rohwer (1980) points out that schools often teach students strategies that are not as good as the ones they already possess. Finally, there is increasing evidence that in order to induce strategy usage in younger versus older children, much more explicit instruction is necessary (Bray, Justice, Ferguson, & Simon, 1977; Ceci, 1980; Corsale & Ornstein, 1980; Pellegrino, Posnansky, & Vesonder, 1977; Wolff & Levin, 1972).

2. Traditional Practices

Evans, Watson, and Willows (1987) conducted a recent inquiry into the classroom use of illustrated textbooks. An initial survey of 120 teachers and observations in their classrooms produced such a consistent pattern of data that the researchers felt that conducting a larger survey, as originally planned, would have been unproductive. Both questionnaire/interview data and classroom observations revealed that the teachers made very few direct references to illustrations in the classroom and that they provided little guidance in explicating the functions of illustrations. When questioned directly about their use of illustrations in teaching, it appears that other than the decorational role ascribed to pictures in classrooms and the motivational/attentional role ascribed to textbook illustrations, different functions of pictures were rarely mentioned by the teachers. Teachers answering the questionnaire indicated that their use of illustrations varied depending on the topic and the students, and their use of illustrations involved less than 10% of their time. From classroom observations, it was concluded that teachers actually allocate much less time than this, and as there was so little to record in the instance of illustration use, the investigators terminated their project at this point.

While the role of illustrations is frequently suggested in manuals and guidebooks accompanying textbooks, the extent to which suggestions are included on how to use textbook illustrations while teaching varies widely. Some manuals don't refer to the illustrations at all; others have clearly scripted lesson plans explicitly referring to textbook illutrations. The attention-getting and motivational aspects of illustrations seem prominent among teachers and publishers (Evans, Watson, & Willows, 1987). With particular relevance, here, Sless (1981) has stated: "Despite the endless production of pictures in our culture, most of them are used in this superficial 'attention' role. It is therefore likely that unless the context in which they are to be used offers sufficient guidance to their use, most students will presume that they have an attentional role and therefore treat them as incidentally relevant to learning" (p. 110).

As noted by Molitor, Ballstaedt, and Mandl (1989), the attitude towards a medium influences

the extent to which the information offered is analyzed and hence the depth of processing. It has been shown, for example, that television is used most of all for entertainment, whereas education and information are predominantly ascribed to the print media (Katz, Blumler, & Gurevitch, 1974). Similarly, illustrations may be underutilized by teachers and students alike because they are not valued as having instructional potential; pictures may simply not be valued as mediators of intellectual content (Fleming, 1962).

Evans, Watson, and Willows (1987) remark that it seems odd that illustrations, so prominent (appearing on about 60% of the pages in intermediate grade science and mathematics texts), and presumably beneficial in textbooks, should receive minimal instructional attention in classrooms.

Weidenmann (1989) concludes that this undervaluation of pictures can be compensated for by explicit picture-oriented instruction. He points out, however, that in educational practice, picture-oriented instructions are typically used in conjunction with "difficult" pictures. Logical and analogical pictures (Knowlton, 1966) are usually explained by detailed captions and comments. But representational pictures, such as the type most often found in social studies texts, are considered as self-explanatory. They are accompanied by short captions and perhaps global references in the prose.

Weidenmann, however, asserts that global references are not enough, and he sees such a practice as more an invitation to an undervaluation of a picture than a warning against it. There is some research evidence supporting this position. Giving students a global hint that the illustrations would be helpful for learning and should be attended to, did not improve the picture effect compared to a control group who received no instructions to attend to the illustrations (Hayes & Readence, 1982, 1983; Moore & Skinner, 1985). Apparently, the learners in these studies used the pictures equally well with and without instructions.

While the mere presence of illustrations in text can produce positive learning benefits, there is also evidence for the failure of pictures to produce this effect. In the review by Levie and Lentz (1982), about 15% of the studies reported no significant picture effect. Reasons, suggested by Weidenmann (1989), for these results might be the ineffective processing of the pictures by the subjects,

the subjects' undervaluation of the informativeness of the pictures, and/or the failure of students to relate the pictures effectively to the text and the task. For all of these problems, special picture-oriented instruction could prove beneficial.

To summarize, it has been found that little attention is given to illustrations during classroom teaching, and manuals and guidebooks accompanying textbooks may vary widely in the extent to which suggestions are given for illustration use. Attitude towards a medium can influence the depth of processing; pictures, for example, may simply not be valued as instructional media. It has been suggested that the undervaluation of pictures could be compensated for with picture-oriented methods of instruction. This instruction needs to supply more than a general direction to attend to illustrations, since this has not been found to be of any additional benefit. Finally, it has been noted that the presence of pictures may not always produce positive learning gains, and that specially designed picture-oriented methods of instruction could overcome some of the possible reasons associated with this failure.

3. Effective Learning Strategies

Investigations of various memory-enhancing strategies and their effects on learning have been the focus of a great deal of educational research. Some of these studies have specific implications for picture-oriented instruction, and the results of these investigations helped to shape the instructional methods devised for this study. Hence, while there are many studies in this general area, this review will be confined to the studies that provide information with possible implications for enhancing the positive effects of pictures on prose learning. Included in this review are studies concerned with: a) effects of pictures on prose recall, b) imagery and mnemonic strategies, and c) memory-enhancing techniques in picture-related instruction.

a) Effects of pictures on recall

A main focus of picture research has been the comparison effects of illustrated versus non-

illustrated text. In their review of 155 experimental comparisons of learning from illustrated text versus text alone, Levie and Lentz (1972) found that the illustrated text version was consistently better than the text alone version. A number of studies demonstrated positive comprehension and recall effects specifically with expository text (DeRose, 1976; Rusted & Coltheart, 1979; Haring & Fry, 1979; Weisberg, 1970). Others have examined the effects of pictures on the comprehension and recall of expository text with illustrated and non-illustrated text. Covey and Carroll (1985) found that pictures facilitate comprehension for some science texts, but found no evidence to support the hypothesis that pictures would be more helpful for less well organized texts than for better organized texts. Levin, Shriberg, and Berry (1983) found that illustrations did not help memory for and organization of critical passage information unless they were presented in conjunction with key words. Holmes (1987) found that 5th and 6th grade students in either a picture-only or print with pictures condition outperformed those students in a print-only condition on a test measuring inferential comprehension.

In a more recent review of 48 experimental studies, Levie and Lentz (1982) reported overwhelming results in favour of illustrated text. The illustrated-text groups had average prose recall scores 36% higher than the text-alone averages. A review by Levin and Lesgold (1978) resulted in a similar conclusion, and in a recent analysis comprised of 142 units (Levin, Anglin, & Carney, 1987), the average effect of text-relevant pictures even surpassed that reported by Levie and Lentz (1982).

Levie & Lentz (1972, 1982) were able to detect two trends based on their reviews of studies: first, facilitation effects of pictures was greater in delayed recall than in immediate recall, and second, poor readers' recall was aided more than good readers recall by the presence of illustrations.

In their 1982 review of the literature, Levie and Lentz listed 24 studies, 19 of which showed that pictures helped more in delayed recall than in immediate recall. The average facilitation due to pictures was five times greater in delayed testing than in immediate testing (Peeck, 1989).

Duchastel (1980) provided additional support for the superior facilitation of delayed recall with illustrated text. Delayed testing, two weeks after exposure to the materials resulted in recall superior to immediate testing for the illustrated condition. Anglin (1987) also found support for the durability

of picture effects over 55 days. The results of his study showed that subjects' average recall in the prose-plus-picture condition was 11% (found at immediate testing) to 15% (found at delayed testing at 55 days) higher than that of subjects in the prose-only condition. However, the average recall of information presented in the prose passage only did not significantly differ between the two conditions (with and without pictures). As previously mentioned, Peeck (1989) found increased benefits for the illustrated condition at delayed testing of story comprehension.

In an attempt to explain the beneficial effects of pictures added to a text, an approach which allocates specific functions or roles to pictures is often put forward. Duchastel (1980) classifies pictures according to one of three functions: an attentional function, and explicative function, and/or a retentional function. Levin (1989) includes five functions of pictures: a decorative function, a representational function, an organizational function (help to make the text better structured), an interpretational function (help to make the text more comprehensible), and a transformational function (pictures are transformed to make the text more memorable).

The question that arises from such picture types is do students and teachers understand that pictures may have certain functions and if so, do they make effective use of the pictures? Salomon (1984) points out that a critical analysis of most studies reveals an optimistic assumption that students use pictures as effectively as the designers of their texts would have hoped. The reason may be found in the widespread naive preconception of pictures as "easy media" (Salomon, 1984).

In an attempt to guard against such an assumption, a few researchers have included some brief instructions to the students. For example, and in contrast to the previously cited studies in this section, Hayes and Readence (1982, 1983) and Moore and Skinner (1985) gave students in the picture conditions some instruction to attend to the illustrations. Their results, however, showed that such instruction did not improve performance beyond what was achieved by the mere provision of illustrations.

In an attempt to introduce more instruction than simply a prompt to attend to the illustrations, Holliday (1976) examined the effects of different types of captions on learning from prose. He found that students learned more from a complex illustration with instructive questions appended,

than from the illustration alone, from text alone, or from combined text and illustration.

In another study designed to influence the perceived importance of illustrations, subjects were also given more instruction than simply a prompt to attend to the pictures (Weidenmann, 1989). Subjects were 206 male undergraduates assigned to one of five text versions: a no-pictures group given no instruction, a no-pictures group given imagination instructions, and three picture groups: one given no instruction, a second, given picture-oriented instructions and a third, given imagination instructions. The students read the text and rated the quality of the materials; two weeks later they answered a questionnaire concerning main ideas and details of the text. The results showed a significant difference in the recall of main ideas and details for the picture group with picture-oriented instructions. Compared to the illustrated text without instructions group, the mean score of the group given instruction was about 26% better. The picture-oriented instruction in this study consisted of briefly directing the readers' attention to various informational aspects of two illustrations and comparing the features in each. Weidenmann concludes from this study that the role of instructions in illustration studies is a neglected aspect of research.

Visual features in content area reading have also been examined with secondary school pupils using physics texts. In a study by Wendt (1979) 600 high school physics students were given a textbook lesson that was redesigned in three versions. Achievement measures suggested that the one experimental version, stressing visual aspects of the printed pages, was superior to the other versions.

One shortcoming of text illustration research pointed out by Willows (1980), is the lack of consistency in the pictures used in these studies and the assumption that all pictures are equal. Some research has, therefore, been directed at the qualitative aspects of pictures and the influence these features have on learning. Moore and Readence (1981), for example, found that line drawings and colour pictures aid comprehension more than do black and white pictures. In contrast, Tversky and Baratz (1985), attributed their findings that photographs led to better recall performance than line drawings to the greater detail and representativeness of photographs relative to drawings. Golden (1986) found that the high quality and clarity of photographic illustrations was an important variable

affecting recall.

The results of Dwyer's work (1970, 1972) indicate that the effectiveness of realism and complexity is very dependent on the time and effort the reader is willing or able to invest in studying the pictures. More recently, it has been suggested by Joseph and Dwyer (1984), that the combination of detailed and less detailed pictures, such as photographs and drawings, perhaps combined in one "hybrid" illustration may be the most effective presentation.

b) Imagery and mnemonic strategies

Based on their analysis of over 100 picture-text experiments, Levin, Anglin, and Carney (1987) note that even though pictures serving "conventional" functions (representation, organization, and interpretation) are facilitative of prose recall, pictures serving an "unconventional" function (transformation) can be even more facilitative. These authors, however, qualify this observation by pointing out that transformational pictures are not suited for all prose-learning contexts, but rather are optimally suited to the efficient storage and retrieval of text-embedded factual information.

Transformational pictures are unconventional in that they are conspicuously absent in the class of traditional textbook illustrations. Unlike other types of pictures which have indirect effects on memory, transformational pictures are designed specifically to enhance memory directly. These pictures are created so that they target the critical information to be learned and then i) recode it into more concrete and memorable form, ii) relate the separate aspects of that information in a well-organized context, and iii) provide the student with a systematic means of retrieving the critical information when later asked for it. Levin (1983) refers to these three components as the "three Rs" of associative mnemonic (memory-enhancing) techniques. These techniques are derived from work on imagery theories.

First, in general, the effectiveness of transformational pictures in enhancing memory is backed up by strong evidence in imagery research that bizarre imagery can improve memory performance (Einstein & McDaniel, 1987). According to Friedman (1979), if all the elements in a picture are in

conformity with a frame, the picture is automatically encoded on the basis of a few noticeable features (that is, a corresponding "frame" activates certain expectations with respect to the details in the picture). If all the details "fit" well together, then they will hardly be looked at more closely and will be processed only superficially. A discordant element in the picture, or between the picture and text, in contrast, is able to increase the depth of processing (Molitor, et al., 1989).

Second, the efficacy of recoding, one of the principles embodied in transformational pictures, is based on the idea in imagery research (which views visual imagery as some part of a memory system), that concrete materials are usually remembered better than abstract materials. Pictures are remembered better than words, concrete words are better retained than abstract words, and, in general, visualization instructions during reading facilitate prose retention (Roediger & Weldon, 1987). Furthermore, it has been demonstrated that recall is facilitated if imagery encoding occurs first before verbal processing (Kosslyn, Holyoak, & Huffman, 1976); Rohwer states that, given a choice, the stimulus or cue for some desired response should be concrete rather than abstract, pictorial rather than verbal. Bransford and Johnson (1972) have demonstrated that the value of accompanying pictures is heightened when pictures are presented prior to the subjects' reading of a passage rather than after reading.

Third, the second principle employed in transformational pictures, referred to above as relating items in context, is supported by imagery research which has demonstated that cued recall is better after subjects image items interacting in some meaningful way than when the same items are imaged as separate units (Bower, 1970; Begg, 1982).

Finally, imagery research also supports the last principle of transformational pictures, the provision of an effective means of information retrieval. The idea that retrieval is enhanced if the picture is associated with a concrete word (recoded from the abstract term) is related to the findings in paired associate and other imagery studies where the combinational effects of words and pictures have been examined. It has been a consistent finding that recall is enhanced when both picture and word are combined, rather than the presentation of either words or pictures in isolation (Kosslyn, Holyoak, & Huffman, 1976; Reed & Hoffman, 1986). Based on his experiments Rohwer (1968) concluded that

pictures were superior to words in promoting learning, but the ability to profit from the stored images was contingent upon the subjects' ability to store an appropriate verbal representation of the object along with its image. The concreteness of pictures may also be a factor in aiding retrieval of text information. Studies have demonstrated, for example, that specific map features are encoded as spatially referenced images and that these images serve as a framework for the retrieval of related text information (Kulhavy, Lee, & Caterino, 1985).

Mnemonic techniques have been analyzed in a variety of contexts including prose learning. Prose passages, such as those found in Social Studies texts, where a variety of factual information is described, lend themselves directly to the use of transformational pictures (Levin, Anglin, Carney, 1987).

An example of a transformational type of picture comes from a study by Shriberg, Levin, McCormick and Pressley (1982). In order to help students remember that Charlene McKune was famous for having a counting cat, McKune was recoded as raccoon, and then incorporated into a picture showing a cat counting raccoons as they were jumping over a fence.

A different type of transformational picture was devised for this study. Already available textbook pictures were altered with additional features to make them more memorable. As an example, one of these is presented in Figure 3. In this study, part of the information students were required to remember were the names of important people and their characteristics, and/or role in history. In Figure 3, for example, the critical information is that Lenin was a harsh dictator who ran a centralized government. This transformed illustration recodes the unfamiliar name Lenin into two words "lean on" and relates these words to Lenin's lack of hair (or how he was lean on hair); Lenin is shown in an interactive image with a whip in his hand to denote the concept of a harsh dictator, and the final idea of a centralized government is emphasized by drawing the students' attention to the large city buildings behind Lenin's whip.

In one mnemonic prose learning study conducted by Shriberg and others (1982), eighth graders were read short passages that described the accomplishment of fictitious people. Using the "keyword" method, each person's name was recoded into a keyword which related the person's name

In May 1919 Lenin speaks to new troops in Red Square.

Figure 3. Transformational black and white photograph of Lenin devised for this study.

with the accomplishment. In each of the three experiments reported by Shriberg et al. (1982), students who applied the mnemonic strategy correctly remembered far more name-accomplishment information than did their non-strategy control counterparts. This study was the first to adapt the mnemonic keyword method (most often used with foreign language and vocabulary learning) to a prose-learning situation. This study also demonstrated, in experiment 2, that while students in either of two mnemonic conditions recalled more information than a non-strategy control group, the menemonic group provided with interactive mnemonic illustrations benefitted more (by about 40%) than did those who were instructed to generate their own interactive mnemonic images.

Two other experiments, however, produced mixed effects. Peters and Levin (1986) found that mnemonic-imagery instruction improved the prose learning of junior high school students representing both above and below average levels of reading ability. Further findings resulted from a study by Morrison and Levin (1986). Eighth-grade students read a relatively complex science lesson on their own, and the results showed that experimenter-provided mnemonic illustrations were facilitative, relative to a no-strategy control condition, whereas subject-generated mnemonic imagery instructions were not. In their review of mnemonic vocabulary-learning research, Pressley et al. (1982) argue that subject-generated visual images are not as consistently facilitative of young children's performance as are experimenter-provided illustrations. In contrast, older children and adults have been found to benefit consistently from both experimenter-provided and self-generated mnemonic imagery vocabulary-learning strategies.

A "compromise" pictorial mnemonic variation that has proved quite effective in facilitating secondary school students' prose recall has been developed (McCormick & Levin, 1984; McCormick et al., 1984, 1986), where the experimenter directs the imagery of the students. With this variation, the experimenter first designs and devises carefully constructed mnemonic images or scenes for his own use in instruction. The students are then instructed to generate their own mnemonic images in direct response to the scene described by the experimenter. This method is a more cost effective alternative to the actual design and production of mnemonic illustrations.

c) Other mental elaboration procedures for prose learning

Levin (1988) broadly defines elaboration as a process which "involves the addition of meaning to enhance comprehension, learning, and/or memory" (p. 200). A number of these elaborative techniques are suitable for prose learning and have been incorporated into the methods of instruction designed for this study. The current research findings related to some of these, including activating schema and integrating visual and verbal information, have already been discussed. The research related to some of the other elaborative techniques (of relevance because of their inclusion in the procedures designed for this study) such as note-taking, answering questions, categorization, and rehearsal is now reviewed.

As a teaching technique, writing to learn is based on a growing body of writing process research that suggests that writing can be a powerful strategy for learning content. Myers (1984) suggests the use of writing in social studies instruction as an aid to better comprehension and recall. In a synthesis of research on the connection between reading and writing, Stotsky (1983) found that almost all studies that used writing activities specifically to improve reading comprehension or retention of information found significant gains. Anderson (1984) notes that carefully planned writing activities help students to organize the various pieces of information presented in class, thus reinforcing them and connecting them to the students' existing knowledge. Bretzing and Kulhavy (1979) have pointed out that notetaking as an encoding strategy requires students to apply sophisticated rules of construction which result in a rich semantic base. When taking notes students must engage in constructive activities that lead to text comprehension such as recycling, chunking, and deleting (Kintsch & van Dijk, 1978). The effect is subsequent better recall than might be found when employing less constructive processing methods such as underlining (Dickson, Schrankel, & Kulhavy, 1988).

Based on their own studies and the findings of others, Konopak, Martin, & Martin (1987) conclude that writing, including as it does that acts of composing and editing, can contribute immeasurably to the understanding and retention of information. They found that a writing group in their experiment generated higher quality ideas on the written posttest than the other groups and better

synthesized information acquired from all its activities. Tucker (1988) conducted an interesting study comparing the effects of three note-taking strategies (student's notes, instructor's notes, and structured notes) on immediate and delayed recall. He found that structured notes produced superior recall to the two other conditions at immediate testing and superior recall to the lecturer's notes condition only at delayed testing. Langer and Applebee (1987) conclude from a number of studies they conducted that activities involving writing lead to better learning than activities involving reading and studying only. In more specific terms, they found that summary writing and note-taking lead to a focus on the whole text in a comprehensive, but more superficial, way than analytic writing.

Question-answering is also a semantic elaborative activity which can serve a number of functions to promote learning. Anstey and Freebody (1987) found that directed questions significantly aided literal comprehension, while White (1982) demonstrated that material focused on by questions is better recalled. Nichols (1983) recommends the use of questions to have students make predictions about what they are to read, while Muth (1987) notes a need for external connection questions to relate what a reader already knows to the text information to be learned. Contrary to Dwyer's findings (1971, 1973) that the use of questions to focus on essential learning cues in visuals is not an effective instructional treatment for improving achievement, Reinking, Hayes, & McEneaney (1988) found that explicit cuing increases attention to graphic aids. They also found that drawing attention to particular features of visuals increased recall of information in the accompanying text. While the "cuing" referred to in the latter experiment was in the form of written instructions embedded in the text, in another study (Weidenmann, 1989), questions about specific features of the illustrations resulted in superior recall over other treatment conditions. A survey by Anderson and Biddle (1975) established that the recall of the particular information focused on by questions is enhanced. More recently, this finding has been confirmed by Wilhite (1982).

Another elaborative technique with implications for learning is categorization, or comparing and relating. In order to learn anything other than isolated pieces of information in a rote manner, the learner must compare various pieces of information, noting ways in which they relate to one another

and establishing links among them whenever appropriate. Shuell (1988) delineates two types of categorization involved in learning from instruction: categorizing different aspects of the material to be learned, and categorizing or incorporating new information with knowledge in the learner's memory. It is suggested that teachers should encourage students to look for interrelationships, similarities, and differences among various aspects of the material being learned. Having students relate text content with picture content is one way of highlighting relationships and integrating visual information with verbal information. Stanny and Weaver (1985) conducted an experiment in order to assess the efficacy for picture recall of four different types of study strategy. Results of their experiment indicated that if subjects rely on only one strategy, attending to details is a superior strategy for remembering pictures. Other investigators have argued that both specific details and more general types of information are important for picture recognition (Graefe & Watkins, 1980; Loftus & Bell, 1975). Focusing on the main idea and details of text and pictures, then, is yet another way to increase elaboration of to-be-remembered material.

Finally, another technique which has been found to aid learning of prose materials is repetition or rehearsal. It has been suggested that repetition is an effective way of transferring information from short-term memory into long-term memory (Gairns & Redman, 1986). Pictures can serve as devices to induce rehearsal of text content (Snowman & Cunningham, 1975); especially if, after viewing pictures, students are provided with a brief retention period where imagery can be used to visually rehearse information (Graefe & Watkins, 1980). The practice of integrating picture content with the accompanying written prose through discussion and guided reading provides an opportunity for repetition of information. Of course, questioning by itself serves to function as a rehearsal device, but pictures provide a concrete, visual form for relating the more abstract, written material. Wiseman, MacLeod, and Lootsteen (1985) conducted three experiments investigating the effects of subsequest verbal information on picture recall. They conclude that a post-picture sentence improves attention to and perhaps rehearsal of the representation of the picture following its display. They prefer to explain their findings in terms of the elaboration hypothesis, where already encoded pictorial information is

elaborated with the presentation of subsequent verbal information, rather than as support for either the integration hypothesis (verbal information is used to revise pictorial information and replaces it) or the semantic code hypothesis (a semantic representation of the verbal information is created in addition to the original visual representation of the picture).

Some of the learning strategies discussed represent specific examples of the utilization of what Levin (1988) refers to as "basic elaboration principles" (p. 192). Levin claims that not just any type of elaboration improves learning, but rather, semantic-based rules must be considered. Some of these rules are as follows: i) elaborations should be meaningful and compatible with students' prior knowledge (Activating schema, and making material personally meaningful to the learner are examples); ii) elaborations should integrate the to-be-associated information and provide logical connections (Mnemonic strategies such as the keyword technique, as well as the integration or linking of pictorial and prose material are examples); iii) elaborations should prompt active information processing on the part of the learner (Having students write in response to questions, and/or locate the details in a picture are examples); in certain cases, the more elaboration the better (Techniques that promote repetition and rehearsal are examples); and, iv) elaborations do not benefit all performance outcomes (Improved recall for only the information a student is questioned about is an example).

Summary:

In this chapter the literature directed towards instructional application was reviewed. Some of the research concerned with individual differences, traditional instruction, and effective learning strategies, with relevance for picture-oriented instruction, was examined.

Several areas where individual differences occur, such as brain hemisphere preference, imagery ability, background knowledge level, reading ability, and age, have implications for picture-oriented instruction, and were examined. Research evidence suggests that these are all variables which have been found to affect the comprehension and recall of prose and they are therefore important variables which need to be controlled or kept in mind when conducting picture/text studies.

Some research, investigating current teaching practices, has implications for picture-oriented instruction. It has been found that teachers make very little use of illustrations in their classroom teaching or spend time explicating the functions of illustrations (Evans, Watson, & Willows, 1987); and the attentional and motivational aspects of illustrations seem to be most often referred to by teachers and publishers. In general, the presence of illustrations with text results in superior recall of the accompanying prose material (Levie & Lentz, 1982; Levin, Anglin, & Carney, 1987). Pictures have certain functions (Duchastel, 1980; Levin, 1989), but it is doubtful that these functions are fulfilled since there is a widespread belief that pictures are easy media (Salomon, 1984). Results from studies suggest that the use of specific picture-oriented instruction in content-area teaching may be beneficial in ensuring positive picture effects.

The application of instructional techniques, which employ imagery or mnemonics, for use in prose learning have been studied. Some interesting findings were discussed. Pictures, such as transformational pictures, which serve an unconventional function can be even more facilitative for prose learning than other types of pictures normally used (Levin, Anglin, & Carney, 1987).

Other mental elaboration procedures, such as note-taking and rehearsal which were used in devising instructional material for this study were also briefly reviewed.

In summary, there have been relatively few studies directed to the identification of methods of instruction which will best enhance and maximize picture benefits. It appears that there are no studies, in fact, in which the effects of a mnemonic type method of instruction, such as those devised by Shriberg et al. (1982), Levin (1986), and McCormick and Levin (1984, 1986), is compared to a non-mnemonic but picture-oriented type of instruction such as adopted, to a minor degree, by Weidenmann (1989). In addition, the effects of imagery ability, gender, and age (or grade level) on a student's ability to profit from pictorial methods of instruction have not been clearly explained.

Chapter Four will describe the research design, and the data analysis. The hypotheses will be presented, and the selection and nature of the sample will be described. Also described will be the instructional materials, the testing instruments, and the procedures of the pilot and main study.

CHAPTER IV.

METHOD

The purpose of the study was to investigate whether students who are exposed to either of two picture-oriented methods of instruction would achieve better comprehension and recall of a social studies unit than students exposed to more traditional text-procdessing instruction, in which pictures may be noticed only incidentally. Also examined are the delayed effects of such instruction on comprehension and recall after a period of two weeks, as well as the relationship of students' individual imagery ability and gender on their ability to profit from such methods.

This chapter will describe the research design, data analysis, the hypotheses, the selection and nature of the sample, the instructional materials, the testing instruments, and the procedures of the pilot and the main study.

1. Design and Data Analysis

To examine the effects of two methods of picture-oriented instruction with grade 8 and grade 11 students a "quasi-experimental pretest-posttest non-equivalent control group" design was used (Borg & Gall, 1983, pp. 682-684; Campbell & Stanley, 1969, pp. 46-50), also known as a "compromise experimental group-control group" design (Kerlinger, 1986, pp. 315-316). This design was chosen because it was not possible to randomly assign students to the experimental groups (picture related methods of instruction) or to the conventional groups (text-processing only) at either the grade 8 or grade 11 level. Due to scheduling problems in high schools, the use of intact classroom groups was necessitated.

To control for the main threat to internal validity (Borg & Gall, 1983: Kerlinger, 1986) that initial group differences in reading comprehension and background knowledge might pose, certain test measures furnished scores which functioned as pretest scores. Standardized reading scores were obtained from the Stanford Diagnostic Reading Comprehension subtest, and background knowledge scores were obtained from an adapted version of Langer's (1984) Background Knowledge Measure.

These scores were used as covariates in the Analysis of Covariance test to factor out initial reading and background knowledge differences, in an effort to ensure that any differences observed on the posttests (immediate and delayed recall tests) were not attributable to pre-experimental group differences in reading ability and prior knowledge.

For the analysis of covariance and the F test to be appropriate, three assumptions are normally made in the populations represented: 1) normality in the distribution of equal interval scores, 2) homogeneity of variance , and 3) random sampling (Glass & Hopkins, 1984).

Research has suggested that recall scores of the type obtained by the dependent variable in this study, are normally distributed (Danner, 1976; Meyer & Freedle, 1984; Meyer, Brandt & Bluth, 1980; Taylor, 1980).

The homogeneity of variance assumption was examined in this study by using Box's M and Chi-Square analyses. The results are presented in Chapter Five.

Finally, to consider the third assumption, although the samples were not randomly selected they could be considered reasonably representative of eighth and eleventh grade students in Canada when their standardized reading scores were compared with local and national norms. The grade 11 mean score for the reading comprehension test obtained on the standardized national sample obtained in September, was a scaled score of 676-678 (grade equivalent of 10.7), and the mean obtained for the grade 11 sample selected was a scaled score of 691 (grade equivalent score of 11.2). This grade 11 mean score obtained would be the equivalent of 10.8 if testing had been conducted in September. The grade 8 mean score mean for the reading comprehension test obtained on the national sample in the month of September was a scaled score of 595-598 (grade equivalent score of 8.3), and the mean

score obtained for the grade 8 sample selected was a scaled score of 614 (grade equivalent of 8.8). This mean would be equivalent to a September grade equivalent mean of 8.4. Thus, while the means obtained for each sample appear to be slightly higher than the national standardized means, this difference is explicable when the time of administration is considered. For standardization of a national sample, testing was conducted in September and October, at the beginning of the school year. The samples selected for the study, however, were tested in December. It is, therefore, not unexpected that their achievement scores would appear slightly higher in comparison.

Fifteen hypotheses concerned with performance on post-tests, subsequent to treatment condition, were generated for each of grades 8 and 11. For all hypotheses, it is assumed that differences in reading ability and background knowledge are accounted for.

Hypothesis $_1$: There will be no significant difference among the three treatment groups (conventional, picture-oriented, altered-pictures) in their adjusted mean performance (as measured by scores obtained on both immediate and delayed test measures).

Hypothesis $_2$: There will be no significant difference between those of high or low imagery ability in their adjusted mean performance as measured by scores obtained on both the immediate and delayed comprehension/recall tests.

Hypothesis $_3$: There will be no significant difference between males and females in their adjusted mean performance as measured by scores obtained on both the immediate and delayed comprehension/recall tests.

Hypothesis $_4$: There will be no significant interaction between the instructional group (conventional, picture-oriented, altered-pictures) and imagery ability level (high or low) as measured by scores obtained on both the immediate and delayed comprehension/recall tests.

Hypothesis $_5$: There will be no significant interaction between type of instruction received and gender as measured by scores obtained on both immediate and delayed comprehension/recall tests.

Hypothesis $_6$: There will be no significant interaction between imagery ability level (high and low) and gender as measured by scores obtained on both immediate and delayed comprehension/ recall tests.

Hypothesis $_7$: There will be no significant interaction among instructional groups, imagery ability levels, and gender as measured on both the immediate and delayed test measures.

Hypothesis $_8$: The comprehension/recall performance of subjects on occasion 1 (immediate score) will not significantly differ from their comprehension/recall performance on occasion 2 (delayed score) regardless of their gender, imagery ability, or treatment condition received (conventional, picture-oriented, altered-pictures).

Hypothesis $_9$: There will be no significant interaction between the type of instruction received (conventional, picture-oriented, altered-pictures) and comparative comprehension/recall (comparing performance on the immediate test measure with performance on the delayed test measure).

Hypothesis $_{10}$: There will be no significant interaction between imagery ability level and comparative comprehension/recall (comparing scores obtained on immediate with delayed test measures).

Hypothesis $_{11}$: There will be no significant interaction between gender and comparative comprehension/ recall (comparing scores obtained on immediate with delayed testing).

Hypothesis $_{12}$: There will be no significant interaction among treatment or instructional group, imagery ability level, and comparative comprehension/recall performance (comparing the scores obtained at immediate with delayed testing).

Hypothesis $_{13}$: There will be no significant interaction between the type of instruction received, gender, and comparative comprehension/recall (comparing scores obtained on immediate and delayed test measures).

Hypothesis $_{14}$: There will be no significant interaction among imagery ability level, gender, and comparative comprehension/recall performance (comparing scores obtained on immediate and delayed test measures).

Hypothesis $_{15}$: There will be no significant interaction among the type of instruction received, imagery ability level, gender and comparative comprehension/recall performance (comparing performance at immediate with delayed testing).

Two separate Univariate Analyses of Covariance (ANCOVA) procedures were used (one for each grade level) since the design is a repeated measures design (the one dependent variable is measured twice on two separate occasions) with two covariates, background knowledge and reading comprehension. The one dependent variable is comprehension/recall performance as measured by the immediate and delayed comprehension/recall tests. These two tests represent essentially the same measure, but the test was administered on two separate occasions. There were three independent variables: gender (male or female), imagery ability (high or low), and treatment (conventional, picture-

oriented, or altered-picture).

The design for analysis is thus a 2 x 2 x 3 x 2 (that is, 2 genders by 2 imagery ability levels by 3 treatments by 2 comprehension/recall test measures) fully crossed, factorial design with repeated measures on the last factor. Figure 4 illustrates the design of the study for one grade level, and Figure 5 charts the Between-Subject and Within-Subject comparisons generated by this analysis for each grade. The level of significance for testing the differences was set at $p < 0.05$. The data were analyzed using the Statistical Package for Social Sciences, version 10 (SPSS:X, 1990), and the MANOVA program, at the University of British Columbia.

Significant treatment effects in overall recall necessitated post-hoc Scheffe test analysis of three pairs of treatment condition means to determine which treatment or treatments produced the significance. This analysis was done by hand calculation using the formula presented by Rummel (1970).

Significant effects in the interaction between treatment and comparative recall necessitated a post-hoc contrast analysis. This was conducted using SPSS:X, the MANOVA program, with 2 contrasts specified in order to determine which pairs of treatment means were significant.

2. Selection of the Sample

In this section the subjects, the schools, and the teachers involved in the study are described.

a) Selection of subjects

Subjects were from three large public high schools in the Maple Ridge School District; a total of 307 students in 18 classrooms were involved in the study. Initially there was a larger sample, but those subjects who were unable, for a variety of reasons, to furnish scores for all of the five measures used, were dropped from the study. This represented a loss of 108 students in total. Of these, there were 59 grade 11 students who attended school on the day of the standardized reading testing. Their average raw score obtained on this test was 41.25 (a grade equivalent score of 10.7). There were 41

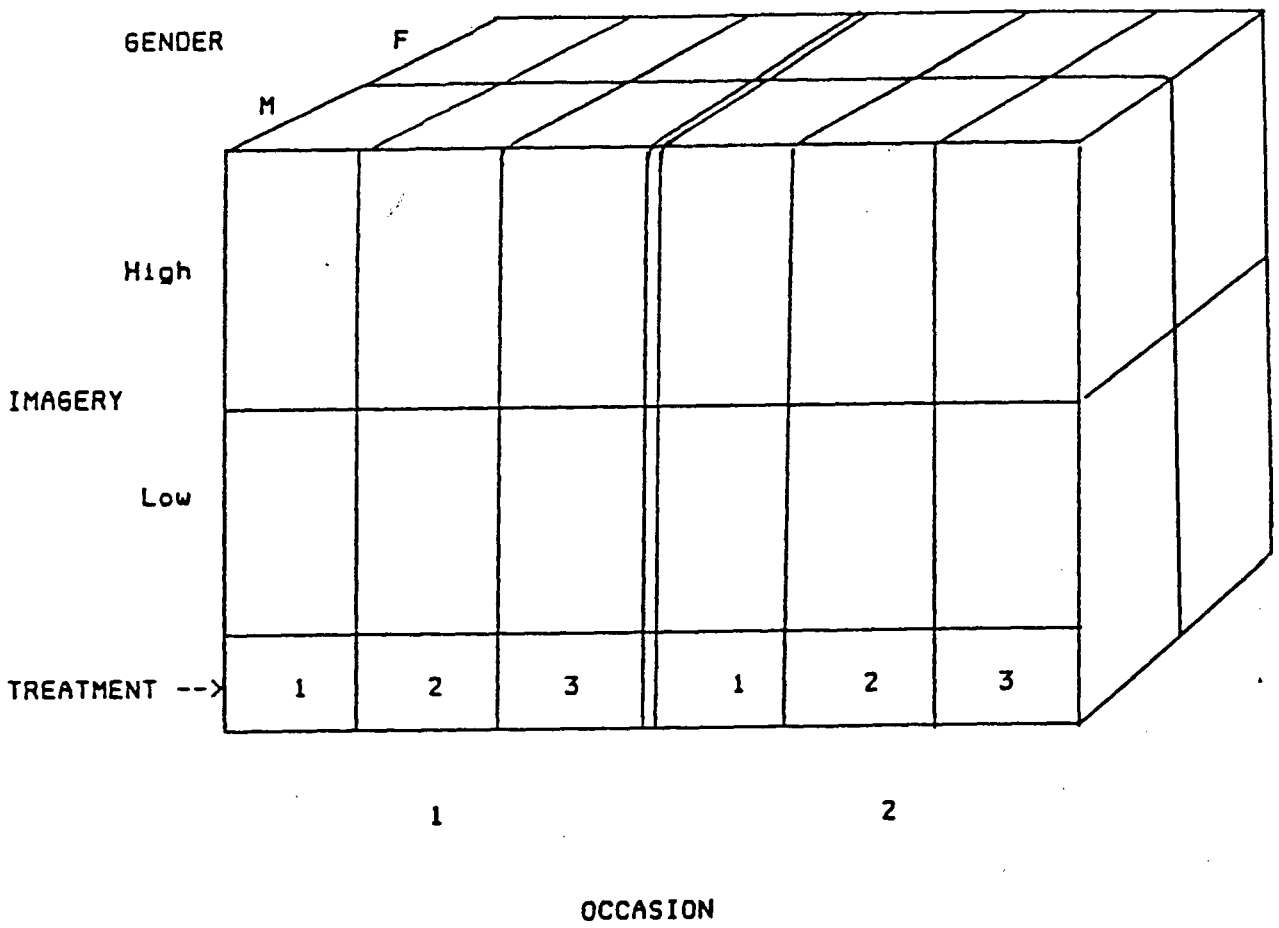

Figure 4. Design of the study: a 2 x 2 x 3 x 2 factorial design with repeated measures on the last factor (2 imagery abilities by 2 genders by 3 treatment groups by 2 occasions). Design is the same for each grade (grade 8 and 11).

Between-Subject Effects	Within-Subject Effects
Treatment	Recall (Comparative)*
Imagery	Treatment by Recall
Gender	Imagery by Recall
Treatment by Imagery	Gender by Recall
Treatment by Gender	Treatment by Imagery by Recall
Imagery by Gender	Treatment by Grade by Recall
Treatment by Imagery by Gender	Treatment by Imagery by Gender by Recall

Figure 5. Between- and within-subject effects examined for each grade.

grade 8 students who furnished reading comprehension scores, and their average raw score was 50.4 (a grade equivalent score of 8.5). These scores suggest that the students who were mitted from the analysis, due to absence, represented a similar population to the students who were selected for the study. The mean grade equivalent scores obtained for the remaining grade 8 and 11 samples, were 11.2 and 8.8 respectively.

Of the 307 students remaining (after following the policy of omitting subjects who did not furnish all 5 test measure scores), 177 were grade eight students (92 females, and 85 males) and 130 were grade eleven students (62 females, and 68 males). Based on information obtained from School Board officials, all three schools have student populations that may be considered representative of middle-class socioeconomic levels.

Three classes of grade 8 students and three classes of grade 11 students were selected from each school making it possible for each of the three treatments to be utilized in all three schools. Even though all three schools were similar in their socioeconomic status, it was possible to further control the socioeconomic factors between treatment groups, since all treatments were represented equally among the three schools, and at the two grade levels.

The grade 8 and 11 levels were selected because: 1) few studies have been conducted at either of these grade levels which focus on the effects of picture-oriented instruction, 2) these two grade levels allow a comparison of students' junior high and senior high school responses to methods of content area instruction, 3) the developmental aspects of imagery ability and/or the ability to make use of pictorial instruction are unclear, and 4) it was possible to devise a social studies passage for these two grade levels on a topic neither had been exposed to before in the prescribed curriculum.

b) School selection

The three high schools in Maple Ridge School District (a municipality of the Greater Vancouver metropolitan area) with the highest student populations were selected in order to ensure access to three social studies classes at each grade level from each school. All classes selected for the study were intact

non-streamed classes. Permission to conduct the study was obtained from the Maple Ridge School Board (see Appendix A), and from the school principals and teachers involved.

Permission to conduct the study was also obtained from the U.B.C. Human Subjects Ethics Committee (see Appendix B for certificate of approval). Each of the three classes at the two grade levels and three schools were randomly assigned to one of the three groups: control, experimental with unaltered pictures, experimental with altered pictures.

c) Teachers

The regular social studies teachers conducted the lessons and administered all testing materials. In both the conventional and picture-oriented groups, the teachers who were involved were experienced teachers with at least 3 years of teaching experience. In order to avoid the Hawthorne Effect, the investigator did not in any instance introduce herself to the students, provide instruction, or administer any of the tests.

Because the teaching in some of the large high schools in British Columbia is somewhat departmentalized, it was most often the case that one teacher was involved in conducting more than one of the treatment conditions with their various regular social studies classes. Figure 6 illustrates the configuration of teachers and types of treatment given to classes at the two grade levels in each of the three schools. It can be seen from this table that in some cases teachers were involved with teaching a treatment to different grade levels, and, at one school, two teachers were involved with only one treatment or class each.

The teachers were given instruction on an individual basis by the investigator as to how to conduct the various lessons and administer the pre- and post-tests. This instruction occurred in three separate sessions.

At the first session, two weeks before the study, teachers were acquainted in very general terms with the study, some of the materials, and the extent of class time required.

At the second meeting, usually on the day before conducting the pretests, teachers were

Teachers for each Treatment	School					
	I		II		III	
	Grade					
	8	11	8	11	8	11
Conventional	A	B	F	E	G	I
Picture-Oriented	B	A	F	E	G	H
Altered-Picture	D	C	F	E	H	I

Figure 6. Individual teachers who taught each treatment, at each grade level, in each school

Note. Teachers are identified by an upper case letter.

instructed in all the procedures involved in giving the three pretests, and given a package of materials which included written procedural instructions and class sets of the three test measures: 1) imagery questionnaires, 2) standardized reading test materials, and 3) background knowledge measure.

At the third meeting, teachers were shown, on an individual basis, the treatment lessons and how to conduct them. The first posttest, a test for comprehension and recall of the lesson, was also shown to the teacher and the manner of administration, explained. At a final meeting with the teacher, almost two weeks later, the delayed test measures were delivered and their manner of administration explained.

Written instructions given to the teachers during these meetings appear in Appendix C.

3. Instructional Materials

The instructional materials used in the study were prepared by the investigator for each grade and treatment group, and included: 1) testing instruction booklets for teachers, 2) detailed lesson booklets for teachers, 3) text booklets for students, and 4) question sheets for students.

a) Teacher testing instruction booklets

There were three sets of testing instructions prepared. The first of these contained specific standardized instructions outlining in detail how each of the three pretests were to be administered. A second instructional sheet gave standardized instructions outlining the procedures to be used for administering the immediate comprehension/recall measure. Finally, a third set of instructions outlined procedures for giving the delayed comprehension/recall measure. These instructional booklets are included in Appendix D).

b) Teacher lesson-instruction booklets

The lesson procedure booklets contained general information about the nature and extent of the

study, specific instructions for conducting one 40 minute social studies lesson, and a detailed outline of the lesson itself. For the various treatment conditions, the lesson outlines differed.

i) Conventional lesson outline

The lesson outline for the conventional group consisted of specific questions that the teacher was to address to the class, which were to be interspersed with the students' silent reading of sections of the text booklets. All questions focused on the written text content only, although pictures accompanied the text. Some questions were to be answered by the students in written form, (on a sheet which provided a brief structuring for their notes) while most answers were to be given orally. In much the same manner as a guided silent reading lesson, subjects in this group were set purposes for reading a section of the text passage and were then asked questions afterwards to check their comprehension and recall (see Figure 7 for an example excerpt from this lesson type).

ii) Picture-oriented lesson outline

The lesson outline for this experimental treatment was identical to the control group except that some questions, which were similar in nature to the control group, focused on obtaining answers from the pictures, instead of solely from the text. Again, the teacher's questions were interspersed with students' reading of the text pages, and in this way, picture content (visual) was integrated with the text material (verbal). In a similar fashion to the control group, some of the teacher questions were answered in written form, (the same sheets were provided as for the conventional group, and were to help students structure their note-taking) while most answers were given orally. This experimental picture group was asked to look at the pictures before and after reading the text. The pictures not only served a preliminary schema-activating and predictive function before reading, but also provided concrete visual frameworks or structures for questioning after reading. For this reason, the experimental lesson was considered a picture-oriented lesson.

The subjects in this group were first asked questions seeking to relate the picture content with their own background knowledge, the main idea of the picture was discussed, and a purpose related to the picture was set for reading a section of the text. After most of the class had had sufficient time to

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Teacher says:	Expected Student Response:
READ TO THE END OF THE TEXT NOW AND WHEN YOU FINISH SEE IF YOU CAN LIST 3 WAYS THE COMMUNIST GOVERNMENT WAS SIMILAR TO THE CZARIST SYSTEM.	
HAS EVERYONE FINISHED READING? WHO CAN TELL ME ONE WAY THE COMMUNIST SYSTEM AND THE CZARIST SYSTEM WERE SIMILAR?	1. Both had dictators in charge.
WHAT WAS ANOTHER SIMILARITY?	2. Both systems forced people to adopt and obey rules.
AND ONE MORE SIMILARITY?	3. Government was centrally, not locally controlled.
WHAT KIND OF RULER WAS LENIN?	Determined, forceful, harsh, ruthless, etc.

Figure 7. Example excerpted from teacher's conventional lesson.

read the text section, students were again asked to look at the picture while answering questions. Questions were designed in order that the picture would serve a review function; students had to examine the pictures carefully for evidence of information read about in the text. Students were then directed to examine the next relevant picture, and the same procedure was followed for each text section (see Figure 8 for an example excerpt from this lesson type).

iii) Altered-pictures outline

The lesson outline for the altered-pictures group was similar to the picture-oriented group except that the pictures in the student text booklets contained some additional features, so that the lesson outline differed accordingly. Students receiving this treatment were told that the pictures in their texts had been deliberately altered as a learning strategy.

This group received similar questions and directions as the picture-oriented group, but attention was directed also to the added features in each picture. As students completed the reading of the relevant text sections they were asked to explain and discuss the added features in the pictures, but otherwise, their instruction was almost identical to the picture-oriented group instruction. (See Figure 9 for an example excerpt of this lesson type).

In all three lesson outlines, the questions focused on drawing out the main ideas and details of the text passages. All three groups received approximately the same number of questions, with one group focusing solely on the text, another group focusing on the text and pictures, and a third group studying text and pictures with added features. Some questions were answered orally and some questions called for written responses (using the structured note-taking sheets) followed by oral response. The manner of responding to particular questions was the same for all three groups. The text for all three groups was parsed in identical sections for question and discussion. All treatment groups were not only limited to the same lesson time, exactly 42 minutes (grade 8) and 41 minutes (grade 11), but also received the same amount of time where the teacher was engaged in giving instruction. Careful timing was stressed. The Lesson Procedure instructions for each grade ans lesson procedure outlines for each treatment group are included in Appendices E and F.

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Teacher says:	Expected Student Response:
READ THE REST OF THE TEXT NOW AND SEE IF YOU CAN LIST ON YOUR PAPER 3 WAYS LENIN'S COMMUNIST GOVERNMENT WAS SIMILAR TO THE CZARIST SYSTEM.	
LOOK AT THE PICTURE OF LENIN AGAIN. WHO CAN TELL ME ONE WAY THE COMMUNIST SYSTEM WAS SIMILAR TO THE CZARIST SYSTEM?	1. Both had a dictator in charge.
GOOD. NOTICE LENIN'S RAISED FIST. WHAT WAS ANOTHER SIMILARITY?	2. Both systems forced people to adopt and obey ideas.
GOOD. NOTICE THE ARMY USED TO ENFORCE OBEDIENCE. AND A THIRD SIMILARITY?	3. Government was centrally, not locally controlled.
YES, THAT'S RIGHT. NOTICE THE LARGE BUILDINGS IN THE PICTURE. THE VILLAGES DID NOT HAVE ANY POWER.	

Figure 8. Example exerpted from teacher's picture-oriented lesson.

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Teacher says:	Expected Student Response
READ THE REST OF THE PAGE NOW AND SEE IF YOU CAN TELL ME 3 WAYS THE COMMUNIST SYSTEM WAS SIMILAR TO THE CZARIST SYSTEM.	
HAS EVERYONE HAD TIME TO FINISH READING? LOOK AT THE PICTURE OF LENIN AGAIN. WHO CAN TELL ME ONE WAY THE COMMUNIST SYSTEM WAS SIMILAR TO THE CZARIST SYSTEM?	1. Both had a dictator in charge.
GOOD. NOTICE THE WHIP. WHAT WAS ANOTHER SIMILARITY?	2. Both systems forced people to adopt and obey ideas.
GOOD. NOTICE THE ARMY USED TO ENFORCE OBEDIENCE. AN A THIRD SIMILARITY?	3. Government was centrally, not locally controlled.
YES, THAT'S RIGHT. NOTICE THE LARGE BUILDINGS IN THE PICTURE. THE VILLAGES DID NOT HAVE ANY POWER.	

Figure 9. Example excerpted from teacher's altered-pictures lesson.

c) Student Text Booklets

All students were provided with researcher-produced text booklets containing expository text and pictures.

i) Expository text

In order to ensure that a comparison between grades 8 and 11 would be legitimate a number of factors were taken into account when creating the expository text that the students were to study.

Because background knowledge about social studies topics is likely to vary between grade 8 and 11 students, the prescribed textbooks from grade 8 to 11 were examined to determine what topics might have been encountered by students in British Columbia schools at these two grade levels (see Appendix G for a list of the Ministry of Education's prescribed texts for grades 8 to 11 in social studies). Although events in Russia up until 1917 are included in one of the grade 9 recommended texts, the Russian revolutions of 1917 and events thereafter are not described in any of the textbooks in the grades after this until grade 12. For this reason, the topic chosen for the text booklets was the Russian revolutions of 1917 and the events immediately afterwards. It was realized, however, that the grade 11 students might have increased their knowledge about this topic through other sources, so that a background knowledge measure was also used to control for differences between the two grades.

Since reading ability is likely to differ between grade 8 and 11, the expository text was written at an appropriate level of difficulty for each grade. Although the basic content of the text was not changed, the vocabulary, sentence length, and amount of detail included was altered to produce texts that were equally difficult relative to each grade level. The changes eventually resulted in two such passages: the grade 8 text has a readability of 6.82 or, (using the Dale-Chall conversion chart) end of grade 8 level, while the grade 11 text has a readability of 8.4 or end of grade 11. The readabilities are based on the Dale-Chall (Dale & Chall, 1948) Readability Formula, and Correction Table with three 100-word samples randomly selected from the texts prepared for each grade.

The length of the text passages was also varied for each grade level as the speed of reading is also likely to differ between grades. The grade 8 text passage contains 1,482 words, the grade 11

passage, 1,575 words. The text is arranged on 5 pages for the grade 8 version, and is spread over 6 pages in the grade 11 version.

The format of the expository text is designed to reflect the sort of text that would appear in either a grade 8 or 11 social studies textbook. Headings are included in bold print,the text is written in two columns per page, and pages are numbered as if extracted from a textbook, beginning with page 48. Textbooks with this format are used at both the grade 8 and 11 level.

ii) Pictures

The pictures appearing in the text booklets were identical in both the grade 8 and 11 text booklet versions. There were 9 black and white photographs with captions. All of the pictures represented material contained in the accompanying text, and all were pictures of people. Although pictures in social studies textbooks may take a variety of forms (colour, black and white, outline drawings, reproductions of paintings, photographs), it was decided to confine the pictures to just one type to avoid confusion in interpreting the results of the study.

Levin (1981) differentiates between four main functions of pictures: representational, organizational, interpretational, and transformational. The pictures that appear in the conventional and picture-oriented groups' booklets serve the representational function, where the pictures overlap with the text and repeat certain contents (see Figure 10 for examples of this picture type). The pictures appearing in the altered-pictures booklets (see Figure 11 for examples of this picture type) not only serve this representational function, but also a transformational function. In this case, the pictures serve as a kind of visual mnemonic, helping not only to recall text contents but single words, names, or concepts as well.

The pictures in the altered text version were altered in the following ways: Picture 1) Alexandra holds a ring of large keys, son has a cross on his chest (to show that Alexandra had a great deal of power, and the son was suffering from the life-threatening disease of hemophilia), Picture 2) Placards written in English are added: "Bread", "Down with the Czar", (to show that lack of food and attitude towards the monarchy were problems), Picture 3) A small rat sits on Rasputin's shoulder (to symbolize

Kerensky (at left) taking the salute at a military parade. He was a brilliant speaker but his Provisional Government failed to end the unpopular war or deal firmly with the Bolsheviks. Kerensky went to live in America where he became a professor of history

Lustful, illiterate, the evil monk Rasputin used mysticism to dominate the Empress—and became the power behind the czarist regime.

Figure 10. Examples of representational pictures appearing in the conventional and picture-oriented lesson text booklets.

Kerensky (at left) taking the salute at a military parade. He was a brilliant speaker but his Provisional Government failed to end the unpopular war or deal firmly with the Bolsheviks. Kerensky went to live in America where he became a professor of history

Lustful, illiterate, the evil monk Rasputin used mysticism to dominate the Empress—and became the power behind the czarist regime.

Figure 11. Examples of transformational pictures appearing in the altered-pictures lesson text booklets.

his disreputable character), and a cross in his hand identical to the one on the son's chest in picture 1 (to show that the influence Rasputin had was largely because of his involvement supposedly curing the Czarina's son of his disease), Picture 3) Captions were added to show what soldiers might have been saying to each other (comments were to illustrate how disillusioned they were with the war), Picture 4) A pair of skis, and the name "Karen" issuing from the army general's mouth (as a means of recoding the army general's name, "Kerensky"), Picture 5) Corner of carriage is emphasized in bold outline (as a means of recoding the army general's name "Kornilov" who was not happy about sitting in a corner or taking a back seat, and attempted to overthrow the government), Picture 6) Upper case letters added to the picture: a "B" over each to the guards' heads (to symbolize they are "Bolshevik" guards), and a large "L" on the door they are guarding (to illustrate Lenin is their leader), Picture 7) A large whip is added to Lenin's upraised hand (to show he was a harsh dictator), and lines radiate from his head (as a means of recoding his name from Lenin to "lean on" hair), Picture 8) An arrow with a peace symbol on the end pierces Trotsky's face (to symbolize that the peace treaty Trotsky negotiated hurt, or was disadvantageous, to Russia).

For examples of the grade 8 and 11 text booklets, both the altered and unaltered-picture versions, please see Appendix H.

d) Question Sheets for Students

Each student was supplied with a single page question sheet as a means of structuring students' brief notes, inserted between the pages of their text booklets. These contained three of the questions asked orally by the teacher during the course of the lesson and were designed to keep the students in all three treatment groups on track with the same tasks. Students were instructed in all three treatment groups to use this paper to jot down brief notes in answer to the teacher's question (if the question was one of the three on the outline) as they read the appropriate section of the text. Space was provided on the sheet to answer each question with the help of a brief outline. (See Appendix I for an example).

4. Testing Instruments

Both for the grade 8 and 11 samples, five instruments were used in the study. One was a standardized test, the Stanford Diagnostic Reading Comprehension Subtest, and four were non-standardized tests: 1) Background Knowledge Measure, adapted from Langer (1984), 2) Vividness of Mental Imagery Questionnaire (Marks, 1973), 3) Immediate Recall Measure, 4) Delayed Recall Measure (after a two weeks' delay).

An additional measure, examining immediate and delayed picture recall was also included, in a section at the end of the immediate and delayed recall tests, as a check on how the pictures were being used.

a) Standardized Reading Comprehension Measure

To obtain a standardized reading score for the grade 8 subjects the Stanford Diagnostic Reading Comprehension subtest, Brown Level, Form A was used (Karlsen, Madden, & Gardner, 1976). For the grade 11 subjects the Stanford Diagnostic Reading Comprehension subtest, Blue Level, Form A was used (Karlsen, Madden, & Gardner, 1977). This test was administered to all grade 8 and 11 classes one week before receiving the treatment lesson in order to provide covariate scores to be used to rule out the effects of reading ability differences on dependent variable scores.

The Stanford Diagnostic Reading Comprehension subtest (1976, 1977) was chosen for a number of reasons. The test was developed by the authors to serve as a diagnostic and instructional tool, which in its editing and reviews sought to eliminate sources of ethnic, cultural, racial, and sex bias. Each item in the test was reviewed and edited for content and style and for its appropriateness for measuring stated objectives.

In standardizing the test, the school systems were selected using a stratified random sampling technique, with socioeconomic status, school system enrollment, and geographic area as the stratification variables. In grades 2 through 9, 25,000 students were tested. In grades 9 through 12, 24,000 students

were tested. The standardization sample was chosen to be representative of the United States national school population. The test, however, is widely in use in Canadian schools.

The content validity of the test must be determined by inspecting the test's content and matching it with the objectives of the local reading program. The objectives written by the authors were written to reflect the content of reading programs in common use throughout the United States. The criterion-related validity of this test was established by correlating scores of the Stanford Diagnostic Test with scores from another standardized test.

The reliability of the grade 8 reading comprehension subtest, Form A, calculated by the Kuder-Richardson formula 20 is .97, and for grade 11, reading comprehension subtest, Form A, the reliability coefficient is .93.

b) Background Knowledge Measure (Langer, 1984)

Scores obtained from this test were used to control the amount of passage-specific knowledge students might have about the topic and the effect that this prior knowledge might have on their subsequent recall. It was hoped that controlling for the amount of prior knowledge students had about the topic to be studied would help to clarify more accurately the effects of treatment.

The background knowledge measure (Appendix J) was administered to classes during the same one hour period that the standardized reading test was given. This test required approximately 10 minutes to administer. Students were asked to free associate in response to nine key words or phrases selected from the text booklet. These nine items were seen as representing key concepts in the passage. Teachers read out each word or phrase in turn while students noted on their papers their associations with that word or concept.

The students' responses were scored using Langer's three organizational levels of knowledge: 1) highly organized knowledge, 2) partially organized knowledge, and 3) diffusely organized knowledge. Responses were scored using a weighted system: one point for category 3 knowledge, 2 points for category 2 knowledge and 3 points for category 1 knowledge.

Research findings indicate that Langer's passage-specific knowledge measure is highly related to passage comprehension, and previous studies (Langer, 1980, 1981) have found the measure to to be predictive of recall as well. Reliability is increased (Winer, 1971) when more than three stimulus words are used for free association, so that by including 9 words it was hoped the reliability would be increased.

c) Vividness of Visual Imagery Questionnaire

The purpose of this questionnaire was to obtain imagery vividness scores, in order to determine if individual differences in the ability to produce vivid images might affect a student's ability to profit from various forms of picture-oriented instruction.

The questionnaire consists of 16 items (see Appendix K) The image summoned for each item is rated along a five-point scale of vividness, once with eyes open and once with eyes closed. Total scores on this questionnaire revealed a median of 67 for grade 8 subjects and a median score of 66 for grade 11 subjects. On the basis of these scores subjects in grade 8 with a score greater than 66 were classed as low imagers, and those with scores less than 67 were classed as high imagers. In grade 11, those with scores greater than 65 were classed as low imagers, and those with scores less than 66 were classed as high imagers.

Marks' Vividness of Visual Imagery Questionnaire (Marks, 1973), unlike a number of other similar measures (Betts, 1909; Gordon, 1949; Sheehan, 1967), has been found to yield a high correlation between scores obtained on the questionnaire (where subjects report their own visual image vividness) and accuracy of recall for information contained in pictures. The questionnaire has a test-retest reliability coefficient of 0.74, and a split-half reliability coefficient of 0.85.

d) Immediate Comprehension/Recall Measure

The Immediate Recall Measure was designed to measure the comprehension and recall of the connected prose appearing in the student text booklets. Test items measured the comprehension and

recall of text content only, and did not elicit comprehension and recall of picture content. There were 33 test items, worth a total score of 36. The test consisted of a 10 item matching question, 9 multiple choice questions, a 10 item true/false question, a 6 item sequential order question, and a 3 item short answer question (see Appendix L for immediate and delayed versions of this measure).

In order to increase the reliability of the test, the number of items and question types was augmented from the pilot study tests used. A number of test construction principles were observed for the various question types (Wesman, 1971).

Multiple choice items were included since they are relatively easy to score and may be easier to write than good true-false items. The following principles were observed in constructing these items: the stem of each item is meaningful by itself and includes all repetitive words and/or phrases that would otherwise be stated in the alternatives, the alternatives for each question are of similar length, and are not paraphrases or opposite in meaning to each other, the questions do not contain negatives, or inclusive terms such as "never," "always," "all." Each question included four options, since theoretically the larger the number of distracters, the more reliable the item.

True-false items, which require less space and reading time than multiple choice items, were included in order to permit broader sampling of the subject matter, and to enhance reliability by increasing the number of test items. Some principles observed were the avoidance of: broad general statements, negative and double negative statements, long complex sentences, verbatim statements or phrases from the text, and statements with more than one idea. True statements and false statements were approximately equal in length, and occured with the same frequency.

In order to include a question type requiring a greater degree of competence than demanded from other question types, a short answer question was included. Blanks were provided equal in length for each answer.

A matching question was included as there were a number of names mentioned in the expository passage, and the matching question is particularly suited for the identification of names. Including this question also increased the number of items that could be included in the test.

A question requiring the ordering of events in sequence was also included. This question required higher order thought processes than required of some of the selection type questions. Statements were brief and of the same length, and were stated without the use of negatives.

The reliability of the Immediate Comprehension/Recall Test was assessed by calculating both test-retest and split-half reliability. For the grade 8 sample, test-retest reliability was 0.69, and for the grade 11 sample, test-retest reliability was 0.67. For the immediate comprehension/recall test, the split-half reliability obtained for the grade 8 sample was 0.65, and for the grade 11 sample, the split-half reliability was 0.73.

e) Delayed Comprehension/Recall Measure

This was essentially the same test as the immediate test measure, but the format differed in order to disguise the fact that the same test was being used. The purpose of the test was to measure the amount of text information still understood and remembered after a period of two weeks had elapsed. The question items were the same as in the immediate test measure, but the question order and item order were altered. The preliminary personal data requested and the colour of the paper used also differed.

The split-half reliability of the Delayed Comprehension/Recall Test was calculated: for the grade 8 sample the reliability was 0.73, and for the grade 11 sample the reliability was 0.77.

f) Immediate and Delayed Picture Recall

Included with the immediate and delayed comprehension/recall testing (but not included as part of the comprehension/recall score) was a question asking for a brief description of all the pictures that the student could remember seeing in the text booklets. This was included as a check to determine to what extent the three treatment groups had focused on the pictures, and how well the pictures were remembered by the three treatment groups after a delay of two weeks.

5. Procedures

The study was conducted in four stages: 1) a 1 hour pretesting session, 2) a social studies lesson coupled with immediate comprehension/recall testing, 3) the delayed testing, and 4) the scoring.

Before discussing the procedures for the main study, however, the pilot study, conducted 5 months before the main study, is described.

a) Pilot Study

The pilot study was conducted primarily to assess the timing, instructional clarity, and administration difficulty of the lessons and testing instruments. It also allowed the opportunity to perform item analysis on the responses to test items.

Three grade 8 classes and three grade 11 classes from the Yale High School in Abbotsford, a middle class socioeconomic area, were involved. One grade 8 teacher and one grade 11 teacher taught all three methods to their classes. The teachers did not perform delayed testing with their students, since the main purpose of the pilot study was not to investigate treatment effects, but to assess and refine the procedures and materials.

Based on classroom observations of the pilot study lessons and testing periods, a number of changes were made to the materials and to the lesson procedures for the main study.

At the pilot pretesting sessions, it was observed that the subjects had difficulty completing all three tests: standardized reading test, imagery questionnaire, and background knowledge measure during the one hour classroom period. The time required to complete each of these tests in all of the classes was noted. It was found that with practice and increased efficiency the teachers were able to complete these three tests in the one hour time period allotted. It was decided to warn the teachers involved with the main study that efficiency and prior organization were required if the three pretests were to be completed during one classroom period.

Observation of the lessons and immediate comprehension/recall testing resulted in many

changes to the main study procedures and materials. First, it was observed that the text booklets were too lengthy and difficult for the grade 8 students to study adequately in the 35 minutes allowed. The grade 11 teacher had difficulty completing the lesson in the 35 minutes allowed also. As a result the text booklets designed for the main study were reduced in length from 2,017 words to 1,482 words for the grade 8 students, and from 2,056 words to 1,575 words for the grade 11 students. The readabilities of both passages were also adjusted so that the resulting grade 8 passage was easier to read (changed from a readability of 7.1, or beginning of grade 9 level, to 6.7, or end of grade 8 level), and the resulting grade 11 passage slightly more difficult (changed from a readability of 8.2, or halfway through grade 11, to 8.4, or the end of grade 11 level). These adjustments represented more comparable text passages relative to each grade.

To allow the teachers more time to complete the lesson, the lesson time was changed to 42 minutes for grade 8 classes and 41 minutes for the grade 11 classes. The number of questions and directions that the teachers were to use during the lesson were also reduced. These changes were based on careful timing of how long it took for students to complete their silent reading of text sections, and how much time was required for each teacher question or instruction.

Also, it was noticed that the actual text content of the text booklets was perhaps more closely akin to narrative than expository writing. The content and approach were changed to reflect text that was more representative of the sort of text students encounter in their regular social studies textbooks.

A comparison of the text used in the pilot study (Appendix M) with the text used in the main study (Appendix H) illustrates these changes.

Because the text content was altered, the pictures that were included in the final main study text booklets were also different. There were 7 pictures included in the pilot study text booklets. There were a total of nine pictures in the main study text booklets, with only one of these pictures chosen from the pilot study text booklet pictures. The pictures were selected on the basis of text content, and similarity of picture type. All pictures were black and white photographs portraying people.

Observation and assessment of the immediate comprehension/recall pilot testing led to some

additional changes. For the pilot study, there were two separate tests given, a 10-item multiple choice measure and a 7-item short answer measure. Because there were two separate tests, the time required to collect papers and administer the tests took up at least 20 minutes of the one hour classroom period. After assessing the results of these tests, it was found that the level of response for individual students correlated closely between the two tests. It was decided, therefore, to create one recall test which would include more selection type answers than supply type, in order to 1) reduce the amount of time required for testing, 2) increase reliability of the measure by increasing the number of items on one test, and 3) make the tests less subjective in nature and easier to score. Three multiple choice items, items 6, 8, and 10 were found to have appropriate discrimination and difficulty indices and were retained for the test used in the main study. The remainder of the items either were too easy or difficult, failed to discriminate properly, or were inappropriate for the "new" content contained in the main study text booklets and were therefore discarded.

In summary, the following changes were made:

i) Instruction was given to teachers to prepare in advance for he pretesting session, and they were cautioned that efficiency of collection and distribution of tests was critical to their completion of tests during the one hour allotted. Teachers were also told to give the tests in a particular order, with the background knowledge measure to be given last. This instruction was given so that the background knowledge measure, the shortest test, could be given during another classroom period if time constraints made this necessary. It was felt that if the standardized reading test (the longest to administer) were not given first, there would be a danger of its being interrupted.

ii) The text content, the text style, the actual pictures, the number of pictures, and the readabilities of the student text booklets were changed.

iii) Instead of two test measures, one comprehension/recall measure was created with more test items, different test items, and more selection type items. The resulting test also took less time to administer.

b) Main Study

i) Pretesting

One week before the treatment lesson was given, teachers administered the Stanford Diagnostic reading comprehension tests, the Vividness of Visual Imagery Questionnaire, and the Background Knowledge Measure to the classes taking part in the study. In most cases this testing was completed during a one hour classroom period. This testing took place during the second and third weeks of November, 1990. These tests were collected, and then scored by the investigator.

ii) Lesson and immediate testing

During the third and fourth weeks of November, 1990 the nine teachers involved in the study gave the treatment lessons and conducted the immediate comprehension/recall testing. In all cases, this was accomplished during a regular one hour social studies period. Before this instruction took place, the investigator met with each teacher individually to discuss the procedures and familiarize the teacher with the lesson. The investigator did not enter the classrooms at any time while students were in attendance. After the lesson was conducted, the text booklets and Immediate Comprehension/Recall tests were collected.

iii) Delayed testing

Two weeks after the lessons were conducted, teachers administered the delayed test measure during one of their regularly scheduled social studies classes. This testing only required 13 minutes for all grade 11 students to complete the test, and 15 minutes for all of the grade 8 students to complete the test. These tests were then collected by the researcher for scoring.

iv) Scoring

The standardized reading comprehension tests were scored according to the procedures outlined in the Stanford Diagnostic test manuals. Raw scores were converted to grade equivalent scores (in order to give classroom teachers meaningful information about their students) and class lists of these scores were provided to each teacher during the first two weeks of conducting the study. Grade equivalent scores were then converted to scaled scores, as these scores, unlike grade equivalent scores,

represent an equal interval scale. Both scaled scores and grade equivalent scores are comparable across levels and forms of the same subtest.

Grade equivalent scores are sometimes included in some of the tables to make the results more meaningful. However, caution should be exercised in interpreting these scores, as they are often misunderstood. For example, if a ninth grader earns a grade equivalent of 6.6 on the Blue Level (grade 11), it means that the students's score was about the same as what the typical score of sixth graders would have been had they been tested with the Blue Level in late February or March (6.6). A grade equivalent of 6.6 does not necessarily mean that the student "has only those reading skills ordinarily acquired by the middle of sixth grade" (Karlson, Madden, & Gardener, 1977, p. 72).

The Vividness of Visual Imagery Questionnaires were scored according to the instructions for this measure (Marks, 1973). Students were asked to rate the vividness of their images with their eyes open and their eyes closed, according to a 5 point scale. The most vivid and distinct images were to be rated as 1, the most vague and indistinct images to be rated as 5. These ratings were totalled to yield one score. (A score of 42, for example, would be attained by a subject who rated their images as very vivid, while a score of 72, for example, would be a score achieved by a subject who rated their images as more vague, and unclear.) These scores were subjected to analysis using the SPSS:X computer program in order to determine the median scores for each grade: for grade 8, this was 67, and for grade 11, the median score was 66. The scores were then split, using the median as the division point, into two approximately equal groups. Those subjects with the lower scores were categorized as high imagers, and those, with the higher scores, were deemed low imagers.

The Background Knowledge Measure was scored according to Langer's (1974) criteria. Subjects were given one point for diffusely organized knowledge: associations, morphemes, sound alikes. For partially organized knowledge such as examples, attributes, and defining characteristics subjects were given 2 points. Finally, for highly organized knowledge including superordinate concepts, definitions, and analogies subjects were given 3 points. Scores ranged from a low of 0 to a high of 33. These raw scores were used in the analysis as covariates to control for the amount of information the students

already knew about the study topic. There were some difficulties in using this measure, however. The raw scores obtained do not represent an equal interval scale, since a student could not be scored with absolute certainty in each of three categories of organized knowledge.

The researcher-designed Immediate and Delayed Comprehension/Recall tests were designed so that for each item there was one correct answer (with a possible correct total of 36). One point was given to all correct responses in all question types, except for the one short answer question where a subject could obtain a maximum of 2 points for each of 3 questions.

The Immediate and Delayed Picture Recall was scored by allocating one point for each picture recalled. If the student's description of the picture was recognizable in any way, the student received one point. It was assumed that students were not already making use of illustrations in some manner to help them remember text content. In order to check if this assumption was valid, and that the type of instruction made no difference to the number of pictures recalled, means tables were requested on SPSS:X of the mainframe computer at U.B.C. for the interaction between picture recall (immediate and delayed) and method of instruction.

Approximately 20% of all tests, including the standardized reading tests, were marked by more than one examiner. After this procedure was carried out, scores were recorded on each subject's test. The following test scores and other data were then entered on computer and analyzed: identity, grade, gender, teacher, treatment, immediate recall score, delayed recall score, immediate picture recall, delayed picture recall, imagery score, raw reading score, background knowledge score, grade equivalent reading score, scaled reading comprehension scores, and split scores for immediate and delayed recall measures (score for each subject of odd and even numbered test items).

In summary, the design of the study was a 2 (grades) x 2 (imagery abilities) x 3 (instructional methods) x 2 (recall occasions) fully crossed, factorial design with repeated measures on the last factor. Fifteen hypotheses for examination were generated for each grade. Based on the design and the hypotheses, the data were analyzed for each grade using two separate Univariate Analysis of Covariance (ANCOVA) procedures (MANOVA program), with two covariates (background knowledge level, and

reading comprehension ability), and with a repeated measures design specified. The selection of the sample, the teaching materials, and the testing instruments used were described. The procedures for the pilot and main study were outlined, and a description of the scoring methods used in the main study were also included.

Chapter Five will present the results of the study in four sections. The results of the covariate measures will be described, and the results of the Visual Imagery Questionnaire will be reported. The reliability measures and procedures used will be outlined, and finally the results of the univariate, repeated measures analysis of the dependent measure and independent variables will be presented.

CHAPTER V.

Results

It was the purpose of this study to determine whether students who are exposed to either of two picture-oriented methods of instruction would achieve superior comprehension and recall of a social studies text than students exposed to more traditional text-only processing instruction where the attention given to the accompanying illustrations is often incidental. Also examined were the effects of picture-oriented methods of instruction on delayed comprehension and recall after a period of two weeks. In addition, the results of various levels of imagery ability and gender on a student's ability to profit from picture-oriented methods of instruction were investigated.

This chapter will present the results of the study in five sections. First, the results of the covariate pretest measures will be described. Second, the results of one of the independent variable measures, the Vividness of Visual Imagery Questionnaire, will be presented. Third, descriptive statistics for each sample including the various means for each treatment group will be presented. The reliability measures and procedures used will be discussed. And, finally, the factorial analysis of the dependent measure variable and the independent variable measures will be reported for each hypothesis.

1. Covariate Measures

a) Stanford Diagnostic Reading Comprehension Scores

Scores from the Stanford Diagnostic Reading Comprehension subtests (Brown Level, grade 8; Blue Level, grade 11) were used to control for initial reading differences between the treatment groups and the control group. Any students for whom these scores were not available were eliminated from the study. The scores were used to factor out initial reading differences that may have influenced the results on the dependent variable measures (the immediate and delayed comprehension/recall tests). It was

important to ensure that any observed treatment effects could not be attributed to the naturally occuring differences in reading comprehension ability.

A one-way Analysis of Variance test on scaled reading score by treatment (SRS xTreat) was conducted on the SPSS:X mainframe computer at U>B>C> for the grade 8 and 11 samples. Results revealed that there was a significant difference between the three treatment groups in the grade 8 sample $F(2, 172) = 9.32$, $p = .000$. For the grade 11 sample there was no significant difference among the three treatment groups in the scaled reading scores $F(2, 127) = 1.138$, $p = .32$.

Considering each grade separately, the grade 8 sample ($n = 177$) had a Stanford Diagnostic scaled reading score mean of 614 (grade equivalent 8.8) and a standard deviation of 94.3. Scores for this group ranged from a low of 297 (grade equivalent 1.9) to a high of 842 (grade equivalent "graduate level"). Figure 12 illustrates the distribution of these scores.

The grade 11 sample ($n = 130$) had a scaled score mean of 691 (or grade equivalent score mean of 11.2) and a standard deviation of 94.3. Scores ranged from a low of 434 (grade equivalent 3.5) to a high of 960 (grade equivalent "graduate level"). Figure 13 illustrates the distribution of these scores.

Table 1 tabulates the results of the standardized Stanford Diagnostic reading comprehension test measures for each grade level.

b) Background Knowledge Measure Scores

Scores obtained from an adapted version of Langer's (1984) Background Knowledge Measure were used to control for pre-treatment differences among subjects in the amount of background knowledge they each possessed about the to-be-learned topic. Any students for whom background knowledge scores were unavailable were eliminated from the study.

Figure 12. Frequency polygon of the Stanford Diagnostic reading comprehension subtest scaled scores for Grade 8

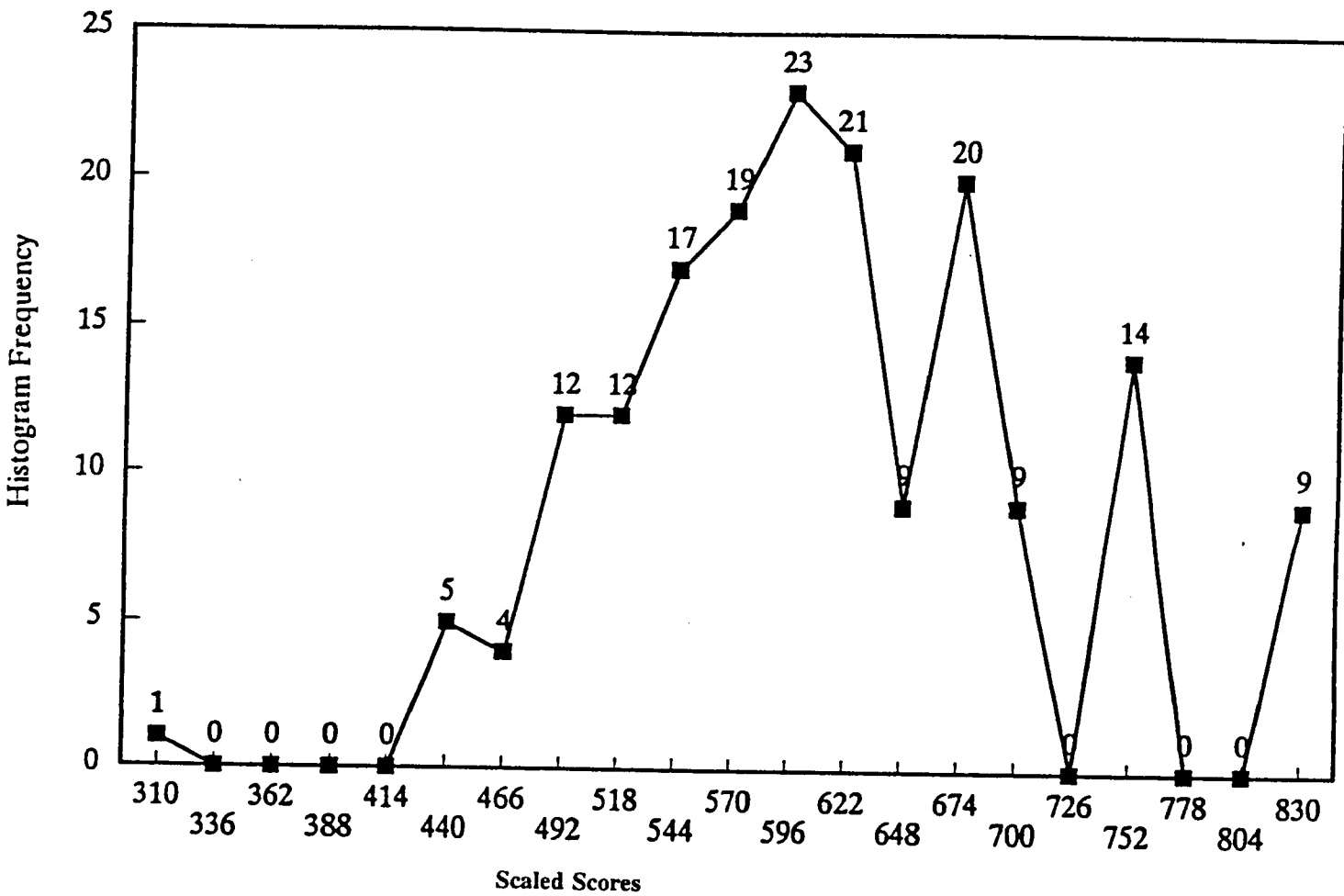


Figure 13. Frequency polygon of the Stanford Diagnostic reading comprehension subtest scaled scores for grade 11

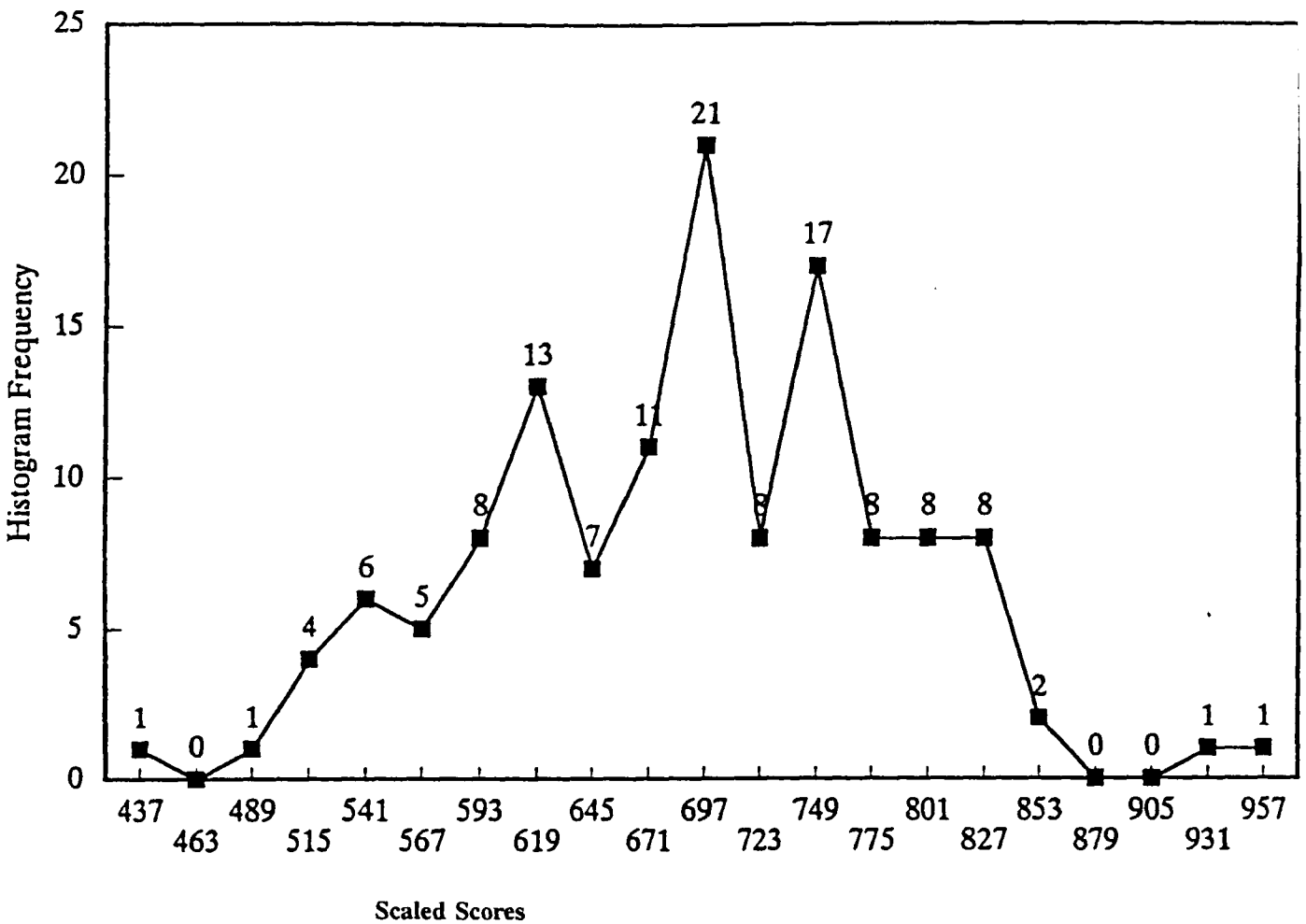


Table 1

Stanford Diagnostic Reading Comprehension Statistics for Each Grade

	Mean	Std. Dev.	Minimum	Maximum	Range	
RGE	10.8	2.32	3.5	13.0	9.5	Grade 11
SRS	691	94.30	434	960	526	Sample
RGE	8.6	2.65	1.9	13.0	11.1	Grade 8
SRS	614	98.96	297	842	545	Sample

Note. RGE = Reading Grade Equivalent Score
SRS = Scaled Reading Score

For the grade 8 sample the mean score obtained was 3.5, the standard deviation, 2.9. Scores ranged from a low of 0 to a high of 14. For the grade 11 part of the sample, the mean score obtained was 7.7, the standard deviation, 5.3. Scores ranged from a low of 0 to a high of 33. Grade 11 students appeared to have more knowledge, on the whole, about the topic than did the grade 8 students. One way Analysis of Variance tests were performed for each sample on background knowledge score by treatment. For the grade 8 sample there was a significant difference among the three treatment groups in their background knowledge scores $F(2,174) = 25.10$, $p = .000$. For the grade 11 sample, there was also a significant difference among treatment groups in the amount of background knowledge $F(2, 127) = 13.8$, $p = .000$.

Table 2 summarizes the results of this measure for the grade 8 and 11 samples separately. Figures 14 and 15 show the distribution of the background knowledge measure scores for each grade level.

2. Independent Variable Measure

The design of this study includes four independent variables: 1) gender, 2) treatment, 3) visual imagery ability, and 4) time or recall occasion. It was necessary to define one of these variables, visual imagery ability. This was done through the use of scores obtained on the Vividness of Visual Imagery Questionnaire (Marks, 1973).

The median score for each grade was found and on this basis the sample was divided into two approximately equal groups, one designated as low in visual imagery ability, and the other designated as a group high in visual imagery ability. For the grade 8 part of the sample, the median score was 66, and for the grade 11 part of the sample the median score was 67. Subjects with a score less than 66 (grade 8) or 67 (grade 11) were defined as high in visual imagery ability, while those subjects with a score of 66 and above (grade 8) or 67 and above (grade 11) were defined as low in visual imagery ability.

On this test measure students were asked to rate the quality of their images in response

Table 2

Background Knowledge Measure Descriptive Statistics for Each Sample, Grade 8 and 11

Grade	Mean	Std. Dev.	Minimum	Maximum	Range	Variance
11	7.7	5.34	0	33	33	28.5
8	3.5	2.9	0	14	14	8.9

Figure 14. Frequecy polygon of background knowledge measure scores for grade 8

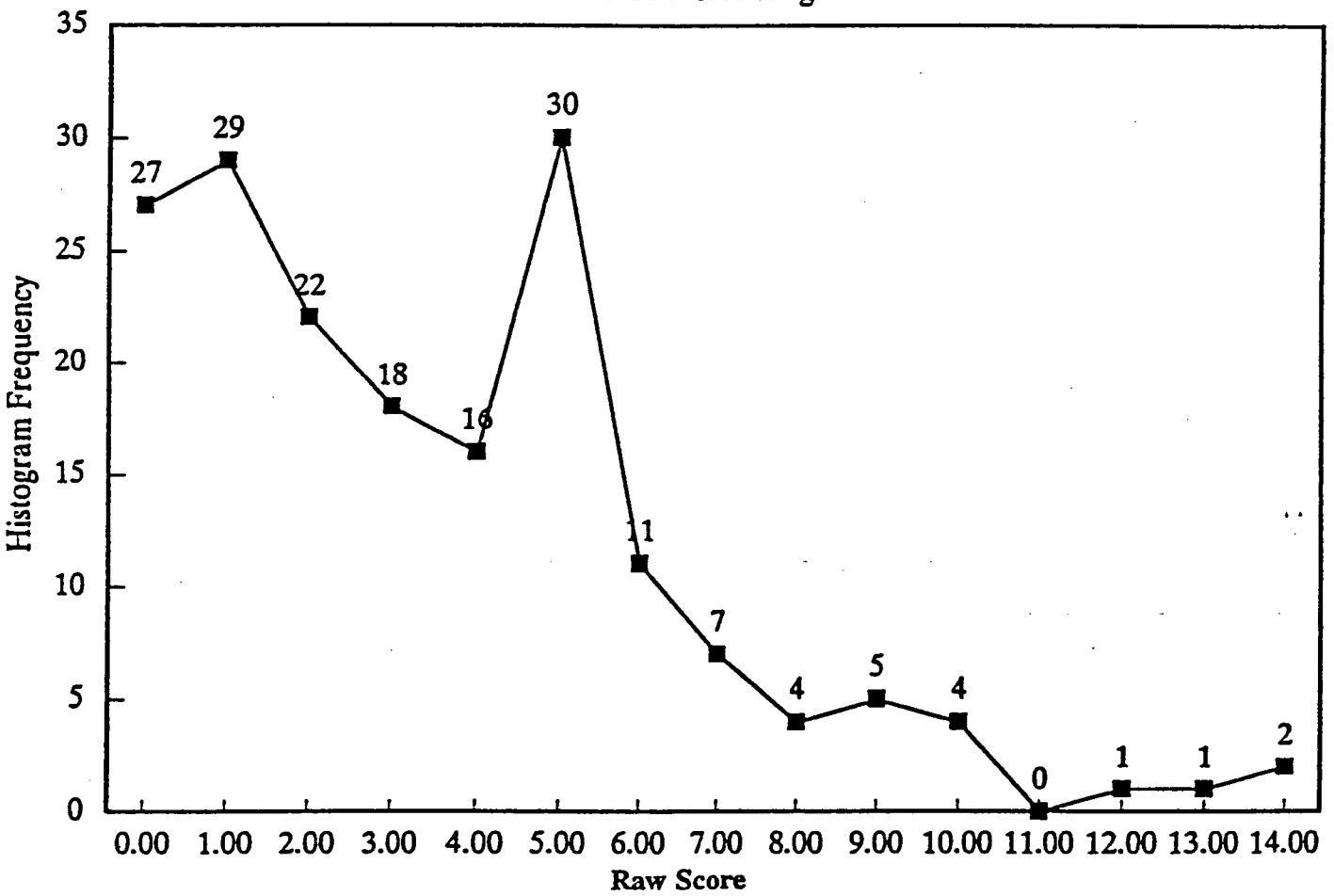
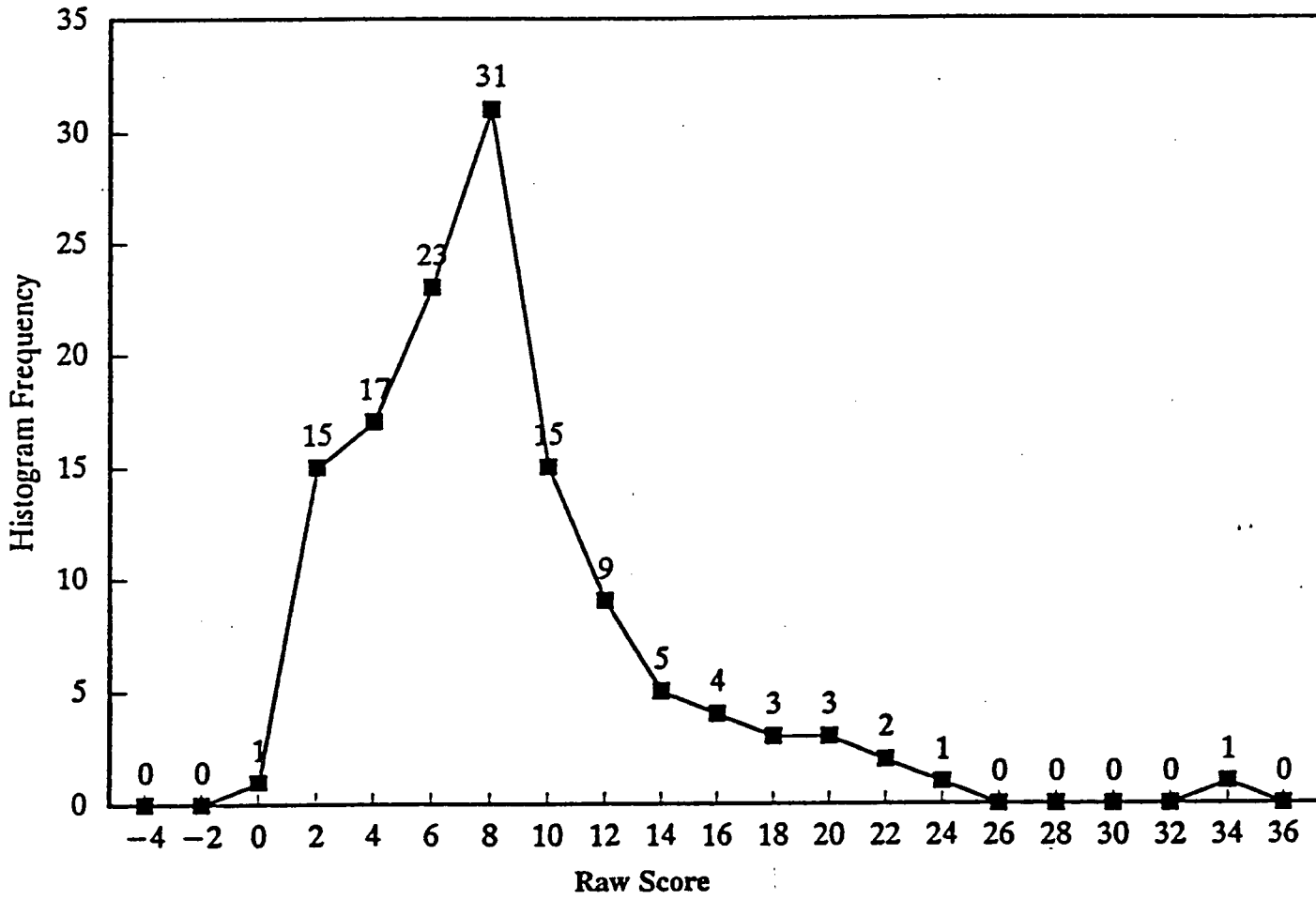


Figure 15. Frequency polygon of background knowledge measure scores for grade 11



to stimulus descriptive scenes, once with their eyes open and once with their eyes closed, according to the following rating scale:

RATING	DESCRIPTION
1	Perfectly clear and as vivid as normal vision
2	Clear and reasonably vivid
3	Moderately clear and vivid
4	Vague and dim
5	No image at all, you only "know" that you are thinking of the object

As a result, this procedure meant that high scores reflected difficulty with maintaining clear images, while low scores indicated facility in eliciting clear images.

Following the same procedures used by Marks (1973), the sum of all scores, both eyes open and eyes closed, furnished the VVIQ (Vividness of Visual Imagery) score for each subject. For the grade 8 sample, the mean score obtained was 69.6, the standard deviation was 21.6. For the grade 11 sample, the mean score obtained was 68.8, and the standard deviation was 20.0. For the grade 8 sample, scores ranged from 32 to 136 and for the grade 11 sample, scores ranged from 30 to 152.

Table 3 summarizes the results of the Vividness of Visual Imagery Questionnaire for each grade separately, and Figures 16 and 17 show the distribution of these scores for each sample.

3. Descriptive Statistics by Treatment Group

An analysis of the means for each independent variable and dependent variable was conducted as a summary of the covariate measure means (background knowledge, and reading comprehension ability), and the imagery ability means for each treatment group at each grade level. This

Table 3

Vividness of Visual Imagery Questionnaire Descriptive Statistics for Each Sample, Grade 8 and 11

Grade	Mean	Std. Dev.	Minimum	Maximum	Range	Variance
11	68.8	20.0	30	152	122	401.4
8	69.6	21.6	32	136	104	466.6

Figure 16. Frequency polygon of Vividness of Visual Imagery Questionnaire scores for the grade 8 sample

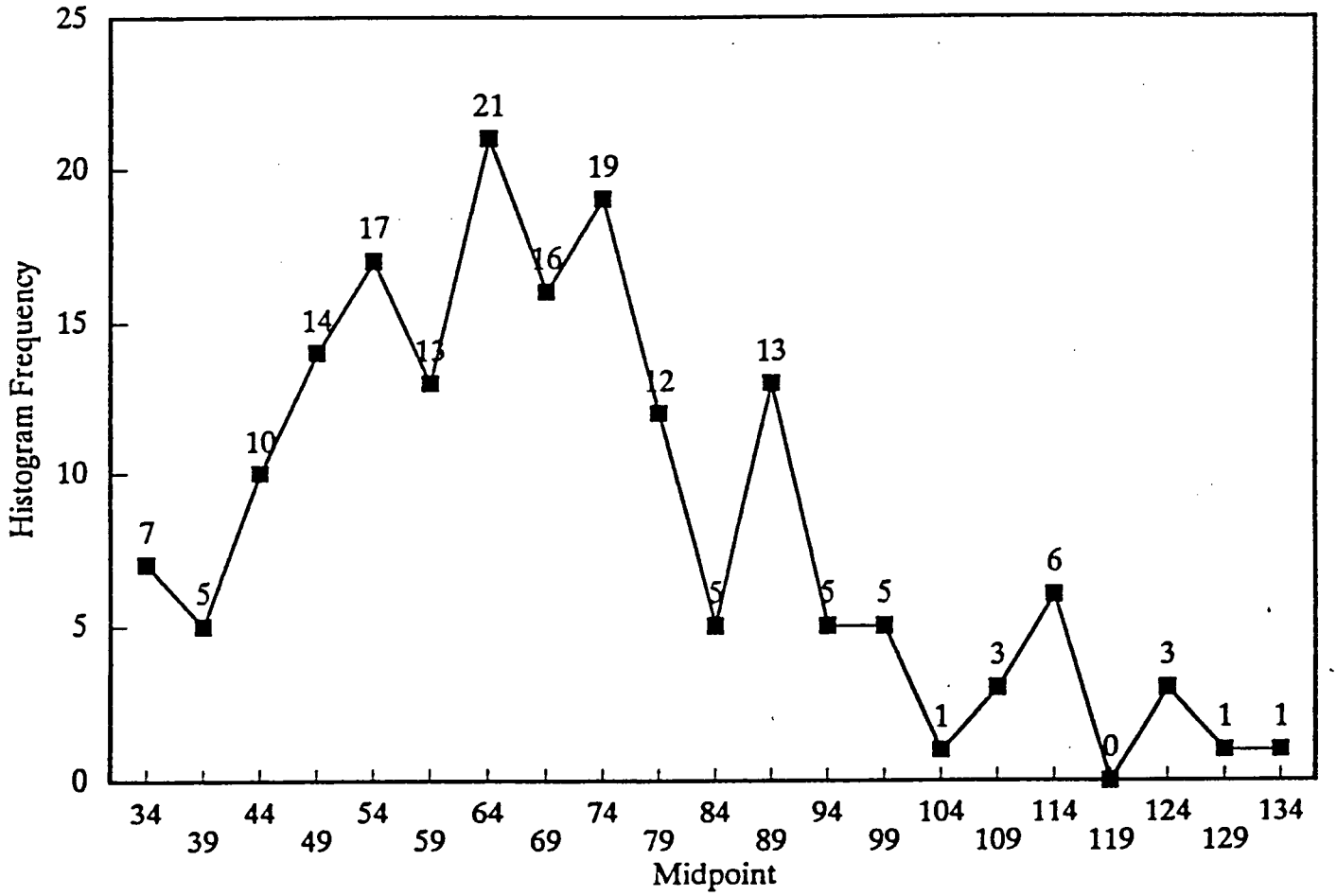
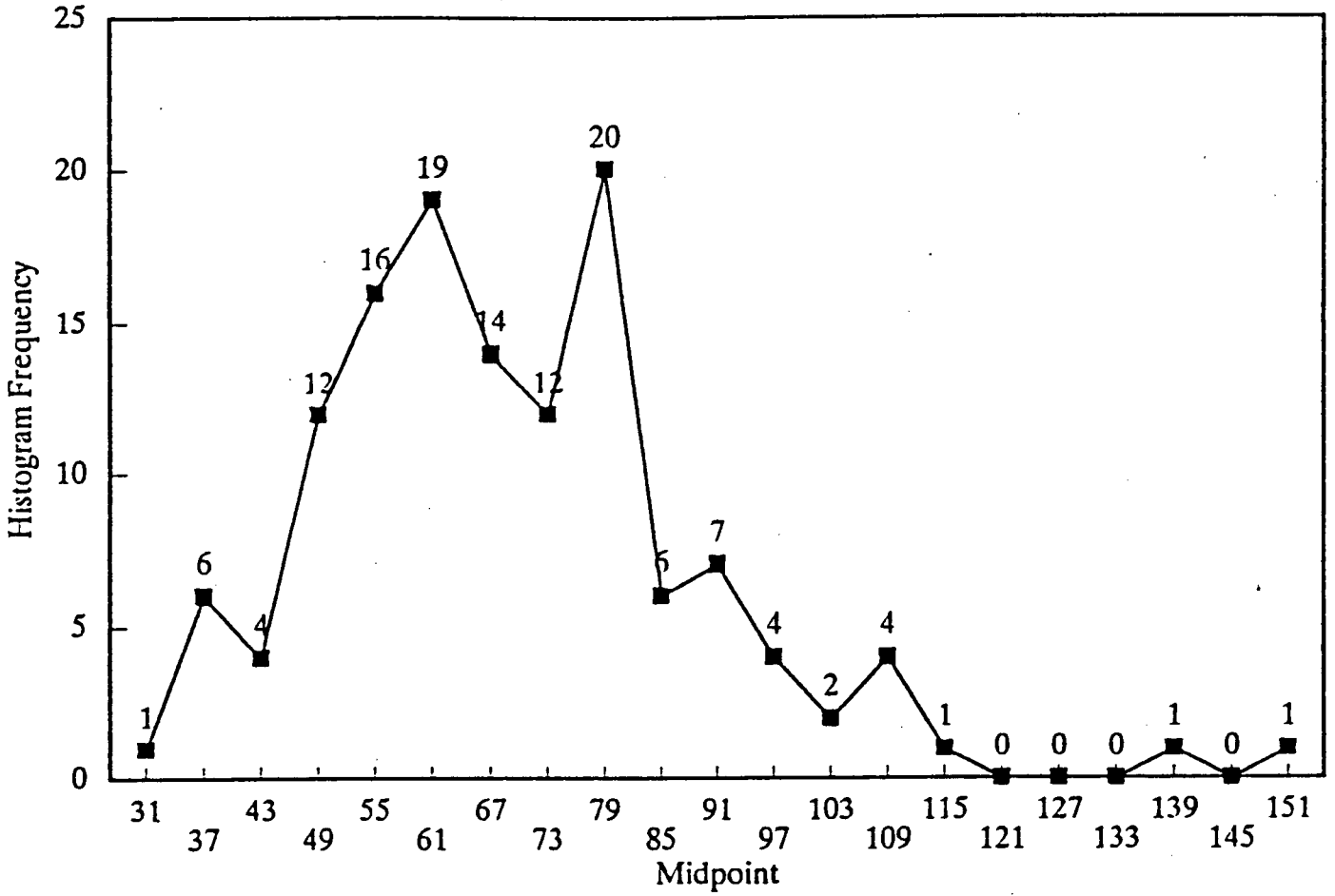


Figure 17. Frequency polygon distribution of Vividness of Visual Imagery Questionnaire scores for the grade 11 sample



analysis also presents the means for each treatment group related to gender, and overall comprehension/recall.

There were 177 students in the grade 8 sample selected, 92 females and 85 males. There were 69 students who received the conventional instruction, 46 students who received the picture-oriented instruction and 62 students who received the altered-pictures instruction.

In the grade 11 sample selected there were a total of 130 students, 62 females, and 68 males. The numbers in each treatment group were more similar than was the case in the grade 8 sample. In the conventional treatment group there were 42 students, in the picture-oriented instructional group there were 47 students, and finally, in the altered-pictures group there were 41 students.

Tables 4 and 5 summarize descriptive information for each sample, including means for each treatment group related to background knowledge, imagery ability, reading comprehension ability, immediate comprehension/recall, delayed comprehension/recall, and overall comprehension/recall.

4. Reliability

There were a number of concerns associated with reliability that were addressed: 1) scoring reliability, 2) assumptions made about the sample, and 3) assumptions made in the analysis of the data.

a) Scoring reliability

Each student in the sample selected completed five test measures: Stanford Standardized Reading Comprehension test, Visual Imagery Questionnaire, Background Knowledge measure, Immediate Recall test, Delayed Recall test. Any student who did not have all 5 scores was excluded from the study. There were, as a result, a total of 1,535 tests which were scored by the investigator and 3 other scorers.

Twenty percent of all tests were randomly selected for initial scoring by the investigator, using a blind scoring method. These tests were then remarked by another scorer unfamiliar with the

Table 4

Treatment Means and (Standard Deviations) for the Grade 8 Sample

Type of Instr	N	Reading Scaled Mean	Back-ground Know-ledge Mean	VVIQ Mean	1st Recall Mean	2nd Recall Mean	Overall Recall Mean	Sex x RC1	Sex x RC2
1	69	595 (100.6)	5.5 (2.93)	71.29 (24.07)	14.29 (4.98)	11.54 (5.07)	12.91 (4.53)	F 13.35 (4.52)	10.62 (3.84)
								M 15.37 (5.33)	12.59 (6.10)
2	46	585 (88.9)	1.6 (1.73)	69.97 (22.02)	15.37 (4.67)	13.37 (4.15)	14.37 (3.84)	F 15.00 (4.80)	13.58 (3.70)
								M 15.77 (4.60)	13.14 (4.69)
3	62	655 (91.29)	3.3 (2.87)	67.69 (18.32)	19.48 (5.40)	16.02 (4.75)	17.75 (4.70)	F 18.90 (5.48)	14.98 (4.08)
								M 20.06 (5.40)	17.06 (5.20)

Note. Instruction Type 1 = Conventional
2 = Picture-Oriented
3 = Altered-Pictures
RC1 = Immediate Recall
RC2 = Delayed Recall
M = Male
F = Female

Table 5

Treatment Means and (Standard Deviations) for the Grade 11 Sample

Type of Instr	N	Reading Scaled Mean	Back-ground Know-ledge Mean	VVIQ Mean	1st Recall Mean	2nd Recall Mean	Overall Recall Mean	Sex x RC1	Sex x RC2
1	42	690 (87.7)	10.6 (6.06)	69.59 (21.47)	20.74 (6.56)	15.09 (5.48)	17.92 (5.51)	F 20.42 (6.43)	14.75 (5.79)
								M 21.17 (6.90)	15.55 (5.17)
2	47	677 (106.0)	7.5 (4.52)	64.95 (17.11)	21.79 (6.20)	16.87 (6.92)	19.33 (6.10)	F 21.12 (4.41)	16.06 (5.60)
								M 22.13 (6.70)	17.29 (7.56)
3	41	707 (85.62)	5.0 (3.78)	72.43 (21.29)	21.88 (6.36)	18.46 (5.00)	20.17 (5.10)	F 20.90 (5.10)	18.14 (5.36)
								M 23.05 (6.73)	18.38 (5.78)

Note. Instruction Type 1 = Conventional
2 = Picture-Oriented
3 = Altered-Pictures
RC1 = Immediate Recall
RC2 = Delayed Recall
M = Male
F = Female

study. Interrator reliability was calculated for each of the tests: for the standardized reading comprehension tests, interrater reliability was 1.0 (representing 100% agreement), for the imagery tests, interrater reliability was 1.0 (representing 100% agreement), for the background knowledge measures, interrater reliability was .86 (or 74 % agreement, since the correlation coefficient = .74) (see Allen & Yen, 1979, p. 74), for the immediate comprehension/recall tests, interrater reliability was .99, (or 81 % agreement), and finally, for the delayed tests, interrater reliability was .99 (or 81 % agreement).

b) Assumptions about the sample

One of the assumptions made about the students selected for the sample was that their current use of learning strategies employed during a social studies lesson did not include giving to the illustrations more than incidental attention.

As a check that the picture-oriented methods of instruction were actually prompting students to notice the pictures more than they would do normally (that is, the picture treatments had validity in actually achieving their stated objectives), an index measuring picture recall was included on the last page of the comprehension/recall tests. Including this index on the delayed tests also allowed assessment of whether or not the pictures are retained longer in memory for those receiving the picture-oriented methods. But, more to the point, the picture recall index is designed as a useful tool to furnish information which may improve the reliability of and lend support to any conclusions drawn about or attributed to treatment effects.

Means tables were requested on SPSS:X for the interaction between immediate and delayed picture recall and treatment condition for each grade level. The results show that, for both grade levels, on both the immediate and delayed occasions those in either of the picture treatment groups were able to describe and remember more pictures than those in the conventional treatment group. The group receiving the altered-pictures treatment remembered the most pictures.

The results of this interaction between picture recall and type of treatment or teaching method received are presented in Table 6 for both samples.

Table 6

Mean Picture Recall on Occasions 1 and 2 for Each Treatment Condition in the Grade 8 and 11 Samples

	Conventional	Picture-Oriented	Altered-Pictures
Grade 8			
Occasion 1	1.69	3.54	5.58
Occasion 2	1.73	3.32	4.58
Grade 11			
Occasion 1	4.19	5.62	5.93
Occasion 2	2.54	3.98	5.32

c) Assumptions made in the analysis of the data

In univariate analysis of variance in a repeated measures design, one of the assumptions that must be met is the homogeneity of variance assumption.

In order to check that this assumption was met, a test for homogeneity, Box M, was run on the SPSS:X program of the mainframe computer at U.B.C. for each grade level sample.

The results of this analysis show that the assumption was met at both grade levels. For grade 8, $F(110, 16{,}585) = 1.023$, $p = .415$, and for grade 11, $F(110, 8{,}821) = 1.18$, $p = .095$. The homogeneity of variance assumption is not rejected since, in both cases, $p > .05$. With this finding, the reliability of interpreting the results of the study is increased, and the probability of committing Type I or II errors is controlled.

4. Hypotheses and Results

Fifteen hypotheses were tested for each grade, seven pertain to Between-Subject effects and eight hypotheses pertain to the Within-Subject effects.

Tables 7, 8, 9, and 10 summarize the results of the analysis for the between-subject and within-subject factors, for the grade 8 and grade 11 samples separately.

Ho_1: There will be no significant difference among the three treatment groups (conventional, picture-oriented, altered-pictures) in their adjusted mean comprehension/recall performance (as measured by both the immediate and delayed comprehension/recall test scores combined).

For the grade 8 sample, a significant difference was found among the three treatment groups on their adjusted mean comprehension/recall performance on both the immediate and delayed measures of comprehension/recall $F(2, 162) = 12.40$, $p < .000$. The null hypothesis was therefore rejected.

For the grade 11 sample, a significant difference was also found among the three

Table 7

Between-Subject Results of the Repeated Measures MANCOVA (Two Covariates) Statistical Analysis for the Grade 8 Sample

Tests of Between-Subjects Effects					
	SS	DF	MS	F	sig of F
WITHIN CELLS	4303.07	162	26.56		
REGRESSION	1910.35	1	1910.35	71.92	
CONSTANT	3.39	1	3.39	.13	
TREATMENT	658.64	2	329.32	12.40	.000 ***
VVIQ	18.35	1	18.35	.69	.407
GENDER	162.03	1	162.03	6.10	.015 *
TREAT BY VVIQ	1.55	2	.78	.03	.971
TREAT BY GENDER	.04	2	.02	.00	.999
VVIQ BY GENDER	24.85	1	24.85	.94	.335
TREAT BY VVIQ BY GENDER	40.52	2	20.26	.76	.468

Note. TREAT = treatment
VVIQ = vividness of visual imagery questionnaire
* Sig at .05 level
*** Sig at .001 level

Table 8

Within-Subject Results of the Repeated Measures MANCOVA (Two Covariates) for the grade 8 Sample

Tests of Within-Subjects Effects					
	SS	DF	MS	F	sig of F
WITHIN CELLS	1402.21	162	8.66		
REGRESSION	89.92	1	89.92	10.39	.002
RECALL	31.83	1	31.83	3.68	.057
TREAT BY RECALL	10.15	2	5.07	.59	.558
VVIQ BY RECALL	29.45	1	29.45	3.40	.067
GENDER BY RECALL	.66	1	.65	.08	.783
TREAT BY VVIQ BY RECALL	14.95	2	7.48	.86	.423
TREAT BY GENDER BY RC	20.94	2	10.47	1.21	.301
VVIQ BY GENDER BY RC	.28	1	.28	.03	.857
TREAT BY VVIQ BY GENDER BY RC	15.91	2	7.95	.92	.401

Note. TREAT = treatment
VVIQ = vividness of visual imagery questionnaire
RC = recall
GE = gender

Table 9

Between-Subject Results of the Repeated Measures MANCOVA (Two Covariates) for the Grade 11 Sample

Tests of Between-Subjects Effects					
	SS	DF	MS	F	sig of F
WITHIN CELLS	3322.16	117	26.39		
REGRESSION	2048.53	1	2048.53	72.15	.000
CONSTANT	220.98	1	220.98	7.78	.006
TREATMENT	342.68	2	171.34	6.03	.003 **
VVIQ	.23	1	.23	.01	.928
GENDER	150.12	1	150.12	5.29	.023 *
TREAT BY VVIQ	18.14	2	9.07	.32	.727
TREAT BY GENDER	38.64	2	19.32	.68	.508
VVIQ BY GENDER	3.72	1	3.72	.13	.718
TREAT BY VVIQ BY GENDER	1.81	2	.91	.03	.969

Note. TREAT = treatment
VVIQ = vividness of visual imagery questionnaire
* Sig at .05 level
** Sig at .01 level

Table 10

Results of the Within-Subject Effects for the Grade 11 Sample MANCOVA Repeated Measures Design with Two Covariates

Tests of Within-Subjects Effects					
	SS	DF	MS	F	sig of F
WITHIN CELLS	2105.96	117	18.00		
REGRESSION	194.54	1	194.54	10.81	.001
RECALL	.03	1	.03	.00	.969
TREAT BY RECALL	437.60	2	218.80	12.16	.000 ***
VVIQ BY RECALL	23.31	1	23.31	1.30	.257
GENDER BY RECALL	2.18	1	2.18	.12	.728
TREAT BY VVIQ BY RECALL	.39	2	.19	.01	.989
TREAT BY GENDER BY RC	2.40	2	1.20	.07	.936
VVIQ BY GENDER BY RC	.12	1	.12	.01	.934
TREAT BY VVIQ BY GENDER BY RC	55.71	2	27.85	1.55	.217

Note. TREAT = treatment
VVIQ = vividness of visual imagery questionnaire
RC = recall
GE = gender
*** Sig at .001 level

treatment groups on their adjusted mean comprehension/recall performance on both the immediate and delayed measures of comprehension/recall $F(2, 117) = 6.03$. $p < .01$. The null hypothesis was therefore rejected.

These results indicate that overall comprehension/recall scores were affected depending on the teaching method received, but the result does not reveal which method or methods are the most successful in producing significantly superior comprehension and recall.

In order to examine this issue, post-hoc pairwise comparisons of the overall recall means for each treatment group, in each grade level, were conducted using the Scheffe procedure.

For the grade 8 sample, the first comparison between the conventional treatment mean and the picture-oriented treatment mean was significant at the .01 level. The observed difference between the two means is 2.90. The critical value (df 2, 162) for these means at the .01 level is 1.735. Since 2.91 > 1.735, the null hypothesis that there is no difference in the measured level of overall comprehension and recall between these two treatment groups is rejected.

For the grade 11 sample, the first comparison between the conventional treatment mean and the picture-oriented treatment mean was significant at the .05 level. The observed difference between the two means is 2.82. The critical value (df 2, 117) for these means at the .05 level is 2.812. Since 2.83 > 2.82, the null hypothesis that there is no difference in the measured level of overall comprehension and recall between these two treatment groups is rejected.

The second pairwise comparison was between the picture- oriented treatment group and the altered-pictures group. For the grade 8 sample, the observed difference between the two means is 6.26. The critical value (df 2, 162) for these means at the .01 level is 1.772. Since the observed difference 6.26 > 1.772, the critical value, the null hypothesis that there is no significant difference in the overall comprehension and recall performance between these two treatment groups is rejected.

For the grade 11 sample, the observed difference between the two means for the picture-oriented and the altered pictures groups is 1.68. The critical value (df 2,117) for these means at the .05 level is 2.829. Since the observed difference 1.68 < 2.829, the critical value, the null hypothesis that there is no

significant difference in the overall comprehension and recall performance between these two treatment groups must be accepted.

For the grade 8 sample, the final pairwise comparison investigated was between the conventional treatment group and the altered-pictures group. The observed difference between the two groups' means is 9.68. The critical value (df 2, 162) for these means at the .01 level is 1.5938. Since the observed difference, 9.68 > 1.5938, the critical value, the null hypothesis that there is no significant difference in the overall comprehension/recall performance between these two treatment groups is rejected.

For the grade 11 sample, the final pairwise comparison investigated was also between the conventional treatment group and the altered-pictures group. The observed difference between the two groups' means is 4.50. The critical value (df 2, 117) for these means at the .01 level is 3.631. Since the observed difference, 4.50 > 3.631, the critical value, the null hypothesis that there is no significant difference in the overall comprehension/recall performance between these two treatment groups is also rejected.

In summary, for the grade 8 sample, the post hoc Scheffe comparisons revealed that there was a significant difference among all three teaching methods in the overall comprehension and recall performance produced. The group of subjects receiving the picture-oriented method of instruction had significantly superior comprehension and recall than those in the conventional instruction group. The overall comprehension and recall of those subjects in the altered-pictures group was significantly superior to the recall of both the conventional and picture-oriented groups.

For the grade 11 sample, the altered pictures method and picture-oriented methods of instructional resulted in superior comprehension and recall performance compared to that produced by the conventional method of instruction. The picture-oriented and altered pictures methods of instruction were equally facilitative in promoting comprehension and recall.

Figures 18 and 19 illustrate in bar graphs the different overall comprehension/recall means for each treatment group, for grade 8 and grade 11 respectively. The level of significance obtained in the three pairwise post-hoc Scheffe comparisons made between treatment groups is also shown.

Figure 18. Grade 8 approximate overall comprehension/recall means attained by each instructional group and the significance of the three post-hoc comparisons made.

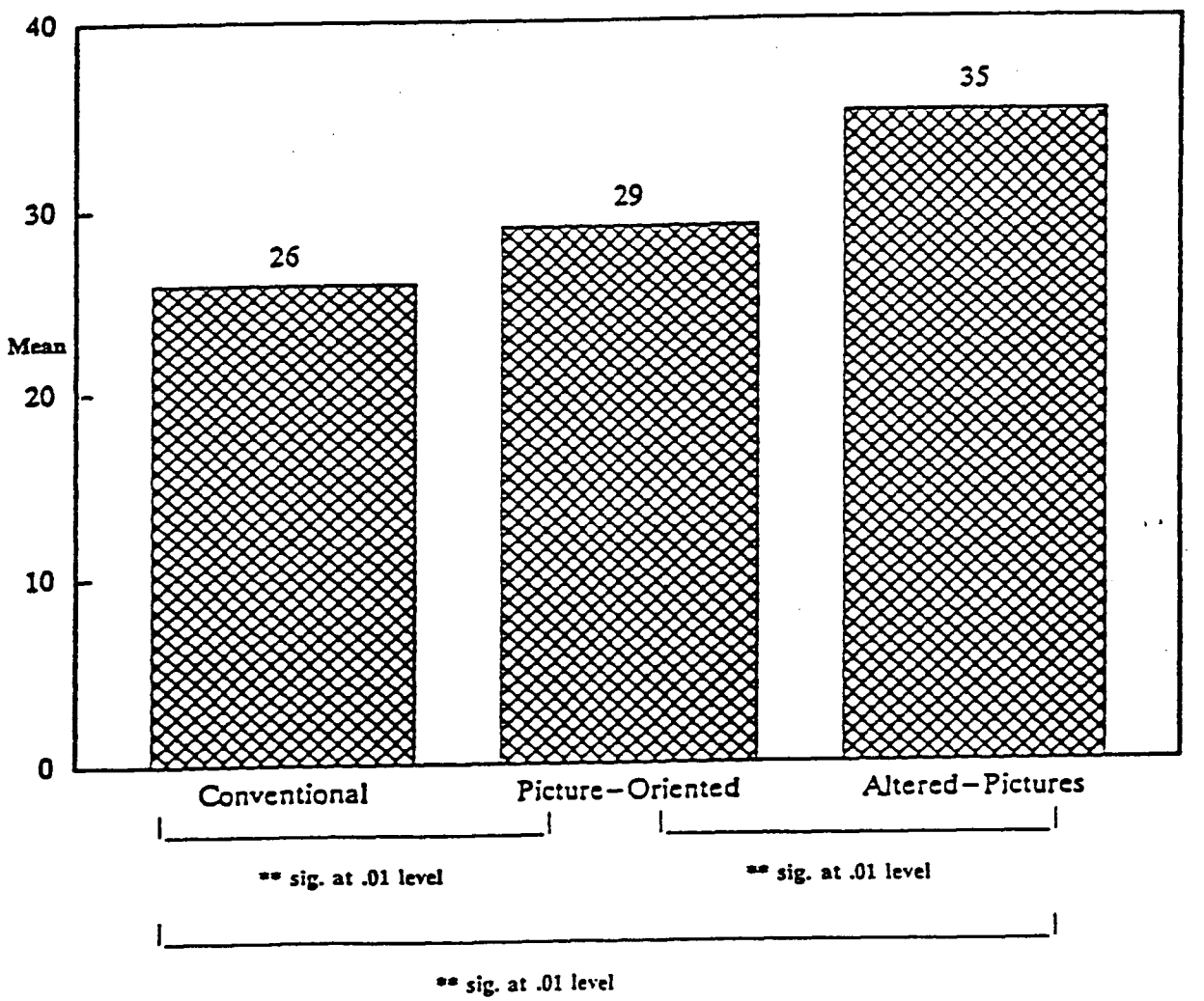
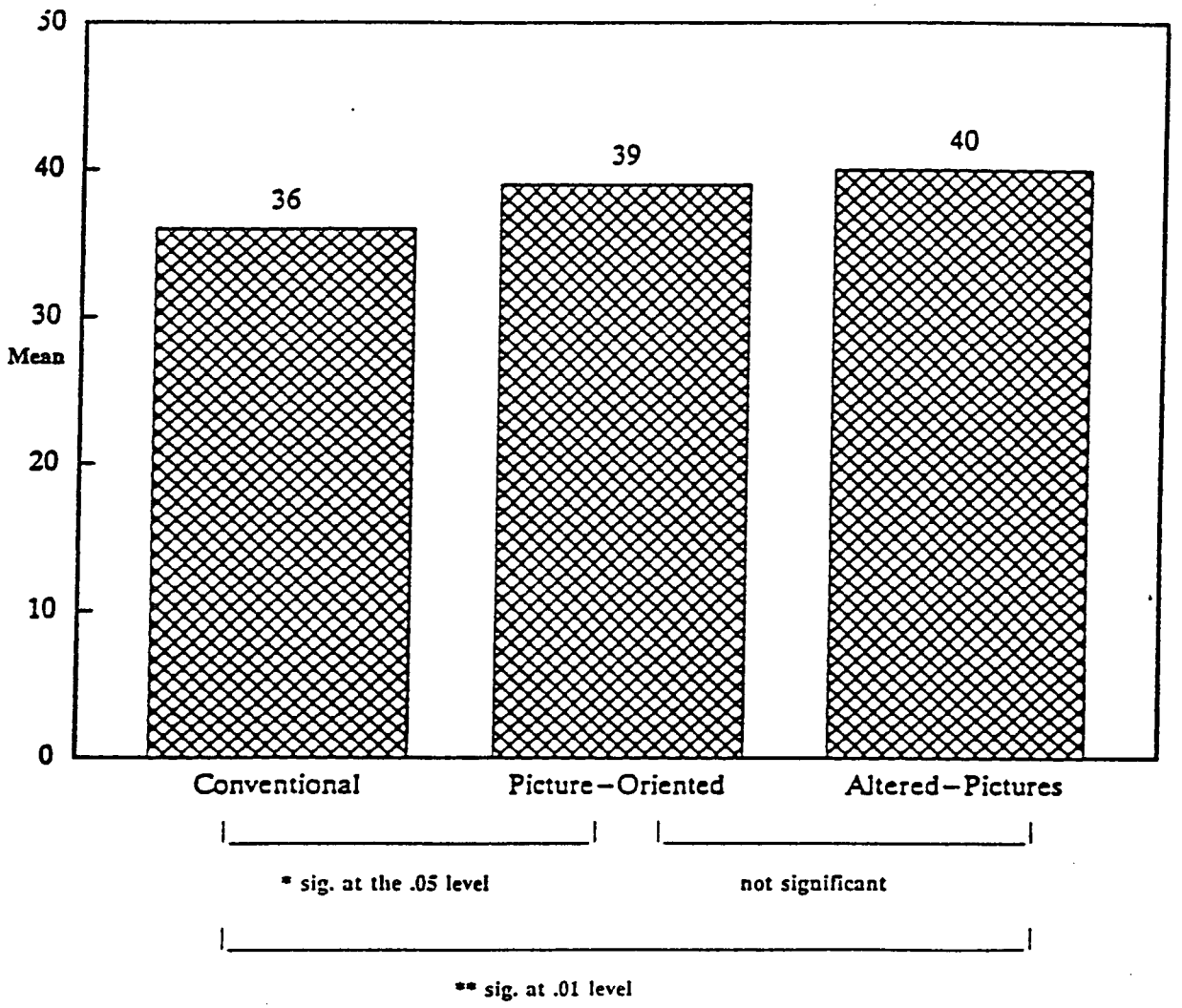


Figure 19. Grade 11 approximate overall comprehension/recall means attained by each instructional group and the significance of the three post-hoc comparisons made.



Ho_2: There will be no significant difference between those of high or low imagery ability in their adjusted mean comprehension/recall performance as measured by scores obtained on the immediate and delayed comprehension/recall test measures.

For grade 8, no significant difference was found in the overall comprehension/recall performance between the two imagery ability groups $F(1, 162) = .69$, $p = .407$. The null hypothesis was therefore accepted.

For grade 11, as well, no significant difference was found in the overall comprehension/recall performance between the two imagery ability groups $F(1, 117) = .01$, $p = .928$. The null hypothesis was therefore accepted.

For both grade 8 and 11, the high and low imagery ability groups performed similarly in their overall comprehension/recall regardless of the type of instruction received, or their gender.

Ho_3: There will be no significant difference between male and females in their adjusted mean comprehension/recall performance as measured by scores obtained on both the immediate and delayed comprehension/recall tests.

For the grade 8 sample, there was a significant difference found between the overall comprehension/recall performance of male and female subjects $F(1, 162) = 6.10$, $p = .015$ when considering their performance at both testing times. The null hypothesis was therefore rejected.

For the grade 11 sample, there was a significant difference found between the overall comprehension/recall performance of male and female subjects $F(1, 117) = 5.29$, $p = .023$. The null hypothesis was therefore rejected.

An examination of the means at each grade level for the overall comprehension/recall performance of males and females revealed that for the grade 8 sample, the males outperformed females. For the grade 11 sample, males also demonstrated superior comprehension and recall to females. Table 11 presents the comprehension/recall means for each gender, for each grade level.

Table 11

Overall Comprehension/Recall Means and (Standard Deviations) for Males and Females for Each Sample, Grade 8 and 11

Grade	N	Gender	Mean
8	92	Males	31.5 (10.52)
	85	Females	28.5 (8.80)
11	68	Males	39.4 (12.18)
	62	Females	37.04 (10.15)

Ho_4: There will be no significant interaction between type of instruction received and level of imagery ability as measured by scores obtained on both the immediate and delayed comprehension/recall tests.

For the grade 8 sample, there was no significant interaction between visual imagery ability level and type of instruction received $F(2, 162) = .03$, $p = .971$. The null hypothesis was therefore accepted.

For the grade 11 sample, there was no significant interaction between visual imagery ability level and type of instruction received $F(2, 117) = .32$, $p = .727$. The null hypothesis was therefore accepted.

For both grade, the overall comprehension/recall performance of high and low imagery ability students was similar across all three treatment groups. Subjects of a particular imagery ability did not appear to benefit more from one form of instruction over another. An examination of the means for high an low imagery ability subjects in each treatment group reveals that for the grade 8 sample both high and low imagery ability students performed similarly, with the means ranging from lowest (conventional treatment) to highest (altered-pictures treatment) in the same order for each imagery ability. For the grade 11 sample, even though the sequence of treatment means differed for low and high imagery ability groups, both high and low imagery ability students performed similarly across treatment groups.

Table 12 presents the overall comprehension/recall means and standard deviations for each treatment and imagery ability group at each grade level.

Ho_5: There will be no significant interaction between type of instruction received and gender as measured by scores obtained on both the immediate and delayed comprehension/recall measures.

For the grade 8 sample, there was no significant interaction effects between type of instruction received and gender as measured by overall comprehension/recall performance $F(2, 162) = .000$, $p = .999$. The null hypothesis was thus accepted.

Table 12

Overall Comprehension/Recall Means and (Standard Deviations) for Each Treatment Group and Imagery Ability at Each Grade Level

Grade	Treatment	Imagery Ability	Overall Recall Mean	N
	1	High	27.71 (10.84)	32
		Low	24.18 (6.91)	37
8	2	High	29.90 (8.82)	21
		Low	27.76 (8.60)	25
	3	High	35.79 (10.40)	34
		Low	35.14 (8.15)	28
			N Total:	177
	1	High	38.10 (12.10)	20
		Low	33.77 (9.76)	22
11	2	High	38.79 (11.28)	24
		Low	38.52 (13.32)	23
	3	High	40.05 (10.17)	18
		Low	40.56 (10.46)	23
			N Total:	130

Note. Treatment 1 = Conventional
2 = Picture-Oriented
3 = Altered-Pictures

For the grade 11 sample, also, there was no significant interaction between treatment and gender as measured by overall comprehension/recall performance $F(2, 117) = .68$, $p = .508$. The null hypothesis was therefore accepted.

For both samples, males and females performed similarly across all three treatment groups. An examination of the means for males and females in each treatment group reveals that for both samples, in almost every case (except for one: picture-oriented treatment group males and females in grade 8), the males appeared to slightly outperform females in every treatment group. (Please see Tables 4 and 5 for the relevant means).

Ho_6: There will be no significant interaction between imagery ability level and gender as measured by scores obtained on both immediate and delayed comprehension/recall tests.

For the grade 8 sample, there was no significant interaction between imagery ability level and gender as shown by their overall comprehension/recall performance $F(1, 162) = .13$, $p = .718$. The null hypothesis was therefore accepted.

For the grade 11 sample, as well, there was no significant interaction between imagery ability level and gender as measured by overall comprehension/recall performance $F(1, 117) = .94$, $p = .335$. The null hypothesis was therefore accepted.

For both samples, high and low imagery ability students performed similarly whether they were male or female.

Although, for both samples, as revealed in hypothesis 3, males outperformed females in general, when their imagery ability was taken into account there were no significant differences found. That is, high and low imagery ability males did not perform differently, at least to the extent that was significant, on the comprehension/recall tests compared to the way high and low imagery females performed. When the performance of all males taken together was compared to the performance of all females taken together, however, the differences were large enough to result in significance at the .05 level for both samples, grades 8 and 11.

Ho_7: There will be no significant interaction among treatment group, imagery ability level, and gender as measured by comprehension/recall scores obtained on both the immediate and delayed tests.

For the grade 8 sample, there was no significant interaction among treatment groups, imagery ability levels, and gender as measured by overall comprehension/recall performance $F(2, 162) = .076$, $p = .468$. The null hypothesis was accepted.

For the grade 11 sample, there was also no significant interaction among treatment groups, imagery ability levels, and gender as measured by overall comprehension/recall performance $F(2, 117) = .03$, $p = .969$. The null hypothesis was accepted.

For both samples, those students receiving a particular type of instruction, and of a particular imagery ability and gender, did not appear to differ in their overall performance compared to students receiving a different type of instruction, of a different imagery ability and gender.

Ho_8: The comprehension/recall performance of subjects on occasion 2 (delayed test measure) will not significantly differ from their comprehension/recall performance on occasion 1 (immediate test measure) regardless of their gender, imagery ability, or type of treatment received (conventional, picture-oriented, altered-picture).

For the grade 8 sample, (see Table 8, p. 122) no significant difference was found between the comprehension/recall performance on occasion 2 (delayed measure) and the comprehension/recall performance on occasion 1 (immediate measure) for all subjects $F(1, 162) = 3.68$, $p = .057$. Since the p value is not less than .05, the null hypothesis was therefore accepted.

For the grade 11 sample, (see Table 10, p. 124) no significant difference was found between the comprehension/recall performance on occasion 2 (delayed measure) and the comprehension/recall performance on occasion 1 (immediate measure) for all subjects $F(1, 117) = .00$, $p = .969$. Since the p value is not less than .05, the null hypothesis was therefore accepted.

For both samples, the students' level of comprehension/recall at delayed testing did not differ appreciably from their performance at immediate testing. Regardless of whether they were male or female, of high or low imagery ability, or receiving one type of instruction over another, for all students their delayed comprehension/recall did not differ markedly from their performance at immediate testing.

Ho_9: There will be no significant interaction between type of treatment received (conventional, picture-oriented, altered pictures) and comparative adjusted mean comprehension/recall performance (comparing performance at immediate testing with delayed testing).

For the grade 8 sample, there was no significant interaction between treatment and comparative adjusted mean comprehension/recall performance $F(2, 162) = .59$, $p = .558$. As the significance level is not $< .05$, the null hypothesis is accepted.

For the grade 11 sample, a significant interaction effect was found between type of instruction received and comparative adjusted mean comprehension/recall performance $F(2, 117) = 12.16$, $p = .000$. The null hypothesis was therefore rejected.

For the grade 8 students, there appeared to be no difference among students receiving the different types of instruction in their patterns of comprehension/recall performance over time, that is, when comparing their performance at times 1 and 2.

For the grade 11 students, however, an examination of the comprehension/recall means at immediate and delayed testing reveals that the altered-pictures method of instruction was the most effective for aiding the retention of content material over time. Comprehension/recall level declined the most for those students receiving the conventional method of instruction, followed by the picture-oriented method of instruction. The least decline in performance occurred for those subjects who received the altered-pictures method of instruction.

When this result was subjected to a "contrast" analysis (SPSS:X, p. 236 in manual) of two pairs of different treatment groups, the p values obtained for the first contrast between the altered-pictures

instruction and the conventional instruction was significant at the .05 level: p = .018. The second contrast analyzed between the altered pictures instruction and the picture-oriented instruction was not quite significant: p = .052. The third contrast analysis between the conventional and picture-oriented methods of instruction was not significant: p = .084. Thus, the altered-pictures method of instruction produced better comparative comprehension/recall (comparing performance at times 1 and 2) than the conventional method of instruction. Figure 20 presents the approximate comprehension/recall means at times 1 and 2 for each treatment group, in the grade 11 sample, and shows the significance of the three contrasts made.

Ho_{10}: There will be no significant interaction between imagery ability level and comparative adjusted mean comprehension/recall performance (when comparing performance at immediate testing with delayed testing).

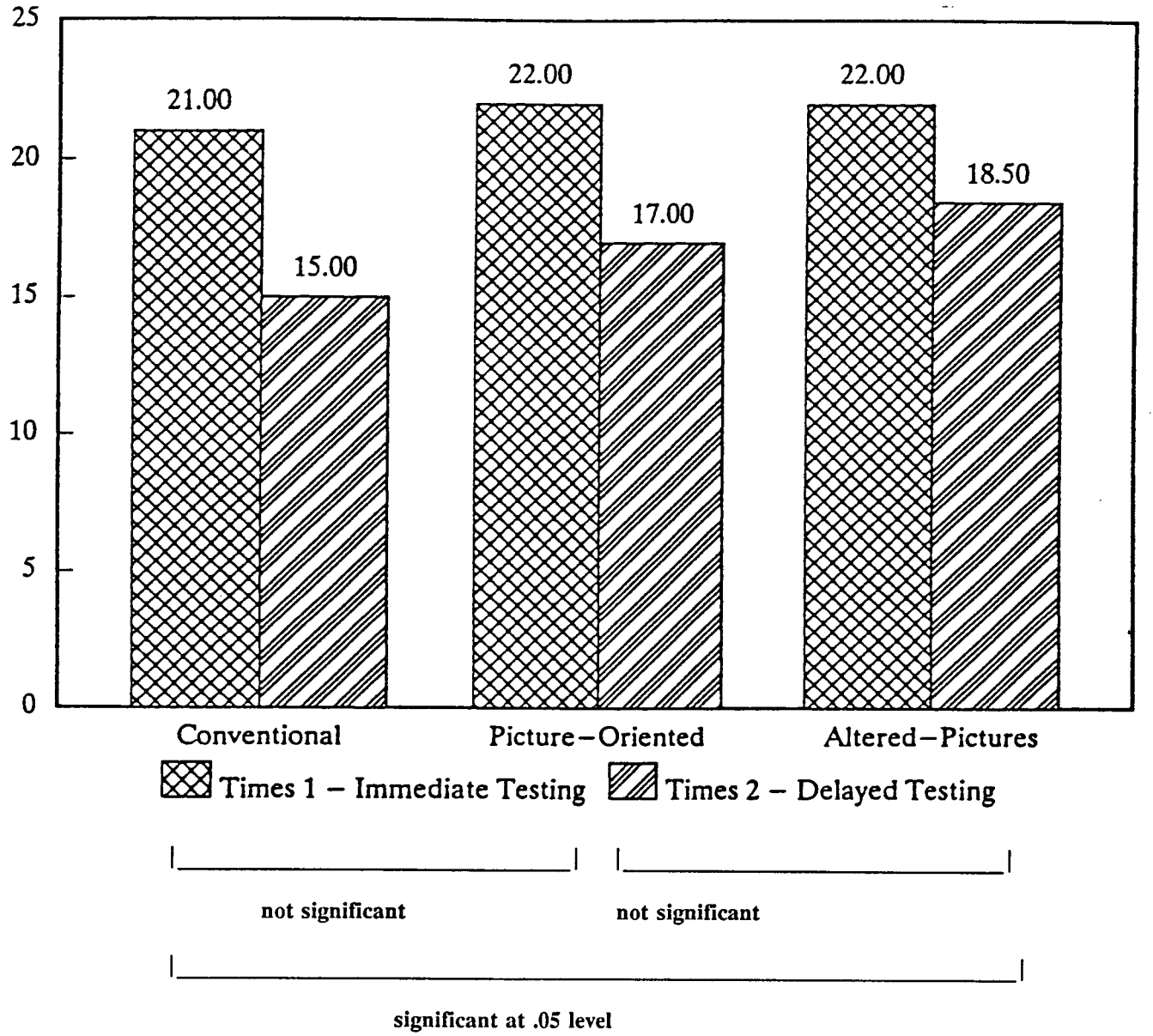
For the grade 8 sample, there was no significant interaction found between imagery ability level and comparative adjusted mean comprehension/recall performance $F(1, 162) = 3.40$, $p = .067$. The null hypothesis was therefore accepted.

For the grade 11 sample, there was no significant interaction between imagery ability level and comparative adjusted mean comprehension/recall performance $F(1, 117) = 1.30$, $p = .257$. The null hypothesis was therefore accepted.

For both samples, there was no particular imagery ability group that outperformed the other when comparing their comprehension/recall performance at delayed testing with their performance at immediate testing. That is high and low imagery ability students demonstrated similar patterns of comparative comprehension/recall (comparing immediate testing performance with delayed testing performance).

An examination of the means for high and low imagery ability students at times 1 and 2 (immediate and delayed testing) shows that for both the grade 8 and 11 samples, low and high imagery

Figure 20. Grade 11 approximate comprehension/recall means at times 1 and 2, immediate and delayed testing, for each instructional group with significance of the three contrast analyses made.



ability groups performed similarly.

Ho_{11}: There will be no significant interaction between gender and adjusted mean comparative comprehension/recall performance (comparing immediate testing performance with delayed testing performance).

For the grade 8 sample, there was no significant interaction between gender and adjusted mean comparative comprehension/recall performance $F(1, 162) = .08$, $p = .783$. The null hypothesis was therefore accepted.

For the grade 11 sample, there was no significant interaction between gender and adjusted mean comparative comprehension/recall performance $F(1, 117) = .12$, $p = .728$. The null hypothesis was therefore accepted.

For both samples, males and females (regardless of imagery ability and instruction received) performed similarly in their comparative comprehension/recall performance (comparing comprehension/recall obtained at delayed testing with immediate testing).

An examination of the comprehension/recall means for males and females at times 1 and 2 (immediate and delayed testing) shows that for both genders their performance at delayed testing declined to some degree from their immediate testing performance, but on each occasion males slightly outperformed females. Table 13 presents the comprehension/recall means for each gender at each grade level.

Ho_{12}: There will be no significant interaction among treatment received, imagery ability level, and adjusted mean comparative comprehension/recall performance (comparing immediate with delayed comprehension/recall performance).

For the grade 8 sample, there was no significant interaction among treatment received, imagery

Table 13

Comprehension/Recall Means and (Standard Deviations) at Times 1 and 2 (Immediate and Delayed Testing) for Males and Feamles at Each Grade Level

Grade	Gender	Immediate Recall	Delayed Recall	N
8	F	15.65 (5.43)	12.85 (4.29)	92
	M	17.18 (5.57)	14.36 (5.75)	85
			N Total:	177
11	F	20.75 (5.72)	16.29 (5.69)	62
	M	22.13 (6.83)	17.26 (6.30)	68
			N Total:	130

Note: F = Female
M = Male

ability level, and adjusted mean comparative comprehension/recall performance $F(2, 162) = .86$, $p = .423$. The null hypothesis was accepted.

For the grade 11 sample, there was no significant interaction among treatment received, imagery ability level, and adjusted mean comparative comprehension/recall performance $F(2, 294) = .01$, $p = .989$. The null hypothesis was accepted.

For both samples, students of high or low imagery ability receiving a certain type of instruction did not appear to demonstrate different patterns of performance at times 1 and 2.

An examination of the means reveals that low and high imagery ability students performed similarly at times 1 and 2 across all three treatment groups.

Ho_{13}: There will be no significant interaction among treatment received, gender, and adjusted mean comparative comprehension/recall performance (comparing immediate performance with delayed).

For the grade 8 sample, no significant interaction was found among treatment received, gender, and adjusted mean comparative comprehension/recall performance $F(2, 162) = 1.21$, $p = .301$. The null hypothesis was therefore accepted.

For the grade 11 sample, as well, no significant interaction was found among treatment received, gender, and adjusted mean comparative recall performance $F(2, 117) = .07$, $p = .936$. The null hypothesis was therefore accepted.

For both samples, males and females performed similarly across all three instructional conditions in their comparative patterns of comprehension/recall (comparing their performance at immediate testing with delayed testing).

An examination of the means (please see Tables 4 and 5) comparing performance at immediate testing with delayed testing, reveals that males and females performed similarly at times 1 and 2 across all three treatment groups, with the males and females demonstrating similar patterns of decline in

comprehension/ recall across all three treatment groups.

Ho_{14}: There will be no significant interaction among imagery ability, gender and adjusted mean comparative comprehension/recall performance (comparing scores obtained on immediate and delayed comprehension/recall test measures).

For the grade 8 sample, there was no significant interaction among imagery ability level, gender, and adjusted mean comparative comprehension/recall performance $F(1, 162) = .03$, $p = .857$. The null hypothesis was therefore accepted.

For the grade 11 sample, there was no significant interaction among imagery ability level, gender, and adjusted mean comparative comprehension/recall performance $F(1, 117) = .01$, $p = .934$. The null hypothesis was therefore accepted.

For both samples, males and females performed similarly across both imagery ability levels in their comparative comprehension/recall, comparing their performance at delayed testing with immediate testing.

Ho_{15}: There will be no significant interaction among treatment received, imagery ability level, gender, and adjusted mean comparative comprehension/recall performance (comparing immediate performance with delayed comprehension/recall performance).

For the grade 8 sample, there were no significant interaction effects among treatment received, imagery ability level, gender, and adjusted mean comparative comprehension/recall performance $F(2, 162) = .92$, $p = .401$. The null hypothesis was therefore accepted.

For the grade 11 sample, as well, there were no significant interaction effects found among treatment received, imagery ability level, gender, and adjusted mean comparative comprehension/recall performance $F(2, 117) = 1.55$, $p = .217$. The null hypothesis was therefore accepted.

For both samples, then, students of high and low imagery ability performed similarly across both

genders, and all three treatment groups in their comparative comprehension/recall performance.

This chapter has presented the results of the study. The results of the covariate pretest measures were described for each of the samples, grades 8 and 11, which included the results of the standardized reading comprehension measures and the background knowledge measure. The results of the Vividness of Visual Imagery Questionnaire were discussed, and descriptive statistics by treatment group were presented. The reliability measures and procedures were reported. Finally, the results of the factorial analysis of all variables were reported for each hypothesis.

Chapter VI will present a discussion of the results, the limitations of the study, conclusions, implications, and suggestions for further research.

CHAPTER VI

Summary, Limitations, Conclusions, Implications

In this chapter a summary of the study, its limitations, the conclusions, and implications will be presented. The summary will review the purpose, the rationale, and the methodology of the study. A discussion of the results will also be included. The discussion of the limitations will deal with the extent to which the results may be generalized. Conclusions will be outlined based on the results obtained, and finally, the implications will address the practical applications of the findings, and suggest areas for future research.

1. Summary

a) Purpose

The purpose of the study was to determine whether Junior and Senior High school students who are exposed to either of two picture-oriented methods of instruction might achieve better comprehension and recall of social studies text than students exposed to more traditional text-processing instruction. The effects on both immediate, and delayed comprehension/recall (after a period of two weeks), were investigated. Also examined was whether any of these methods of instruction might be more beneficial to those of a particular level of imagery ability (either high or low), or to those of a certain gender.

b) Rationale

The rationale for using picture-oriented methods of instruction was based on research which suggests that pictures do have the potential of increasing prose learning, but due to their widespread undervaluation (Weidenmann, 1989), they often do not have their intended effect. What is needed are forms of instruction that will ensure that textbook illustrations not only fulfill their intended functions, but are used in such a way that their potential to aid learning is maximized.

It has been found that global instructions to attend to illustrations (Hayes & Readence, 1983; Moore & Skinner, 1985), are not enough to extend the positive effects of illustrations beyond what is achieved by the mere presence of illustrations alone. So far, mnemonic methods designed for prose learning have involved the use of experimenter-designed pictures. There is a need to develop forms of picture-oriented instruction for use with the classroom text materials already available.

A number of strategies, that have been found to be successful in enhancing learning, emerge from the research concerned with visual perception, mental imagery, and general elaborative techniques. Several of these learning principles or strategies were incorporated into the instructional methods devised. In addition, for the picture-oriented methods, pictures were used as structures for integrating visual with verbal material.

As there are few if any studies (Weidenmann, 1989, conducted a study with male university undergraduates) with high school students as subjects where picture-oriented methods of instruction have been investigated, grade 8 and 11 were selected for this study. In addition, since there is evidence some students may be more likely to profit from pictorial or imagery instruction than others, it was important to investigate the effects of differences of individual imagery ability on recall under picture-oriented instructional conditions.

Finally, there is a lack of research information concerning the delayed effects of pictorial methods of instruction (Peeck, 1989). This is an important issue to address since there is a tendency for the presence of pictures to help more in the delayed recall of text than in immediate recall.

The purpose of this study was to investigate whether or not students exposed to either of two methods of picture-oriented instruction would achieve superior comprehension and recall of the accompanying social studies passage than those students who received more traditional instruction, focusing on the connected prose only. In trying to determine this, the following questions were asked for each of two samples, grades 8 and 11:

1) Would students exposed to either a picture-oriented or altered pictures lesson demonstrate superior comprehension and recall of a social studies passage over students receiving traditional instruction, on immediate and delayed measures?

2) Would students of high imagery ability differ from those of low imagery ability in either their overall or comparative comprehension/recall performance?

3) Would males differ from females in their overall or comparative comprehension/recall performance?

4) Would there be an interaction between the overall or comparative comprehension/recall performance of students of different imagery ability levels and the type of instruction received?

5) Would there be an interaction between the overall or comparative comprehension/recall performance of students of different gender and the type of instruction received?

6) Would there be an interaction among gender, imagery ability, and overall comprehension/recall or comparative comprehension/recall (pattern of performance comparing immediate with delayed testing)?

7) Would there be interaction effects among imagery ability level, gender, and overall or comparative comprehension/recall patterns than students of another imagery ability and gender, depending on the type of instruction received?

c) Method

Data were collected from nine grade 8 and nine grade 11 classes attending three large public high schools in the Maple Ridge School District. A pretest-posttest non-equivalent control group design was used to test fifteen hypotheses for each of two grade levels, 8 and 11. The control group received conventional text-processing instruction only, while the two experimental groups received picture-oriented and altered-pictures instruction. Data on immediate and delayed comprehension/recall (two weeks after treatment) measures were analyzed using a 2 (genders) X 2 (imagery ability groups) X 3 (treatments) X 2 (recall measures), fully crossed, factorial design with repeated measures on the last factor. Two covariates (reading comprehension ability, and background knowledge) were also included in the analysis. A separate analysis was performed to determine the mean picture recall according to treatment received at each grade level.

d) Discussion of Results

The results will be discussed for each of the two samples (grades 8 and 11) in order according to the hypotheses earlier presented. The first 7 hypotheses are concerned with between-subject effects or group effects, while the last 8 hypotheses are concerned with within-subject effects or effects pertaining to differences among individuals.

The results indicated that, for the grade 8 or grade 11 samples, comprehension and recall of text content appeared to be significantly enhanced, compared to that produced by the conventional treatment, for those subjects who received either of the experimental methods of instruction, picture-oriented or altered-pictures. Furthermore, at the grade 8 level, the altered-pictures method produced significantly superior comprehension/recall to both the conventional and picture-oriented method of instruction. "Comprehension/recall" is defined, in this instance, as overall comprehension and recall, including both the immediate and delayed scores. In general, then, regardless of individual imagery ability or grade level, the altered-pictures and picture-oriented methods of instruction resulted in superior comprehension and retention at both immediate and delayed testing combined. In addition,

for the grade 8 sample the altered-pictures method of instruction was found to produce superior overall comprehension and recall compared not only to the conventional instruction but also compared to the picture-oriented instruction.

i) Why was the comprehension and recall of those grade 8 students receiving the altered-pictures method of instruction superior to the grade 8 students receiving either the picture-oriented or conventional methods of instruction? ii) Why was the altered-pictures method of instruction at the grade 11 level superior only to the conventional form of instruction in producing enhanced comprehension and recall? iii) And why was the picture-oriented method of instruction superior at both grade levels to the conventional method of instruction in the comprehension and recall produced? There are a number of explanations for these findings.

i) First, the type of pictures which appeared in the altered-pictures method of instruction (examples found in chapter 3), unlike the representational pictures of the other two methods, were transformational in function. These illustrations were designed especially with a view to increasing their memorability for a number of facts, and concepts. This difference in the type of illustrations may help to explain the grade 8 result where the altered-pictures method (in which transformational pictures appeared) produced superior comprehension and recall than **both** other methods of instruction (in which representational pictures appeared). Levin, Anglin, and Carney (1987) have noted that transformational pictures may often facilitate learning to a greater extent than conventional, representational pictures.

Secondly, the pictures in the altered-pictures group were altered in such a way that unusual or novel features were added. (It is assumed that the novel features led to the retrieval of the critical to be remembered information, and the novel features themselves did not confuse meaning). Thus, another reason comprehension/recall may have been facilitated to the greatest extent in the grade 8 sample for this altered-pictures group is related to the finding, in the area of mental imagery research, that bizarre imagery can particularly improve memory performance (Einstein & McDaniel, 1987).

Related to this issue, the novel features present in the altered-pictures may have led to an increase in the number of eye fixations grade 8 students gave to these illustrations, and may in turn have

led to better comprehension and recall when comparing the performance of grade 8 students receiving the conventional or picture-oriented instruction. It has been demonstrated that it is not so much the length of viewing time but the number of eye fixations, that determines what is remembered (Loftus, 1972; Spoehr & Lehmkuhle, 1982). It has been found that a discordant element in a picture may increase the depth of processing (Molitor, Ballstaedtt, & Mandl, 1977) and that unusual elements in a picture can attract more eye fixations (Zusne & Michel, 1964). Both Flagg and Weaver (1981) and Nesbit (1981) have found a high correlation between the number of eye fixations given to a picture and subsequent recall.

Still another explanation for the altered-pictures method producing superior comprehension and recall for the grade 8 sample, may be related to the general finding that the more elaboration, the better the comprehension and/or recall (Levin, 1988). Students may have engaged in deeper, more elaborate processing when attending to the altered-pictures, than those students in the other treatment conditions (where there were actually fewer elements contained in the pictures to process).

Finally, another possible explanation for the superiority of the altered-pictures method in the grade 8 sample may have been related to what Molitor, Ballstaedt, and Mandl (1989) refer to as the "attitude towards the medium." They point out that attitude can influence the extent to which a medium is analyzed or processed. In the case of the altered-pictures method, students may have been more intrigued with the novelty of the approach (compared to the other methods).

Throughout this discussion, the assumption has been made that if the pictures were more memorable, comprehension and recall for the accompanying text would be improved. This assumption is supported by the results of the picture recall measure. For both grades, in fact, students who remembered the most pictures were those who received the altered-pictures method of instruction, followed by those who received the picture-oriented method of instruction. And for the grade 8 sample at least, there was a significant difference between all three instructional groups in their comprehension and recall of the social studies text with the altered-pictures method most superior, followed by the picture-oriented method, and finally the conventional method. That is, the same order of methods

producing the highest to lowest picture recall was also reflected in the order of the methods producing the highest to lowest text comprehension and recall.

ii) At the grade 11 level the altered-pictures and picture-oriented methods were equally successful in producing superior overall (both immediate and delayed performance) comprehension and recall of text compared to that produced by the conventional method of instruction. Why, as was the case for the grade 8 students, did the altered-pictures method not prove to be the most superior?

Unlike the grade 8 students, both the picture methods may have been equally novel, at least initially (particularly at immediate testing) for the grade 11 students. Students in senior high school may be less likely to encounter such unusual methods of instruction compared to those students in junior high school.

iii) That the picture-oriented method of instruction resulted in superior comprehension and recall of text content compared to the conventional method at both grade levels is also supported to some extent by previous research findings. Although both the conventional and picture-oriented groups were exposed to the illustrations, the picture-oriented group received specific instruction directed towards the pictures. There is some evidence that picture-oriented instruction can overcome the undervaluation of pictures (Weidenmann, 1989) problem and improve recall for text content (McComb, 1987; Weidenmann, 1989) over and above the effects obtained for the presence of pictures alone. In addition, the integration of text with picture content that was required in the picture-oriented instruction may have improved text comprehension and recall, as findings in the area of mental imagery research indicate that the combining of concrete, visual stimuli with abstract, verbal stimuli, (or the combining of word with picture) produces superior picture recall over the presentation of either words or pictures in isolation (Brainerd, Desrochers, & Howe, 1981).

For both grade level samples, imagery ability did not appear to affect how well the text content was remembered on the whole (considering both immediate and delayed testing performance). Nor was it the case in either grade that a particular instructional method was better suited to a particular imagery ability group. Thus, if one is concerned with what method is best overall for a class or group, the

picture-oriented instructional method or the altered-pictures instructional method appear to result in superior text comprehension and recall, compared to the use of the conventional method regardless of the grade level (8 or 11), and the level of imagery ability. Both grade 8 and 11 students appeared to profit from the picture strategy methods, demonstrating superior comprehension and recall for text content, and both high and low imagery ability students appeared to benefit.

At both grade levels there was an interaction between gender and the overall comprehension/recall performance regardless of the type of instruction received or level of imagery ability.

These gender differences may be explained in terms of the subject matter of the text booklets. A great deal of these texts dealt with military matters during the Russian Revolutions of 1917, and perhaps the subject matter was of more interest to the males. Interest and attitude towards reading material has been found to affect memory for such text (Hidi & Baird, 1988).

For the grade 8 sample, there did not appear to be any type of instruction that was better than another in alleviating comprehension and memory decay over time. No particular method of instruction aided the retention of information over time. The decrease in comprehension/recall observed between immediate and delayed testing was relatively the same for all three instructional methods. This result is contrary to some of the literature that indicates that in some cases the presence of pictures may aid more in delayed recall than immediate recall (Levie & Lentz, 1982). Related to instruction, it has also been found that picture instruction with grade 5 and 7 texts is particularly beneficial in delayed recall (McComb, 1987).

For the grade 11 sample, however, the altered-pictures instruction appeared to facilitate comprehension and recall of text compared to the conventional method of instruction. Those students receiving the conventional method of instruction in grade 11 showed a more dramatic decline in delayed comprehension and recall relative to their performance at immediate testing, compared to the decline observed for the altered-pictures method. Although the picture-oriented instruction also enhanced delayed performance compared to the conventional instruction, this difference did not quite reach the

significance level of .05 ($p = .052$).

For the grade 11 students, it appears that the features inherent in the altered-pictures method of instruction which facilitated overall comprehension and recall, were also of benefit in aiding retention and comprehension over time. The novelty of the method (perhaps more unusual over time for the grade 11 students than for the grade 8 students), the bizarreness of the pictures, the deeper processing required to understand them, and the probable increase in eye fixations may help to explain the durability of this method of instruction over the other methods for enhancing comprehension and recall over time.

Related to Kosslyn's model (1981) of the cognitive processing of text and pictures, perhaps the separate imagery component he proposes, has the capacity to store some information beyond short-term memory storage. The altered-pictures method of instruction may facilitate access to these stored images.

The fact that the grade 11 students appeared to be able to profit from one instructional method as an aid to retention over time, and the grade 8 students did not, is not perhaps unexpected. Many studies in the area of imagery training, have shown that students' ability to profit from imagery methods increases with age. It has also been found that younger students may require more explicit direction in how to use these methods than older students.

2. Limitations

The following limitations should be noted when interpreting the results of this study.

Generalizability of the results is limited to the type of materials used in the study, the grade levels of students who participated, and to the type of measurements used to assess immediate and delayed recall. The materials used were experimenter-designed, with controlled readabilities for each grade. However, the text booklets were designed to resemble as closely as possible the sort of textbook material that students already encounter in their social studies classrooms. There may have been some

risk with the altered-pictures materials that students gained distorted information without being adequately aware of the true meaning of the material to be learned. The students who participated were from grade 8 and 11, and represented a wide range of reading comprehension ability levels, as well as a wide range of differences in background knowledge of the topic to be learned. Text recall was measured by an immediate and delayed 3-page, multiple question type test measure. It was not adequately determined, however, whether this test measured the recall of meaningful information only or, for the altered-pictures instructional groups, information that was irrelevant and bizarre.

A limitation in random sampling took place in the selection of students. It was necessary to use intact classes from schools willing to participate in the study. The conditions arranged in the study, however, with regular classes of students and regular social studies teachers, were in many respects comparable to the usual learning situations. For this reason, an argument could be made that the study may have more ecological validity than if random sampling were to have been conducted.

Teacher involvement in the study limited the control of instruction given to students. Two teachers each administered all three methods of instruction, one to each of three of their classes. Other teachers taught two different instructional methods, one to each of two of their classes. Two other teachers in the sample taught only one method of instruction to one of their classes. Thus, although training sessions and standardized lesson outlines were provided the presentation of instructional methods could not be totally controlled.

A limitation is noted in the absence of procedures examining transfer effects. Due to the constraints of time and expense this was not done. It would have been valuable, however, to test whether these picture related methods could be used successfully by students independently of teacher direction with training and with the necessary practice instruction.

One other limitation is noted in the difference in instruction given to the three treatment groups. The altered-pictures groups were given additional information concerning the pictures. These groups were informed by the teacher in one single statement that the pictures had been altered as a deliberate memory strategy. It would have been appropriate to have included a similar statement for

the other two instructional groups. The teachers in these groups could have informed their classes that the pictures were present (conventional) or would be focussed on (picture-oriented) as a memory strategy.

3. Conclusions

Based on the results obtained, a number of conclusions may be drawn. First, for both the grade 8 and 11 students selected, and regardless of imagery ability, it appears that both of the experimental picture methods of instruction facilitate the recall of social studies text content, as measured by the immediate and delayed comprehension/recall tests. Students exposed to either the altered-pictures method of instruction or to the picture-oriented method of instruction scored generally higher on the tests measuring comprehension and recall compared to those students receiving the conventional method of instruction. Furthermore, at the grade 8 level the altered-pictures method of instruction appeared to be the most beneficial method of instruction for enhancing overall comprehension and recall of text (on both immediate and delayed testing combined).

Another conclusion drawn is that males in both grade 8 and 11 appear to perform better on the comprehension/recall tests used in this study compared to females. The subject matter of the text or differences in the brain lateralization of adolescent males may have led to this difference.

Also, it is concluded that for grade 11 students, the conventional method of instruction may not be as effective in helping students to understand and retain social studies text information over a period of time (i.e. 2 weeks) as the altered-pictures method of instruction.

4. Implications

Based on the conclusions and limitations of the study, several implications are suggested. The implications are organized according to implications for the classroom teacher, and suggestions for

further research.

a) Implications for teachers

Although pictures may enhance memory for prose, there is evidence that often they do not. Whether this failure is due to the ineffective processing of illustrations on the part of learners, or to an undervaluation of pictures' informativeness on the part of the student and/or the teacher, special picture-oriented instructions could prove beneficial.

If teachers can devise ways to increase, not so much the viewing time, but the number of times students might focus on individual features of pictures, and the amount of time spent relating these features to the text content, then they will likely not only increase students' subsequent picture recall, but recall of prose content as well.

If teachers can arrange to have students relate the prose content to the accompanying illustrations, (combine visual with verbal), recall of prose content may be enhanced considerably as indicated by this study.

To maximize the effects on prose recall, the teacher may wish to arrange for deeper, more elaborate picture\text processing. This can be accomplished by using available pictures in conjunction with teacher or student devised mnemonic strategies, teacher-directed mental imagery exercises, or physically active participation activities. This would include activities such as tracing, labelling, or making additions to pictures using transparencies.

Most important, recent investigations into teacher's attitudes towards illustrations in texts indicate that very little time or attention is paid to them (Evans, Watson, & Willows, 1987). There is a need for teachers to view illustrations as valuable learning aids, which can be used in ways which will enhance memory for text content. Since the attitude towards the medium has been found to influence processing (Molitor, Ballstaedt, & Mandl, 1989), it is important that teachers not only change their perception of pictures, but also that they help to change their students' attitudes towards illustrations. By simply revising their own attitudes towards pictures, teachers could be influential in helping students to view illustrations not merely as attentional or motivational media, but as powerful structures for

aiding memory and learning.

Finally, since it has been noted that by increasing the use of effective memory strategies, other aspects of intellectual performance can be improved as well (Pressley, Heisel, McCormick, & Nakamura, 1982). It is important generally that teacher education become much more sophisticated in training teachers to teach strategies (Duffy & Roehler, 1986). As far as mnemonic strategies are concerned, for example, it has been suggested that educators have barely scratched the surface of the full range of mnemonic strategies' educational potential (Levin, 1987).

b) Implications for publishers

A recent survey conducted in a number of publishing houses revealed that in the designing of content area textbooks, rarely do the author and the illustrator meet, and "it appears that research plays little role in the decision-making process" (Evans, Watson, & Willows, 1987, p. 89). The results of this recent survey confirm Dwyer's (1972) summary that the selection and inclusion of illustrations in textbooks appear to be based on "subjective feelings of the designer about what is best, the accessibility of raw information, the availability of materials, the cost, the attractiveness of the finished product, and the availability of a ready market" (p. 16). In the absence of research to substantiate decisions, the potential for less than optimal decision making may be considerable. There is thus a need for closer collaboration between researchers and publishers.

Some specific implications for publishers arising from literature review and the results of this study are as follows. It should be determined what function an illustration is meant to serve; then, that function should be incorporated into the design of the text or content of the teacher's manual to ensure that the illustrations function and are used as was intended. Publishers should consider replacing illustrations designed to fill attentional roles only with illustrations designed especially to increase learning of the text content. The use of cueing strategies should be considered as well as labelling activities, questions, captions, and transformational features to increase the integration of text and picture content. Publishers should consider the inclusion of specific instructions to teachers within

teacher's manuals to ensure that the maximum learning benefits are obtained from illustrations.

c) Suggestions for further research

Based on the conclusions and the limitations of the study several implications for further research are suggested.

Further research needs to be conducted to determine what the effects of training students to use picture-oriented methods independently in the classroom are. Investigations concerned with how to train students to transfer the use of picture-oriented methods appropriately to different learning situations also is needed. There has been little work conducted on the various aspects of transfer with elaboration strategies (Pressley, Heissel, McCormick, & Nakamura, 1982). Pressley (1983) surmises that it seems likely that over the years people could abstract from optimal presentations of various strategies, general rules to enhance cognitive efficiency. There is a need to determine if this might actually be the case, or whether left to their own devices, students could better develop a repertoire of strategies for enhanced learning themselves.

In more specific terms, there is a need to develop new methods of picture-oriented instruction which engage students more actively with illustrations, and which can be adapted for use with current textbooks. For example, textbook illustrations could be copied (with permission from the publishers) for students and meaningful features added by the students themselves, in order to increase a picture's memorability, and interaction with the text content. Alternatively, students could perhaps add their own captions, labelling, or features to textbook illustrations based on the information contained in the accompanying prose with, for example, post-it stickers. There is a need to investigate the efficacy of such methods.

Further research also needs to be conducted to determine more clearly how age or gender influence a student's ability to profit from various picture-oriented methods of instruction. What, for example would be the youngest age at which the altered-pictures method of instruction could be successfully employed to increase prose learning? There is a lack of research in the area of gender

differences and their effects on pictorial methods of instruction, and so far, studies have presented mixed, and sometimes confusing results.

Pictures in textbooks are extremely valuable visual aids. The first illustrated textbook by Comenius is reputed to have been published in 1658. This was a primer and first reader with illustrations and was based on the author's conviction, as reported by Kinder (1959, pp. 34-35), that the teaching of words and pictures must go together. Since this first illustrated text, with its crude woodcuts, millions of texts have been produced which are vivid, interesting, and scientifically illustrated. It has been generally established that pictorial materials create interest and provide motivation. With our widespread perception of the role of pictures as interesting, attention-getting media, have we been blind to their even greater value for enhancing memory? Have we long overlooked the idea that pictures can be used as powerful devices for increasing learning?

Perhaps Alice knew something that we did not when she remarked, "What is the *use* [italics added] of a book without pictures?"

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APPENDICES

Appendix A: Permission Letter from Maple Ridge School District

Appendix B: Certificate of Approval from U. B. C. Ethics Committee

Appendix C: Preliminary Procedural Instructions for Teachers

GENERAL INSTRUCTIONS FOR CONDUCTING THE FIRST ONE HOUR OF THE STUDY:

In this first hour there are 3 pretests to administer:

1. Stanford Diagnostic Reading Comprehension Test (30-40 minutes)
2. Vividness of Visual Imagery Questionnaire (5-10 minutes)
3. Background Knowledge Measure (5-10 minutes)

Please administer the tests in the order above. Teachers have found that the one hour allotted for these three tests is quite tight. Do not worry if you are running out of time since tests 2 and 3 (above) are quite short and could be given during another period.

Sometimes students forget to put their surname on their papers which makes it difficult to match up all their tests. Please remind them to do this.

If students ask: "Do the tests count?" (a common question!) please say they will not count for their report cards or influence their marks, but they are very important. It is important they try their very best.

PROCEDURE:

1. Have distributed the answer sheets and reading booklets for the Stanford Diagnostic Test.
2. Follow the instructions in the Teacher's Manual of Administration starting with where it is marked in pink highlighter.
3. Time the test. Then collect all papers and booklets.
4. Distribute the Vividness of Visual Imagery Questionnaire, and read over the beginning instructions with the class to ensure that they understand what to do. Point out there are <u>two</u> pages to complete.
5. As students finish they may turn over their papers; those finished can be collected and blank sheets of paper distributed ready for the next test measure.
6. Ensure all imagery questionnaires are collected, and that everyone has a lined piece of paper.
7. Follow the instructions given for the Background Knowledge Measure which you will find following this sheet.
8. Collect all papers; please put all answer sheets in the file folder.

Appendix D: Instructions for Teachers

Appendix E: General Instructions for Lesson Procedures

GENERAL INSTRUCTIONS ON CONDUCTING THE LESSON

1. As you read the questions and instructions in this handbook to your class try not to alter your normal teaching style. If you wish, you may give positive reinforcement, and repeat answers for clarity.

2. If any question fails to elicit the desired response after one of two attempts, briefly explain the correct answer to the class yourself and move on with the lesson.

3. Do not rush. The lesson has been designed so that everyone in the class should have time to read the text at least once.

4. Timing is important. Please adhere to the 41 minutes allowed for the lesson.

PROCEDURE:

STEP 1: Each student should have a Social Studies booklet, with a piece of note paper in it. Have these materials handed out.

STEP 2: As they are being handed out, say: THESE ARE SOME SOCIAL STUDIES BOOKLETS THAT WE ARE GOING TO READ.

STEP 3: When everyone has a booklet, say: PLEASE LOOK AT PAGE 49 NOW IN YOUR BOOKLET.

STEP4: At this point, make a note of the STARTING TIME. Total exposure time to the materials should be exactly 41 MINUTES from this point onwards.

STEP 5: Proceed with the lesson as outlined in this booklet. Try to ensure that correct answers have been heard by the whole class before moving on to the next question.

STEP 6: When you come to the end of the lesson, check the time and decide how many minutes the students have remaining to study their booklets. Stop the lesson and have all materials collected when the 41 minutes have elapsed.

PAGE 49:

Teacher says:	EXPECTED STUDENT RESPONSE
TURN TO PAGE 49 PLEASE AND LOOK AT THE TITLE.	
CAN YOU PREDICT WHAT THESE PAGES WILL BE ABOUT?	The beginning of communism.
YES, GOOD.	
IN WHAT COUNTRY DO YOU THINK THIS HAPPENS? HOW DO YOU THINK THE COUNTRY WAS RULED BEFORE THE INTRODUCTION OF A COMMUNIST GOVERNMENT?	Russia. By czars or royal families.
NOW READ THIS PAGE TO SEE IF YOU CAN FIND OUT WHY THE WAR MADE THE SOLDIERS, THE PEASANTS, AND THE NOBLES UNHAPPY WITH THE CZAR'S RULE. WHEN YOU FINISH READING JOT DOWN ON YOUR PAPER WHY THESE 3 GROUPS OF PEOPLE WERE UNHAPPY.	
WHY DID THE WAR MAKE THE SOLDIERS UNHAPPY WITH THE CZAR?	- They didn't have enough food or weapons; many died.
WHY WERE THE PEASANTS UNHAPPY?	- Lack of food and fuel; high prices; relatives killed.
AND WHY WERE THE NOBLES UNHAPPY?	- Corruption in the government.
WHO WAS THE MAN THAT INFLUENCED THE CZAR'S WIFE SO MUCH?	Rasputin.
RIGHT. HE ACTUALLY INFLUENCED THE CZAR'S WIFE A LOT BECAUSE HE WAS ABLE TO KEEP HER SON'S ILLNESS UNDER CONTROL. THIS SON HAD A DISEASE CALLED HEMOPHILIA.	
NOW TURN TO PAGE 50 AND READ THE TWO HEADINGS THERE.	

Appendix F: Lesson Outlines for All Three Types of Instruction

Conventional Lesson Outline

PAGE 50:

Teacher says:	EXPECTED STUDENT RESPONSE:
CAN YOU PREDICT WHAT THIS PAGE WILL BE ABOUT BASED ON THESE TWO HEADINGS?	(Accept any reasonable answers.)
GOOD IDEAS. READ THIS PAGE NOW AND THE FIRST SIX LINES OF PAGE 51 TO SEE IF YOU ARE RIGHT.	
(Allow enough time for most of the class to read this to themselves and then resume questions.)	
WHAT HAPPENED TO THE CZAR?	He abdicated from the throne.
WHAT DOES ABDICATE MEAN?	He gave up the throne and his powers as ruler of the country.
WHY WERE THE PEOPLE SO UNHAPPY?	They wanted more food. (or) They didn't have enough food
WHAT WAS THE NEW GOVERNMENT LIKE?	It was too weak to rule.
IT WAS ONLY A TEMPORARY GOVERNMENT; WHAT WAS IT CALLED?	Provisional Government.
GOOD. WHAT IS THE HEADING ON PAGE 51?	The Bolsheviks.

PAGES 51 AND 52:

Teacher says:	EXPECTED STUDENT RESPONSE:
IN RUSSIAN, "BOLSHEVIK" MEANS THE GROUP MAKING UP THE MAJORITY OR LARGEST GROUP IN THE GOVERNMENT COUNCIL OR SOVIET. CAN YOU GUESS WHY THE BOLSHEVIK PARTY ARE GOING TO BE IMPORTANT NOW?	(Accept any reasonable answers)
READ THE REST OF THIS PAGE, AND PAGE 52 AS WELL NOW, TO SEE IF YOU ARE ON THE RIGHT TRACK AND TRY TO LIST ON YOUR PAPER SOME OF THE IMPORTANT EVENTS THAT OCCURRED AT THIS TIME.	
(Allow enough time for most of the class to silent read these pages, and then resume.)	
WERE YOU RIGHT ABOUT THE BOLSHEVIKS? WHAT DID THEY DO?	They took over from the Provisional Government.
WHO CAN TELL ME ONE OF THE FIRST EVENTS THAT LED TO THE BOLSHEVIK TAKEOVER? WHO RETURNED TO RUSSIA TO LEAD THE BOLSHEVIKS?	1. Lenin returned to Russia.
WHAT HAPPENED NEXT?	2. Bosheviks gained control of the soviet in Petrograd.
WHAT WAS A THIRD EVENT?	3. Boshevik attempt to takeover the government failed in July.
WHAT HAPPENED AFTER THAT?	4. An army general, Kornilov tried but also failed to gain power.
FINALLY, THERE WAS AN ORGANIZED REVOLUTION LED BY LENIN AND TROTSKY. WHAT NAME WAS GIVEN TO IT?	5. The October Revolution.
GOOD.	
CAN YOU TELL WHAT THE REST OF THE TEXT WILL BE ABOUT BY READING THE REMAINING HEADINGS?	What the government was like under Lenin. The changes that resulted.
READ TO THE END OF THE TEXT NOW AND WHEN YOU FINISH SEE IF YOU CAN LIST 3 WAYS THE COMMUNIST GOVERNMENT WAS SIMILAR TO THE CZARIST SYSTEM.	

PAGE 53:

HAS EVERYONE FINISHED READING?

WHO CAN TELL ME ONE WAY THE COMMUNIST AND THE CZARIST SYSTEMS WERE SIMILAR?	1. Both had dictators in charge.
WHAT WAS ANOTHER SIMILARITY?	2. Both systems forced people to adopt and obey ideas.
AND ONE MORE SIMILARITY?	3. Government was centrally, not locally, controlled.
WHAT KIND OF RULER WAS LENIN?	Determined, forceful, harsh, ruthless, etc.
WHAT WAS WRONG WITH THE PEACE TREATY TROTSKY ARRANGED WITH THE GERMANS?	Russia lost a lot of land and people.

(If time remains out of the ___ minutes allowed, say to the class:)

YOU HAVE ____MORE MINUTES TO LOOK OVER THESE PAGES. TRY TO REMEMBER WHAT YOU HAVE READ, BECAUSE YOU WILL BE ASKED SOME QUESTIONS ABOUT IT.

WHEN ____ HAVE ELAPSED, SAY: "Stop reading now please."

Then have all the booklets and papers collected and proceed to testing.

Picture-Oriented Outline

Czar Nicholas II and his family, all of whom were executed after the 1917 revolution.

PAGES 48 & 49:

Teacher says:	EXPECTED STUDENT RESPONSE
TURN TO PAGE 48 PLEASE AND LOOK AT THE PICTURE THERE.	
THESE PEOPLE WERE THE LAST ROYAL FAMILY OF WHAT COUNTRY? CAN YOU GUESS?	Russia.
IS THERE ANYTHING ABOUT THIS PICTURE TO SUGGEST WHO IS THE STRONGER PERSONALITY - THE CZAR OR HIS WIFE, THE CZARINA?	The czar's wife. She is standing and wears a crown. The czar has a meek expression.
THE ONLY SON AND HEIR TO THE THRONE HAD A DISEASE CALLED HEMOPHILIA. WHAT IS THERE IN THE PICTURE TO SUGGEST THAT THE FAMILY MIGHT HAVE WORRIED ABOUT HIM?	One sister has her arms around him.
READ THE WORDS UNDER THE PICTURE; CAN YOU PREDICT WHAT THESE PAGES WILL BE ABOUT?	The end of rule by czars in Russia and the beginning of communism.
YES, GOOD.	
NOW READ PAGE 49 TO SEE IF YOU CAN FIND OUT WHY THE WAR CAUSED THE SOLDIERS, THE PEASANTS, AND THE NOBLES TO BE UNHAPPY WITH THE CZAR'S RULE. WHEN YOU FINISH READING, WRITE DOWN ON YOUR PAPER WHY THESE 3 GROUPS OF PEOPLE WERE UNHAPPY.	
(After enough time has elapsed for most of the class to finish reading, resume.)	
LOOK AT THE PICTURE AGAIN NOW ON PAGE 48.	
WHY WERE THE SOLDIERS UNHAPPY WITH THE CZAR?	- They didn't have enough food or weapons; many died.
WHY WERE THE PEASANTS UNHAPPY?	- Lack of food and fuel; high prices; relatives killed.
AND WHY WERE THE NOBLES UNHAPPY?	- Corruption in the government.
WHO WAS THE MAN THAT INFLUENCED THE CZAR'S WIFE SO MUCH?	Rasputin.
RIGHT. NOW TURN TO PAGE 49 AND LOOK AT THE PICTURE OF THIS MAN.	

Soldiers' wives protested against their inadequate rations

PAGE 50:

Teacher says:	EXPECTED STUDENT RESPONSE:
IS THERE ANYTHING ABOUT THE PICTURE TO SUGGEST THAT RASPUTIN POSED AS A RELIGIOUS MAN?	His clothing.
YES, HIS CLOTHING. IS THERE ANYTHING UNUSUAL ABOUT HIS FACE?	His eyes.
YES, HE WAS SUPPOSED TO HAVE SPECIAL PSYCHIC ABILITIES AND WAS ABLE TO INFLUENCE THE CZAR'S WIFE A LOT BECAUSE HE SEEMED TO BE ABLE TO CONTROL HER SON'S DISEASE. WHAT WAS THE NAME OF THE DISEASE?	Hemophilia.
GOOD.	
LOOK AT THE PICTURE AT THE BOTTOM OF THE PAGE NOW. WHO ARE THESE PEOPLE?	Soldiers' wives.
YES, CAN YOU SEE THE PEOPLE ARE MOSTLY WOMEN? READ THE WORDS UNDER THE PICTURE: WHY ARE THEY ANGRY?	Inadequate rations.
YES, THEY WANT MORE FOOD, RIGHT? CAN YOU GUESS WHAT WILL HAPPEN TO THE CZAR?	He will be killed. He will be taken prisoner. (accept any answer)
OKAY, THOSE ARE GOOD IDEAS: READ PAGE 50 NOW AND THE FIRST HALF OF PAGE 51, AND SEE IF YOU ARE RIGHT.	
(Allow enough time for most of the class to read and then resume questions.)	
LOOK AT THE PICTURE OF THE WOMEN PROTESTING AGAIN. WERE YOU RIGHT? WHAT HAPPENED TO THE CZAR?	He abdicated.
WHAT DOES ABDICATED MEAN?	He gave up the throne and his power to rule.
LOOK AT THE PICTURE OF RASPUTIN AGAIN. THE PEOPLE WERE UNHAPPY WITH THE OLD FORM OF GOVERNMENT, AND ESPECIALLY WHEN RASPUTIN CAME TO HAVE SO MUCH POWER? BUT WAS THE NEW GOVERNMENT IN A STRONGER POSITION?	No, the new government was too weak to rule.
THE NEW GOVERNMENT WAS ONLY TEMPORARY: WHAT WAS IT CALLED?	Provisional.

GOOD. LOOK AT THE PICTURE AT THE TOP OF PAGE 51 NOW.

PAGE 51 (TOP)

A loyal Russian soldier attacking one of the many deserters from the Russian army in 1917.

PAGE. 52 (TOP)

General L. G. Kornilov

PAGE 52 (BOTTOM)

Two of Trotsky's Red Guards outside the headquarters of the Bolshevik leaders, Lenin and Trotsky, October 1917. It was men like these who drove the Provisional Government from power later that month.

PAGES 51 & 52:

Teacher says:	EXPECTED STUDENT RESPONSE
WHAT IS HAPPENING IN THIS PICTURE?	A soldier is leaving the army.
WHY IS THE SOLDIER DESERTING THE ARMY?	Too many battles and lives lost; tired of fighting a war he did not want to be in.
LOOK AT THE PICTURE AT THE BOTTOM OF THE PAGE NOW AND READ THE WORDS UNDERNEATH TO SEE IF YOU CAN FIND OUT WHO IS THIS MAN? (THE ONE SPEAKING)	Kerensky, leader of the Provisional Government.
YES, RIGHT. IN RUSSIAN, "BOLSHEVIK" MEANS THE GROUP IN THE GOVERNMENT THAT MAKES UP THE LARGEST OR MAJORITY GROUP. WHY DO YOU THINK THE BOLSHEVIKS ARE GOING TO BE IMPORTANT NOW?	They will try to take over the government.
READ THE <u>REST OF THIS PAGE AND PAGE 52</u> TO SEE IF YOU ARE RIGHT, AND TRY TO LIST ON YOUR PAPER 5 IMPORTANT EVENTS THAT OCCURRED NOW. (After most of the class has had time to read and jot down answers, resume.)	
LOOK AT THE PICTURE AT THE BOTTOM OF PAGE 52. WERE YOU RIGHT ABOUT THE BOLSHEVIKS?	They took over from the Provisional Government.
WHO ARE THE TWO MEN IN THIS PICTURE?	Bolshevik Guards.
WHO ARE 2 BOLSHEVIK LEADERS THAT MIGHT BE BEHIND THE DOOR THEY ARE GUARDING?	Lenin and Trotsky.
LOOK AT THE PICTURE AT <u>THE TOP OF THE PAGE</u> NOW. WHO WAS KORNILOV?	An army general who tried to gain power.
BEFORE KORNILOV, WHAT WAS ONE OF THE FIRST EVENTS LEADING TO THE BOLSHEVIK TAKEOVER? (WHO RETURNED TO RUSSIA TO LEAD THE BOLSHEVIKS?)	1. Lenin returned to Russia.
WHAT HAPPENED NEXT?	2. Bolsheviks became majority in Petrograd soviet.
WHAT WAS A THIRD EVENT?	3. Bosheviks tried but failed to take over the government in July.
WHAT HAPPENED AFTER THAT?	4. Kornilov tried to take charge.
FINALLY, THERE WAS AN ORGANIZED REVOLUTION, LED BY LENIN AND TROTSKY. WHAT NAME WAS GIVEN TO IT?	5. The October Revolution.
GOOD. LOOK AT THE PICTURE OF LENIN ON <u>PAGE 53</u> NOW.	

PAGE 53

In May 1919 Lenin speaks to new troops in Red Square.

PAGE 54

Looking strangely smug and satisfied, a fur-hatted Trotsky was photographed at Brest-Litovsk, Poland, as he arrived to sign a humiliating German peace treaty.

PAGES 53 & 54:

Teacher says:	EXPECTED STUDENT RESPONSE:
LENIN'S OLDER BROTHER WAS EXECUTED BECAUSE OF HIS REVOLUTIONARY ACTIVITIES WHEN THE CZAR WAS IN POWER. HOW WOULD YOU DESCRIBE LENIN'S ATTITUDE IN THIS PICTURE?	Determined. Dictatorial, etc.
TURN TO THE LAST PAGE NOW, PAGE 54.	
WHO IS THIS A PICTURE OF?	Trotsky.
WHY IS IT QUITE STRANGE THAT HE IS SMILING?	He signed a peace treaty with Germany that was very unfavourable for Russia.
READ THE REST OF THE TEXT NOW AND TO SEE IF YOU CAN LIST ON YOUR PAPER 3 WAYS LENIN'S COMMUNIST GOVERNMENT WAS SIMILAR TO THE CZARIST SYSTEM.	
HAS EVERYONE HAD TIME TO FINISH READING?	
LOOK AT THE PICTURE OF LENIN AGAIN.	
WHO CAN TELL ME ONE WAY THE COMMUNIST SYSTEM WAS SIMILAR TO THE CZARIST SYSTEM? GOOD. NOTICE LENIN'S RAISED FIST.	1. Both had a dictator in charge.
WHAT WAS ANOTHER SIMILARITY? GOOD. NOTICE THE ARMY USED TO ENFORCE OBEDIENCE.	2. Both systems forced people to adopt and obey ideas.
AND A THIRD SIMILARITY?	3. Government was centrally, not locally, controlled.
YES, THAT'S RIGHT. NOTICE THE LARGE BUILDINGS IN THE PICTURE. THE VILLAGES DID NOT HAVE ANY POWER.	

(If time remains out of the ____ allowed, say to the class:)

YOU HAVE ____ MORE MINUTES TO LOOK OVER THESE PAGES. TRY TO REMEMBER THE PICTURES AND THE TEXT BECAUSE YOU WILL BE ASKED SOME QUESTIONS ABOUT THEM.

WHEN ____ HAVE ELAPSED, SAY: "Stop reading now please."

Then have all the booklets and papers collected, and proceed to testing.

Altered-Pictures Outline

Czar Nicholas II and his family, all of whom were executed after the 1917 revolution.

PAGES 48 & 49:

Teacher says:	EXPECTED STUDENT RESPONSE
TURN TO PAGE 48 PLEASE AND LOOK AT THE PICTURE THERE. ALL THE PICTURES IN THESE BOOKLETS HAVE BEEN ALTERED, OFTEN IN AN UNUSUAL OR BIZARRE WAY. THIS IS HAS BEEN DONE ON PURPOSE AS A STRATEGY TO HELP YOU REMEMBER THE PICTURES BETTER.	
IS THERE ANYTHING ABOUT THIS PICTURE TO SUGGEST WHO IS THE STRONGER PERSONALITY - THE CZAR OR HIS WIFE, THE CZARINA?	The czar's wife. She is standing and wears a crown. The czar has a meek expression. The czar's wife is holding keys to suggest she is the real boss.
THE ONLY SON AND HEIR TO THE THRONE HAD A DANGEROUS DISEASE CALLED HEMOPHILIA. WHAT DOES HE HAVE ON HIS CHEST TO HELP YOU REMEMBER HIS LIFE WAS MARRED?	A cross.
READ THE WORDS UNDER THE PICTURE; CAN YOU PREDICT WHAT THESE PAGES WILL BE ABOUT?	The end of the Czar's rule, and the beginning of Communism in Russia.
YES, GOOD.	
NOW READ <u>PAGE 49</u> TO SEE IF YOU CAN FIND OUT WHY THE WAR MADE THE SOLDIERS, THE PEASANTS, AND THE NOBLES UNHAPPY WITH CZAR NICHOLAS'S RULE. WHEN YOU FINISH READING WRITE DOWN ON YOU PAPER WHY THESE 3 GROUPS OF PEOPLE WERE UNHAPPY. (After enough time has elapsed for most of the class to finish reading, resume.)	
LOOK AT THE PICTURE AGAIN NOW ON PAGE 48.	
WHY DID THE WAR MAKE THE SOLDIERS UNHAPPY WITH THE CZAR'S RULE?	- They didn't have enough food or weapons; many died.
WHY WERE THE PEASANTS UNHAPPY?	- Lack of food and fuel; high prices; relatives killed.
AND WHY WERE THE NOBLES UNHAPPY?	- Corruption in the government.
WHO WAS THE MAN THAT INFLUENCED THE CZAR'S WIFE SO MUCH?	Rasputin.
YES, RIGHT. NOW TURN TO PAGE 49 AND LOOK AT THE PICTURE OF THIS MAN.	

Soldiers' wives protested against their inadequate rations

PAGE 50:

Teacher says:	EXPECTED STUDENT RESPONSE:
IS THERE ANYTHING ABOUT THE PICTURE TO SUGGEST THAT RASPUTIN WAS NOT A GOOD MAN EVEN THOUGH HE POSED AS A RELIGIOUS MAN?	The rat on his shoulder.
YES, THE RAT HELPS TO REMIND YOU OF THIS. HE WAS SUPPOSED TO HAVE SPECIAL PSYCHIC ABILITIES AND WAS ABLE TO INFLUENCE THE CZAR'S WIFE A LOT BECAUSE HE SEEMED TO BE ABLE TO CONTROL HER SON'S DISEASE. WHAT DO YOU SEE IN THE PICTURE THAT SUGGESTS THIS TO YOU?	The cross in his hand.
YES, GOOD; IT'S AS IF HE HOLDS THE YOUNG BOY'S LIFE IN HIS HAND.	
LOOK AT THE PICTURE AT THE BOTTOM OF THE PAGE NOW. WHAT IS THIS PICTURE ABOUT?	Women demonstrating.
YES, WHY ARE THEY ANGRY?	They want more food.
YES, GOOD. WHAT IS VERY STRANGE OR OUT OF PLACE ABOUT THIS PICTURE? (REMEMBER THIS IN RUSSIA.)	The placards or signs are written in English.
YES, THE SIGNS WOULD NOT BE WRITTEN IN ENGLISH WOULD THEY? BUT THIS WILL HELP YOU TO REMEMBER WHAT THEY WERE ANGRY ABOUT.	
WHAT DO YOU THINK WILL HAPPEN TO THE CZAR?	He will be taken prisoner. (accept any answer)
OKAY, THOSE ARE GOOD IDEAS; READ PAGE 50 NOW AND THE FIRST 6 LINES OF PAGE 51, AND SEE IF YOU ARE RIGHT. (Allow enough time for most of the class to read and then resume questions.)	
LOOK AT THE PICTURE OF THE WOMEN PROTESTING AGAIN. WERE YOU RIGHT? WHAT HAPPENED TO THE CZAR?	He abdicated.
WHAT DOES ABDICATED MEAN?	He gave up the throne and his power to rule.
LOOK AT THE PICTURE OF RASPUTIN AGAIN. THE PEOPLE WERE UNHAPPY WITH THE OLD FORM OF GOVERNMENT, AND ESPECIALLY WHEN RASPUTIN CAME TO HAVE SO MUCH POWER. BUT WAS THE NEW GOVERNMENT IN A STRONGER POSITION?	No, the new government was too weak to rule.
THE NEW GOVERNMENT WAS ONLY TEMPORARY; WHAT WAS IT CALLED?	Provisional.

GOOD. LOOK AT THE PICTURE AT THE TOP OF PAGE 51 NOW.

PAGE 51 (TOP)

A loyal Russian soldier attacking one of the many deserters from the Russian army in 1917.

PAGE 52 (TOP)

General L. G. Kornilov

PAGE 51 (BOTTOM)

Kerensky (at left) taking the salute at a military parade. He was a brilliant speaker but his Provisional Government failed to end the unpopular war or deal firmly with the Bolsheviks. Kerensky went to live in America where he became a professor of history

PAGE 52 (BOTTOM)

Two of Trotsky's Red Guards outside the headquarters of the Bolshevik leaders, Lenin and Trotsky, October 1917. It was men like these who drove the Provisional Government from power later that month.

PAGE 51:

Teacher says:	EXPECTED STUDENT RESPONSE
WHAT IS HAPPENING IN THIS PICTURE?	A soldier is leaving the army.
WHY IS THE SOLDIER DESERTING THE ARMY?	Too many battles and lives lost; tired of fighting a war he did not want to be in.
LOOK AT THE PICTURE AT THE BOTTOM OF THE PAGE NOW AND READ THE WORDS UNDERNEATH TO SEE IF YOU CAN FIND OUT WHO THE MAN IS WHO IS SPEAKING. WHO IS HE?	Kerensky, leader of the Provisional Government.
HOW CAN YOU REMEMBER HIS NAME WAS KERENSKY?	He is calling "Keren", and he has a pair of skis.
GOOD. "KEREN" plus "SKI", = KERENSKY.	
IN RUSSIAN, "BOLSHEVIK" MEANS THE GROUP IN THE GOVERNMENT THAT IS THE LARGEST OR THE MAJORITY. WHY DO YOU THINK THE BOLSHEVIKS ARE GOING TO BE IMPORTANT NOW?	They will try to take over the government.
READ THE <u>REST OF THIS PAGE AND PAGE 52</u> NOW TO SEE IF YOU ARE RIGHT, AND TRY TO LIST ON YOUR PAPER 5 IMPORTANT EVENTS THAT OCCURRED NOW. (After most of the class has had time to read and jot down answers, resume.)	
LOOK AT THE PICTURE AT THE <u>BOTTOM OF PAGE 52.</u>	
WERE YOU RIGHT ABOUT THE BOLSHEVIKS? WHAT DID THEY DO?	They took over from the Provisional Government.
WHO ARE THE TWO MEN IN THIS PICTURE? WHY ARE THERE CAPITAL 'B's OVER THEIR HEADS?	They are Bolshevik Guards.
THE CAPITAL LETTERS ON THE DOOR HINT AT 2 BOLSHEVIK LEADERS WHO MIGHT BE BEHIND THE DOOR. WHO WOULD THEY BE DO YOU THINK?	Lenin and Trotsky.
GOOD. LOOK AT THE PICTURE AT THE TOP OF THE PAGE NOW. WHO IS THE ARMY GENERAL SITTING IN A <u>CORNER</u> WHO HAD A <u>CORNY</u> PLAN TO SEIZE CONTROL OF THE GOVERNMENT?	Kornilov.
BEFORE KORNILOV, WHAT WAS ONE OF THE FIRST EVENTS LEADING TO THE BOLSHEVIK TAKEOVER? (WHO RETURNED TO RUSSIA TO LEAD THE BOLSHEVIKS?) WHAT HAPPENED NEXT?	1. Lenin returned to Russia. 2. Bolsheviks became majority in the soviet in Petrograd.
WHAT WAS A THIRD EVENT?	3. Boshevicks tried but failed to take over the government in July.
WHAT HAPPENED AFTER THAT?	4. Kornilov tried to take charge.
FINALLY, THERE WAS AN ORGANIZED REVOLUTION, LED BY LENIN AND TROTSKY. WHAT NAME WAS GIVEN TO IT?	5. The October Revolution.
GOOD. LOOK AT THE PICTURE OF LENIN ON PAGE 53 NOW	

PAGE 53

In May 1919 Lenin speaks to new troops in Red Square.

PAGE 54

Looking strangely smug and satisfied, a fur-hatted Trotsky was photographed at Brest-Litovsk, Poland, as he arrived to sign a humiliating German peace treaty.

PAGES 53 & 54:

Teacher says:	EXPECTED STUDENT RESPONSE:
LENIN'S OLDER BROTHER WAS EXECUTED BECAUSE OF HIS REVOLUTIONARY ACTIVITIES WHEN THE CZAR WAS IN POWER. HOW WOULD YOU DESCRIBE LENIN'S ATTITUDE IN THIS PICTURE?	Determined. Dictatorial, etc.
WHAT DO YOU SEE IN HIS HAND TO SUGGEST THAT HE WAS A VERY HARSH AND RUTHLESS LEADER?	A whip.
LENIN WORE A WIG TO DISGUISE HIMSELF RIGHT UP UNTIL HE LED THE OCTOBER REVOLUTION. WHAT DO YOU SEE IN THE PICTURE TO REMIND YOU OF THIS AND TO SUGGEST THAT LIKE HIS NAME, "LENIN", HE WAS REALLY "LEAN ON" HAIR?	Lines radiating from the top of his head.
TURN TO THE LAST PAGE NOW, PAGE 54. THIS MAN IS SITTING IN A CARRIAGE BEING PULLED BY A TROTTING HORSE. WHAT IS HIS NAME?	Trotsky.
WHAT DO YOU SEE IN THE PICTURE TO SUGGEST THAT ALTHOUGH HE ARRANGED A PEACE TREATY TO END THE WAR WITH GERMANY, THE TERMS WERE VERY UNFAVOURABLE TO RUSSIA?	The arrow piercing his cheek with the peace symbol attached
YES, GOOD. THE ARROW BRINGING PEACE IS HURTING HIM. RUSSIA LOST ALOT OF LAND AND PEOPLE.	
READ THE REST OF THE TEXT NOW AND SEE IF YOU CAN LIST ON YOUR PAPER 3 WAYS LENIN'S COMMUNIST GOVERNMENT WAS SIMILAR TO THE CZARIST SYSTEM.	
HAS EVERYONE HAD TIME TO FINISH READING? LOOK AT THE PICTURE OF LENIN AGAIN. WHO CAN TELL ME ONE WAY THE COMMUNIST SYSTEM WAS SIMILAR TO THE CZARIST SYSTEM? GOOD. NOTICE THE WHIP.	1. Both had a dictator in charge.
WHAT WAS ANOTHER SIMILARITY? GOOD. NOTICE THE ARMY USED TO ENFORCE OBEDIENCE.	2. Both systems forced people to adopt and obey ideas.
AND A THIRD SIMILARITY?	3. Government was centrally, not locally controlled.
YES, THAT'S RIGHT. NOTICE THE LARGE BUILDINGS IN THE PICTURE. THE VILLAGES DID NOT HAVE ANY POWER.	

(If time remains out of the ____ allowed, say to the class:)
YOU HAVE ____ MORE MINUTES TO LOOK OVER THESE PAGES. TRY TO REMEMBER THE PICTURES AND THE TEXT BECAUSE YOU WILL BE ASKED SOME QUESTIONS ABOUT THEM.

WHEN ___ HAVE ELAPSED, COLLECT ALL BOOKLETS AND PAPERS AND PROCEED TO TESTING.

Appendix G: List of B. C. Ministry of Education Prescribed

Textbooks for Grades 8 and 11 Social Studies

Teacher Reference

	British Columbia: frontiers for ideas	T 23 C844 1986

Social Studies

Social Studies 8

8	World history vol.1	D 20 R44 1987
8-9	World history vol. Teacher's Manual	
8-11	Canadian Oxford school atlas 5/e (B.C.ed)	G 1020 O86 1985
8-9	Geographic essentials	G 1020 O864 1987
8-9	Geographic essentials Teacher's edition	G 1020 O864 1987 T.gui
8	Thinking about our heritage: a Hosford study	G 1030 T52 1985
8	Thinking about our heritage..Teacher's guide	G 1030 T52 1985 T.guid
8	Geolab 1	GA 105.3 D471 1981
8	Geolab 1 Teacher's Manual	GA 105.3 D471 T.guide
8	Patterns of civilization vol.1	CB 69.2 B437 1984
8	Patterns of civilization vol.1 T.guide	CB 69.2 B437 1984 T.gu

Social Studies 9

9	World history v.2	D 20 R44 v.2 1987
8-9	World history v.2 Teacher's manual	D 20 R44 v.2 T.guide
8-11	Canadian Oxford school atlas 5/e (B.C.ed)	G 1020 O86 1985
9	Exploration Canada	FC 170 C64 1986
9	Exploration Canada Teacher's Resource Hand..	FC 170 C64 1986 T.guid
9	Patterns of civilization v.2	CB 69.2 B437 1984 v.2
9	Patterns of civilization v.2 Teacher's	CB 69.2 B437 v.2 T.gui
9	Thinking about our history: a Hosford study	G 1020 T52 1985
9	Thinking about out history: a Hosford T.G.	G 1020 T52 1985 T.guide

Social Studies 10

10-1	Geographic understandings	
8-11	Canadian Oxford school atlas	G 1020 O96 1985
10	Our land: building the west	FC 170 B695 1987
10	Our land: teacher's resource book	FC 170 B695 1987 T.gui
10	Canada and the world: atlas resource	G 1115 M375 1985

Social Studies 11

11	Canada in a changing world-history	
11	Canada in a changing world-history T.Manual	
11	Canada in a changing world-geography	GF 41 D86 1987
11	Canada in changing world-geography T.Manual	
11	Canada in a changing world-government	
11	Canada in a changing world-gov. T.Manual	
8-11	Canadian Oxford school atlas 5/e (B.C.ed.)	G 1020 O86 1985
11-2	Urban prospects 2/e	HT 127 C2 W64 1971
11-2	Cities	NA 9040 S3 1965
	Population and production	HF 1027 S65 1971
11-2	Ordeal by fire	F 5085 A4 1961
11-2	Search for identity	F 5091 F73 1967
	French Canadians, 1760-1967 v.2	FC 132 W354 1968
	Life and letters of Sir Wilfred Laurier	F 5080.9 L354
	Search for a nation	F5029.2 M673

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8-9	World history vol. Teacher's Manual	
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Appendix H: Text Booklets, Altered and Unaltered Versions

Czar Nicholas II and his family, all of whom were executed after the 1917 revolution.

Chapter 3

THE FOUNDING OF COMMUNISM

Introduction

The year 1917 was very important in the history of Russia. This year marked the end of autocratic rule by the Russian monarchs or czars, and the beginning of the world's first communist state.

What were the events that led to the overthrow of the last Czar of Russia, Nicholas II? What were some of the factors which allowed the small Bolshevik party to take control of the largest state on earth?

The First World War

When Germany declared war on Russia in 1914, the Russian people supported the czar in wanting to defend their country. But this attitude was to change.

For Russia, the war was an almost total disaster. In the first two and a half years the army suffered more than five million casualties. In many parts of the front line the troops were reduced to fighting with their bare hands because the whole transport system had broken down and it was impossible to keep them properly supplied with food and weapons.

The situation was no better behind the lines. In the big cities the breakdown of the transport system meant shortage of food and fuel and so led to strikes and riots.

When Nicholas dedided to take personal command of the troops at the front he handed over the running of the Government to his wife, the Czarina. She was completely under the influence of a religious teacher, Rasputin. When any of the Czar's ministers tried to say anything against him, Rasputin persuaded the Czarina to dismiss them. The Government of Russia was therefore paralyzed as one incompetent minister was succeeded by another in rapid succession. In the last twelve months of Nicholas's rule there were no less than four Prime Ministers, three Foreign Ministers and three War Ministers.

By 1917 the peasants and workers had become heartily sick of the war. Millions of men had been forced to join the army. Food production fell and prices rose. The corruption and weakness of the Government became more and more obvious every day. Many Russians wanted a strong Government that would fight the war properly. Even some of the nobles and officials who supported the idea of absolute rule began to plan how to get rid of Nicholas.

Russia was on the verge of breakdown. This was an ideal situation for the revolutionaries who wanted to overthrow the Government.

The February Revolution

In late February 1917 strikes and food riots broke out in Petrograd. The soldiers, called out by the government to restore order, mutinied and joined the rioters. Czar Nicholas ordered the Duma (the elected assembly) to dismiss but its members set themselves up as the Provisional Government of Russia.

On the next day Nicholas abdicated from the throne. Crowds all over Russia rejoiced at the end of the Romanov dynasty.

The Provisional Government

During the next eight months the Provisional (or temporary) Government tried to govern Russia. Its leaders were reformers and moderate revolutionaries. They wanted to do two main things: win the war against Germany, and hold elections for a new Duma which would then decide what changes had to be made in Russia. They introduced many new reforms and set all political prisoners free.

But the Provisional Government was not strong enough to rule. It did not have enough power. Throughout Russia factory workers, peasants and soldiers had organized themselves into councils, or soviets, which held local control.

Lustful, illiterate, the evil monk Rasputin used mysticism to dominate the Empress—and became the power behind the czarist regime.

One of the strongest soviets was in the capital, Petrograd. It was well organized and supported by so many workers and soldiers that it could act as another government alongside the Provisional Government.

In the countryside law and order broke down and peasants seized the

Soldiers' wives protested against their inadequate rations

A loyal Russian soldier attacking one of the many deserters from the Russian army in 1917.

land for themselves. At the front thousands of soldiers, most of whom were peasants, deserted and went home. And many of the national groups set up governments independent of Russia.

Kerensky (at left) taking the salute at a military parade. He was a brilliant speaker but his Provisional Government failed to end the unpopular war or deal firmly with the Bolsheviks. Kerensky went to live in America where he became a professor of history

The Bolsheviks

When the February Revolution broke out Lenin was living in Switzerland. He was against the policies of the Provisional Government and wanted to return to Petrograd to organize the Bolsheviks (the largest group of revolutionaries) ready to seize power. The Germans, eager to see revolt and chaos weaken Russia's war effort, agreed to help Lenin return home. After travelling secretly through Germany and Sweden by train Lenin arrived at the Petrograd Station in April 1917. Other leading Bolsheviks living in exile also hurried back to Russia.

The war with Germany continued. Food supplies ran short. Most Russians wanted peace. Lenin was against the war and in his speeches his demands for "Bread, Peace, and Freedom" appealed to the people. Workers in the big industrial areas gave their support to the Bolsheviks who gained control of the Petrograd soviet.

In July the Bolsheviks tried to take over the Government by force but the attempt failed. Then, in August, an army general named Kornilov threatened to march on Petrograd with his troops and seize power. Kerensky, the leader of the

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Although the Bolsheviks were never a large group, they were well organized, skilled at propaganda, and had strong, ruthless leaders, like Lenin and Trotsky, who were prepared to do almost anything to gain and keep power. Their supporters lived in the large industrial centers and were disciplined, determined and united.

Lenin Takes Control

In the first months of Bolshevik control Lenin kept his promise to end Russia's involvement in the war. The Germans made heavy demands, however, and the treaty that was signed cost Russia about one third of its population and much of its richest land.

A decree was passed giving the land to the peasants and all banks

Two of Trotsky's Red Guards outside the headquarters of the Bolshevik leaders, Lenin and Trotsky, October 1917. It was men like these who drove the Provisional Government from power later that month.

In May 1919 Lenin speaks to new troops in Red Square.

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Effects of Revolution on Russia

The Revolution brought great and lasting changes to Russia. The Czarist system of government was completely destroyed but the new Communist way of ruling Russia was similar in many ways.

Under the old system the Czar and his ministers had ruled as dictators. After 1917 Lenin and the leaders of the Communist Party became the dictators. Both the Czarists and the Communists believed that there was one right way of looking at the world and that it was the duty of the Government to see that all Russians accepted it.

The Czar had used the peoples' belief in the Orthodox Church to get obedience to his rule. The new Soviet Government educated people to accept the ideas of Marxism and forced them to obey the Communist Party.

Both before and after the revolution all important decisions about how Russia was ruled were made in the capital. Although Lenin had said that workers should control their own affairs through local soviets, in fact the Communist Party had much greater powers than the Czar ever had.

As more people lived in towns and worked in factories, and as communications improved, it became easier for the government to enforce control. Thousands of officials were used to do this. All newspapers and trade unions were run by the Communist Party, meetings were controlled, all industries were state controlled, and the secret police killed and imprisoned opponents of the Government.

Summing Up

In this tumultuous period of Russian history two governments were overthrown, vast areas of land and vast numbers of men had been lost, and perhaps most important of all, the world's first Communist state had been established.

Looking strangely smug and satisfied, a fur-hatted Trotsky was photographed at Brest-Litovsk, Poland, as he arrived to sign a humiliating German peace treaty.

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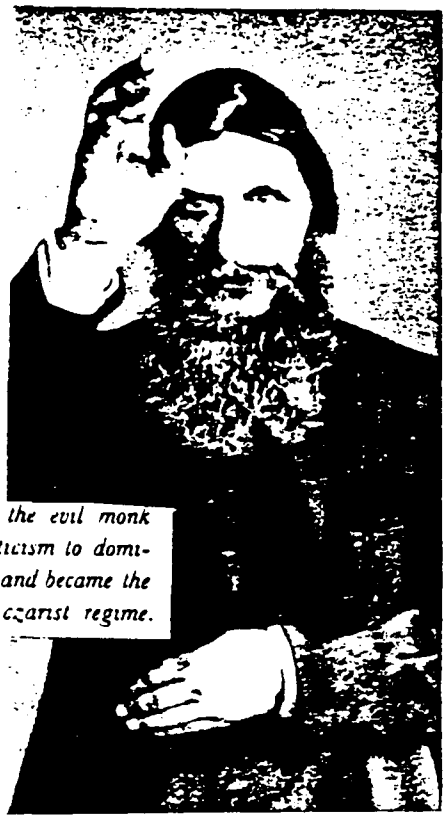

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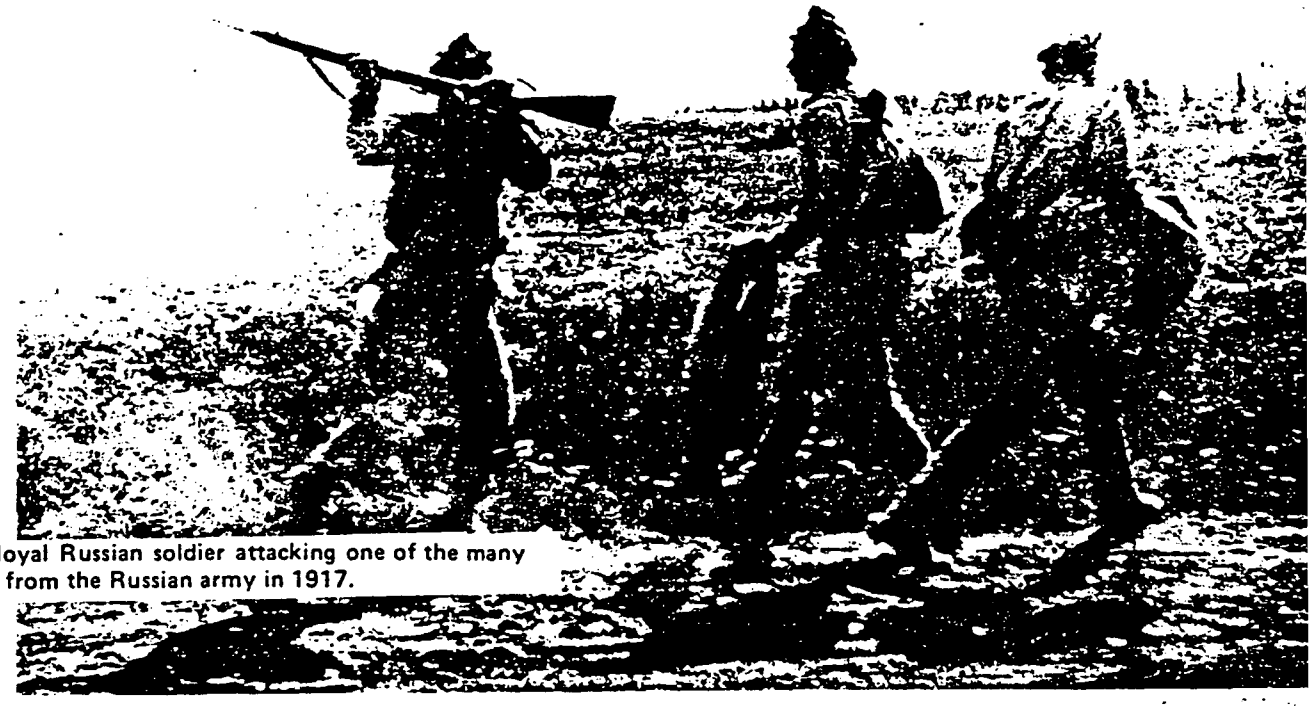

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Appendix I: Structured Note-Taking Sheets for Students

USE THIS PAPER TO JOT DOWN NOTES AS YOU READ:

BECAUSE OF THE WAR, 3 GROUPS OF PEOPLE WERE UNHAPPY WITH THE CZAR. WHY?

Soldiers unhappy because -

Peasants unhappy because -

Nobles unhappy because _

5 IMPORTANT EVENTS THAT OCCURRED BEFORE LENIN SEIZED CONTROL

1.

2.

3.

4.

5.

3 WAYS THE COMMUNIST SYSTEM WAS SIMILAR TO THE CZARIST SYSTEM:

1.

2.

3.

Appendix J: Background Knowledge Measure

BACKGROUND KNOWLEDGE MEASURE - Adapted from Langer, 1984.

To be administered by the teacher.

1. Make sure that each student has plenty of blank paper to write on.

2. Ask students to write: name, school, and grade at the top of all papers used.

3. Teacher then says:

"I am going to read some words and phrases to you. Jot down on your paper anything that comes to mind as you hear each word; just write down anything that you know about the concept. Are there any questions?"

Check for any problems. You may write each word on the blackboard as they are given if you like.

When you are ready to start, say:
"The first word is,

czar."

"Write the word, and anything that comes to your mind at all about this concept."

"The next word is, communism."

"Write down the word, and anything that this word makes you think of."

Follow the same procedure for each of these words or phrases:

World War I

Czar Nicholas II

Rasputin

hemophilia

Lenin

revolution

Bolshevik

Collect all papers, ensuring students have indicated name, school, and grade at the top of their papers.

Please put their papers in the file folder.

Appendix K: Vividness of Visual Imagery Questionnaire

VIVIDNESS OF VISUAL IMAGERY QUESTIONNAIRE:

NAME:_____
SCHOOL:_____
GRADE:_____

In each of the following items you are to rate the image that comes to mind according to one of these five descriptions:

RATING	Description
1	Perfectly clear and as vivid as normal vision
2	Clear and reasonably vivid
3	Moderately clear and vivid
4	Vague and dim
5	No image at all, you only "know" that you are thinking of the object

Consider what kind of image is seen first with your eyes open, and then with your eyes closed.

RATING: (Choose a number from 1 - 5 as described above).

EYES OPEN	EYES CLOSED	
		For items 1-4, think of some relative or friend whom you frequently see (but who is not with you at present) and consider carefully the picture that comes before your mind's eye.
_____	_____	1. The exact contours of face, head, shoulders and body.
_____	_____	2. Characteristic poses of head, attitudes of body, etc.
_____	_____	3. The precise carriage, length of step, etc., in walking.
_____	_____	4. The different colours worn in some familiar clothes.

RATING:

EYES OPEN	EYES CLOSED	
		Visualize a rising sun. Consider carefully the picture that comes before your mind's eye.
_____	_____	5. The sun is rising above the horizon into a hazy sky.
_____	_____	6. The sky clears and surrounds the sun with blueness.
_____	_____	7. Clouds. A storm blow up, with flashes of lightning.
_____	_____	8. A rainbow appears.

RATING	Description
1	Perfectly clear and as vivid as normal vision
2	Clear and reasonably vivid
3	Moderately clear and vivid
4	Vague and dim
5	No image at all, you only "know" that you are thinking of the object

Think of the front of a shop which you often go to. Consider the picture that comes before your mind's eye.

EYES OPEN	EYES CLOSED	
_____	_____	9. The overall appearance of the shop from the opposite side of the road.
_____	_____	10. A window display including colours, shapes and details of individual items for sale.
_____	_____	11. You are near the entrance. The colour, shape, and detail of the door.
_____	_____	12. You enter the shop and go tto the counter. The counter assistant serves you. Money changes hands.

Finally, think of a country scene whyich involves trees, mountains and a lake. Consider the picture that comes before your mind's eye.

EYES OPEN	EYES CLOSED	
_____	_____	13. The contours of the landscape.
_____	_____	14. The colour and shape of the trees.
_____	_____	15. The colour and shape of the lake.
_____	_____	16. A strong wind blows on the trees and on the lake causing waves.

Appendix L: Experimenter-Designed Comprehension/Recall Measures (Immediate and Delayed)

RECALL MEASURE: TODAY'S DATE: _____

SCHOOL: _____ TEACHER: _____

NAME: _____ 1ST LANGUAGE: _____

TICK ONE: Male_____ Female_____ Right-Handed _____ Left-Handed _____

I. FIND THE CORRECT NUMBER ON THE RIGHT TO MATCH THE DESCRIPTION ON THE LEFT, AND FILL IN THE BLANKS:

_____ Name of Russia's capital city in 1917.	1. Kornilov
_____ The leader of the Bolsheviks.	2. Provisional
_____ The last Czar of Russia.	3. Petrograd
_____ Temporary government after the Czar.	4. Duma
_____ Religious man who controlled the Czarina.	5. Lenin
_____ Army General who tried to seized power.	6. Soviet
_____ Elected assembly under the czarist regime.	7. Kerensky
_____ Leader of the Provisional Government.	8. Bolshevik
_____ Local council of soldiers, peasants, and workers.	9. Nicholas
_____ Revolutionary party headed by Lenin.	10. Rasputin

II. FIND THE LETTER THAT REPRESENTS <u>THE ONE BEST ANSWER</u>, AND RECORD YOUR ANSWER IN THE BLANK PROVIDED.

_____1. The October Revolution in Russia took place in,
A) 1915.
B) 1916.
C) 1917.
D) 1919.

_____2. The Germans helped Lenin to return to Russia because they wanted,
A) Lenin to organize the war effort.
B) the allied countries to be diverted.
C) Kerensky's government to fail.
D) Russia to focus on internal problems.

_____3. One reason the Czar's wife became powerful within the government was,
A) The government ministers were corrupt.
B) The Czar took command of the army.
C) Rasputin gave many useful suggestions.
D) Noblemen were devoted to the monarchy.

_____4. Which of the following best describes the Provisional Government?
A) Workers, soldiers and revolutionaries.
B) Elected body of representatives.
C) Government set up by the army.
D) Soviet in the capital city.

_____5. The first country in the world to adopt communism was,
A) China.
B) Russia.
C) Japan.
D) Germany.

_____6. During the February Revolution,
A) revolutionaries beseiged the Palace.
B) government soldiers fired on the crowds
C) the demonstrators killed the guards.
D) the soldiers deserted the monarchy.

_____7. The main difference between the February and October Revolutions was,
A) one involved violence, the other did not.
B) one was organized, the other was not.
C) one was over food, the other, over the war.
D) one was done secretly, the other, openly.

_____8. The peasants were most unhappy about World War I because,
A) there was a lack of food.
B) their soldiers had few weapons.
C) the transport systems broke down.
D) the government became irresponsible.

_____9. Noblemen were most disenchanted with the war because it brought about,
A) the deaths of their relatives.
B) unwise and improper government.
C) a shortage of food and supplies.
D) the loss of vast amounts of land.

III. DECIDE WHETHER THE FOLLOWING ARE TRUE OR FALSE, AND ANSWER T OR F IN THE BLANK PROVIDED:

_____1. The Provisional Government wanted to end the war.

_____2. Trotsky signed a fair peace treaty with Germany.

_____3. The Czar's only son had a blood disorder.

_____4. Marxism is similar to democracy.

_____5. Kerensky was indirectly responsible for Lenin's return.

_____6. Kornilov thought that Kerensky was a weak ruler.

_____7. Under Lenin's rule, secret police enforced obedience.

_____8. Under Kerensky's rule, the peasants worked harder for their landlords.

IV. NUMBER THESE EVENTS IN ORDER AS THEY OCCURRED:

_____ Lenin leads the October Revolution.

_____ Trotsky signs a peace treaty with Germany.

_____ Lenin's brother is executed.

_____ The czar abdicated from the throne.

_____ Food rioting in Petrograd.

_____ Kornilov attempts to seize power.

V. List three ways Lenin's Communist system of government was similar to the Czarist system.

1. _____

_____

2. _____

_____

3. _____

_____

PICTURE RECALL:

There were nine photographic illustrations in the text you read. Can you recall what each picture was about?
Describe in any order the pictures that you remember.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

DELAYED RECALL: TODAY'S DATE: _____

SCHOOL: _____ TEACHER: _____

NAME: _____

I. DECIDE WHETHER THE FOLLOWING ARE TRUE OR FALSE, AND ANSWER T OR F IN THE BLANK PROVIDED:

_____1. Kerensky was indirectly responsible for Lenin's return.

_____2. Under Lenin's rule, secret police enforced obedience.

_____3. The Czar's only son had a blood disorder.

_____4. Under Kerensky's rule, the peasants worked harder for their landlords.

_____5. Marxism is similar to democracy.

_____6. The Provisional Government wanted to end the war.

_____7. Kornilov thought that Kerensky was a weak ruler.

_____8. Trotsky signed a fair peace treaty with Germany.

II. FIND THE LETTER THAT REPRESENTS <u>THE ONE BEST ANSWER</u>, AND RECORD YOUR ANSWER IN THE BLANK PROVIDED.

_____1. During the February Revolution,
A) the demonstrators killed the guards.
B) the soldiers deserted the monarchy.
C) government soldiers fired on the crowds
D) revolutionaries beseiged the Palace.

_____2. One reason the Czar's wife became powerful within the government was,
A) The government ministers were corrupt.
B) Noblemen were devoted to the monarchy.
C) Rasputin gave many useful suggestions.
D) The Czar took command of the army.

_____3. The Germans helped Lenin to return to Russia because they wanted,
A) the allied countries to be diverted.
B) Russia to focus on internal problems.
C) Kerensky's government to fail.
D) Lenin to organize the war effort.

_____4. The peasants were most unhappy about World War I because,
A) their soldiers had few weapons.
B) there was a lack of food.
C) the government became irresponsible.
D) the transport systems broke down.

_____5. Noblemen were most disenchanted with the war because it brought about,
A) the deaths of their relatives.
B) the loss of vast amounts of land.
C) a shortage of food and supplies.
D) unwise and improper government.

_____6. The first country in the world to adopt communism was,
A) Japan.
B) Germany.
C) Russia.
D) China.

_____7. The main difference between the February and October Revolutions was,
A) one was over food, the other, over the war.
B) one was organized, the other was not.
C) one involved violence, the other did not.
D) one was done secretly, the other, openly.

_____8. The October Revolution in Russia took place in,
A) 1918.
B) 1917.
C) 1916.
D) 1915.

_____9. Which of the following best describes the Provisional Government?
C) Government set up by the army.
A) Workers, soldiers and revolutionaries.
D) Soviet in the capital city.
B) Elected body of representatives.

III. NUMBER THESE EVENTS IN ORDER AS THEY OCCURRED:

_____ The czar abdicated from the throne.

_____ Lenin leads the October Revolution.

_____ Food rioting in Petrograd.

_____ Lenin's brother is executed.

_____ Trotsky signs a peace treaty with Germany.

_____ Kornilov attempts to seize power.

IV. FIND THE CORRECT NUMBER ON THE RIGHT TO MATCH THE DESCRIPTION ON THE LEFT, AND FILL IN THE BLANKS:

_____ Army general who tried to seize power.	1. Bolshevik
_____ Local council of soldiers, peasants, and workers.	2. Duma
_____ Leader of the Provisional Government.	3. Lenin
_____ Temporary government after the Czar.	4. Kerensky
_____ The leader of the Bolsheviks.	5. Rasputin
_____Capital city of Russia in 1917.	6. Soviet
_____ The last Czar of Russia.	7. Petrograd
_____ Religious man who controlled the Czarina.	8. Kornilov
_____ Revolutionary party headed by Lenin.	9. Nicholas
_____ Elected assembly under the czarist regime.	10. Provisional

V. List three ways the czarist system of government was similar to the communist system under Lenin. _____

_____

_____

_____

_____

VI. There were nine photographic illustrations in the text you read. Can you recall what each picture was about? Describe in any order the pictures that you remember.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

Appendix M: Text Use for the Pilot Study

The storming of the Winter Palace, March 1917.

The Czar Nicholas II of Russia with his only son, Alexis

The Fall of the Romanov Dynasty

The Russian Revolutions of 1917:

Introduction

The year 1917 was a momentous one in the history of Russia for this fateful year marked the end of the Russian monarchy and the establishment of the world's first communist state.

What were the events that led to the overthrow of the last Czar of Russia, Nicholas II? What were some of the factors that enabled the small Bolshevik party to emerge in control of the largest state on earth?

I. PRECEDING EVENTS:

Defeats and Casualties in World War I The initial reaction of the average Russian to the German declaration of war was one of intense nationalistic fervour, but this attitude was to change after horrendous defeats. Seventeen days after mobilization, Russia launched an offensive at Tannenburg; the disastrous result was a staggering defeat for the Russian forces. Other defeats and retreats followed: heavy fighting took enormous casualties; supply lines broke down.

By the end of 1914 one million men, one quarter of the Russian army, had been killed, wounded, or taken prisoner. By August 1915, close to 30 percent of the Russian soldiers were being sent into battle unarmed and were told to pick up the rifles of their wounded or dead.

The Germans had 161 divisions of men fighting Russia and only 84 fighting elsewhere, but the Russian people did not know these figures; they only knew they were losing territory and men in large swaths.

Nicholas at the Front Although ten of Nicholas's twelve ministers opposed the decision, Nicholas foolishly decided at this point to take personal command of the army. By so doing he hoped to restore the prestige of the dynasty and, at the same time avoid the demands of the Duma: the Duma, an elected assembly with little power, were demanding a Cabinet that had the confidence of the country not one devoted only to the czar. Nicholas also had a romantic concept of his duties as czar. One of the duties was to lead his people: he would do so physically as well as diplomatically. Secondly, there is evidence to suggest that Alexandra, his wife, (with the advice of Rasputin) believed the commander at the time (an uncle of the czar) was less than loyal. In Nicholas's absence, Alexandra would be his "eyes and ears", and would assume all his authority. Unfortunately, so would Rasputin. Nicholas' decision was indeed fateful.

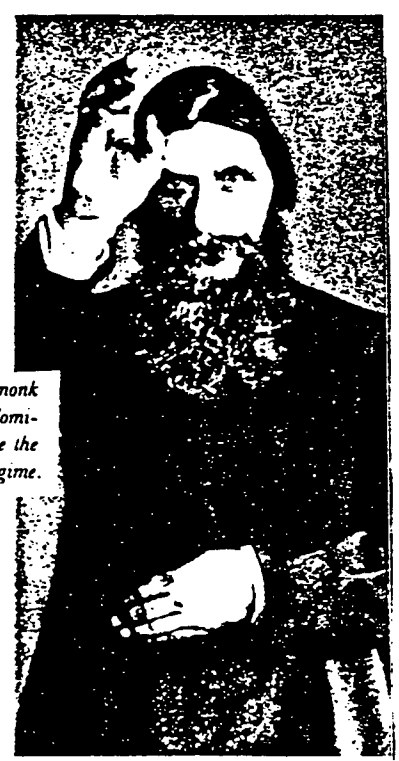
Alexis Has Hemophilia After four daughters, Alexandra gave birth to a son, called Alexis. Nicholas was ecstatic in having an heir to the

throne but six weeks later, it was discovered that the baby suffered from hemophilia, an inherited disease transmitted from female to male. It is a disease in which the blood fails to clot, and in which the slightest nick or bump may cause hemorrhaging and death.

In trying to control her anxiety and frustration, Alexandra hurled herself into the activities of the Russian Orthodox Church. When she heard that the Siberian starets Gregory Rasputin, who was reputed to have the power of faith healing, was in St. Petersburg, she believed God had sent her a respite from her torture.

Alexis recovering from one of his many brushes with death brought on by the disease hemophilia. The strain of these ordeals is evident in the face of his mother, Alexandra.

Influence of Rasputin The rise of Rasputin to the de facto control of Russia is one of the most bizarre tales in modern history. Rasputin was a specific example of a Russian phenomenon: the starets or holy man. These were people who usually lived holy lives and who served as advisers or spiritual guides to any who came to them. Some were elderly monks; some were frauds. Rasputin was among the latter.



Lustful, illiterate, the evil monk Rasputin used mysticism to dominate the Empress—and became the power behind the czarist regime.

Having achieved a reputation as a clairvoyant by the age of 12, Rasputin later ingratiated himself among high ranking officials of St. Petersburg society. To Alexandra, Rasputin represented all that she had prayed for: He was a peasant, devoted to the czar and the Orthodox Church, and he was soon to help her son live. This was to be the key. As the British geneticist Haldane wrote, "Rasputin took the empire by stopping the bleeding of the Czarevich."

On a number of occasions, when Alexis was near death due to days of severe hemorrhaging, Rasputin was consulted and the bleeding mysteriously ceased. After this, believing that Rasputin could succeed where medical experts failed, placed her faith and the health and the fate of her son under his guidance.

Thus while her husband was at the front, Alexandra evaluated ministers based almost entirely on whether or not they held Rasputin in high esteem. Since she was personally against democracy and responsible government, ministers devoted to these ideals wer not long in power. Worse, far more important than a man's understanding of supplying food or munitions or conducting diplomacy, was his attitude to

Rasputin and Rasputin's appraisal of him.

Politically, things could hardly have been much worse that they were by December, 1916; in the sixteen months that Alexandra and Rasputin had taken over there were countless government dismissals and appointments made. Many of the new ministers appointed on Rasputin's advice had no idea of state business; one of these, Boris Sturmer was said to be pro-German. The empress herself was German and rumours began to circulate not only that she was pro-German and anti-Russian in her policies, but also that she and her daughters were involved in illicit love affairs with Rasputin. Most writers fail to believe these stories now, but the situation at the time was such that many people did give credence to them.

Rasputin is Murdered Finally some Russians of importance began to see that the only way to remove the influence of Rasputin was to kill him. A plan was hatched by Prince Felix Yusupov to poison Rasputin during an evening soiree. When the poison failed to have any effect, Rasputin was shot several times and his body disposed of through a hole in the frozen Neva. Three days later, the body was found -- the lungs full of water. Rasputin, "the mad monk" whose blood was full of poisin and whose body was torn by bullets, had died by drowning.

II. THE REVOLUTIONS OF 1917:

Food Shortages in Petrograd Compared with other revolutions of historical significance, the March Revolution seemed almost accidental, almost a mistake, and certainly unplanned. Whereas other major revolutions have been struggles of a mainly political nature, the March Revolution was rooted in economic dissatisfaction brought on by the continuing setbacks of the war. The major problem in Petrograd, the capital, was a shortage of food and

A breadline in Moscow in 1916

fuel brought on by the at least ten million men which had been taken from the farms for army service; what produce there was went to the soldiers.

The March Revolution The first inkling of revolution came on Saturday, March 10 when red banners were observed and slogans such as "Down with the war!" and "Down with the German woman!" were heard. Nicholas, by this time returning to the front after a visit at home, ordered the demonstrations to be put down - the implication being that force was to be used if necessary. However, it transpired that the troops, sympathetic to the people, refused to defend the government by firing on the crowds. By Monday, 66,000 troops were in mutiny, and by Tuesday afternoon, the final stronghold of czarism, the Winter Palace was surrendered - Petrograd had fallen.

Abdication of Nicholas Nicholas, was still the czar, was absent from the capital, his information about the uprising received only in spurts. He was aware that the Duma was demanding his abdication, that his troops had deserted him, and that his family was in the hands of the newly formed Provisional Government. Under great pressure, on March 15 at 3:00 p.m. he abdicated. Three hundred and four years after the first Romanov came to the throne, the dynasty existed no longer.

by a disreputable person of this type.

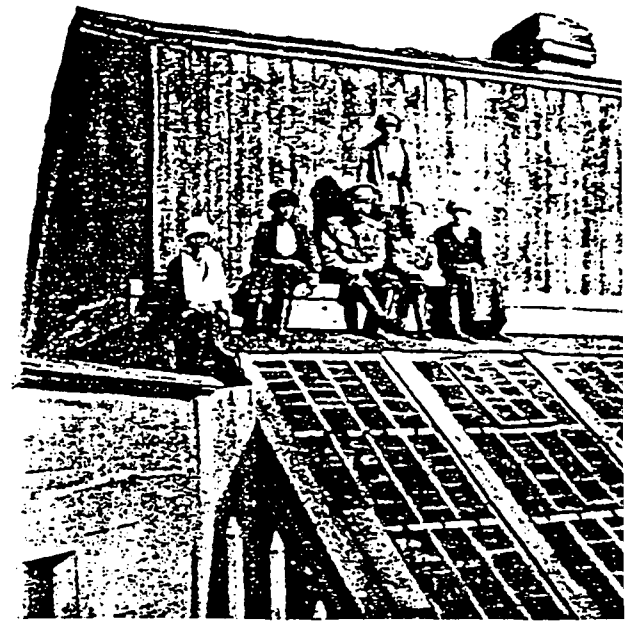
Role of World War I The outbreak of World War I was definitely a cause of Revolution. Economically, the war brought a halt to industrial and agricultural progress, where great advances had been occurring. Politically too, the consequences were disastrous: the Russian people wanted to end the war; the timing of the July 1917 offensive showed a lack of awareness of public feeling. Militarily, the war brought misery; soldiers that are inadequately trained, equipped, and fed do not win wars, and yet this was the condition of the average Russian peasant soldier.

The Role of Luck One cannot help but be struck by the role of chance at this time. For example, if Nicholas and Alexandra had not been so deathly afraid of a Duma and a consititutional monarchy, the revolution quite possibly would never have manifested. Had Alexis been born a healthy child the empress would probably never have fallen under the influence of Rasputin, and had there been no war, Russia might easily be a monarchy today. Had Nicholas not ignored the advice of his counsellors in assuming command at the front, Alexandra might never have become so powerful. The list is almost endless.

Although these factors led to revolution they did not dictate who would emerge victorious. What enabled the Bolsheviks to capture the government from under the noses of the Provisional government, other revolutionary groups, and the army?

IV. WHY THE BOLSHEVIKS WON

One formidable factor was that the Bolsheviks were strong at the center of government in Petrograd and in Moscow. Secondly, the Bolsheviks



The deposed Czar Nicholas II and his family were interned at this house in t Urals. Here, they were later all shot and killed by the Bolsheviks who fear that if they remained alive they might serve as a focus of resistance to Bolshevism.

were able to work through the Soviet to gain power, using them as an acceptable "cover". Another factor that helped was the absence of any really efficient and strong opposition. Perhaps the most important and determining factor in the Bolshevik seizure of power was the incredible ability of its leaders; both Lenin and Trotsky played a significant role. These leaders saw the need for propaganda to win over the masses, and their absolute dedication to their cause meant that they lived and breathed revolution.

Summing Up In this tumultuous period of Russian history two governments were overthrown; vast areas of land and vast numbers of men had been lost; in spite of setbacks considerable economic, industrial, social, and cultural advances had been made, and perhaps most important of all, the world's first Communist state had been established.