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THE EFFECT OF MENTAL IMAGERY AND COGNITIVE STYLES ON LISTENING COMPREHENSION

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THE EFFECT OF MENTAL IMAGERY AND COGNITIVE STYLES ON LISTENING COMPREHENSION

A

DISSERTATION

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THE EFFECT OF MENTAL IMAGERY AND COGNITIVE STYLES

ON LISTENING COMPREHENSION

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TO THE MEMORY OF MY FATHER

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CHAPTER I

INTRODUCTION TO THE STUDY

In an instructional setting the learner selects what will be learned. It is what the learner actually does with the instructional materials that brings about learning and retention. To learn, one has to pay attention to incoming information, retain it in short-term memory, and then encode and store it in long-term memory. For learning to be useful, one should also be able to retrieve the stored information from long-term memory. The more paths available for retrieval the more accessible the stored information. There are some acts that assist the process of encoding and retrieval of information. Rothkopf (1970) terms these behaviors which expedite learning as mathemagenic. Some examples of mathemagenic behaviors are recitation, overlearning, note-taking, mnemonics, and mental imagery (Rosser & Nicholson, 1984). The use of these techniques facilitates the processes of encoding information for storage in long-term memory and of its retrieval in the

future.

In this study, the use of mental imagery as a strategy for comprehending prose materials presented orally was investigated. Also, the influence of mental imagery in the individual learner's field dependent/field independent cognitive style was examined. The time lapse before recall constituted the third dimension of this reseach. The effect of induced mental imagery, cognitive style, and time on the recall of prose materials was measured by the learner's score on a multiple-choice test.

BACKGROUND

Mental imagery is now widely accepted as an important adjunct in human learning. Although experimental research in this area does not exceed twenty five years, the subject is one of the most ancient and controversial topics in the history of intellectual development. Aristotle in De Anima writes "The soul never thinks without a mental picture" (quoted in Yates, 1966, p.32). According to Aristotle knowledge is a result of experiences, and the information coming through the senses are interpreted and then stored in the form of images (Yuille & Marschark, 1983). Through centuries the subject of mental imagery has played an important role, not only in the philosophical interpretation of thought and memory process, but in magic, religion and literary works. As Segal explains "we know so much about

imagery, it is hard to recognize how little of what we know is documented and how much of our knowledge is speculation" (1971, p.1). In a historical overview, Yuille and Marschark (1983) noted that the subject of mental imagery was revived by Aquinas in the 13th century, that British philosophers, from Hartley to Mill considered image an element of the mind, and Hume explained that all mental activities could be defined in terms of association of mental images. As modern psychology evolved, mental imagery became the subject of rigorous investigation of some prominent psychologists such as Fechner, Wundt, Galton, James, and Titchener. For Wundt, images were the building blocks of mental structure (Yuille and Marschark, 1983), and Titchener, considering imagery as a basic cognitive function, utilized introspection as the central tool in analyzing the images of the mind (Segal, 1971). Galton invented the first questionnaire on mental imagery and conducted the first statistical surveys (Holt, 1964).

The early years of this century witnessed a revolution in the field of psychology with the development of the Behaviorist school. Watson, generally regarded as the founder of the school, discredited the study of mental images on the grounds that it was mentalistic and unobservable (Richardson, J. 1980). He proposed that mental images were the ghosts of sensations and had no functional

importance whatsoever (Richardson, J. 1980). Holt (1964) remarked that during the period between the two world wars, eidetic imagery emerged as a topic of intense research, yet in general, the psychologists lost interest in studies on mental imagery. There was some research on mental imagery, however, during this "dry period", but it was done by European psychologists, and not published in English (Holt, 1964). As a result, for about forty years the study of mental imagery was abandoned in the discipline of psychology (Hebb, 1960; Holt, 1964; Jacob, 1976; Richardson, J. 1980). Gradually, in the early 1960's, signs of change began to appear in research toward all kinds of mental experiences, especially mental imagery (Holt, 1964). Paivio has stated, "One of the most striking facts concerning the history of the concept (imagery) is that it has been repeatedly criticized and opposed and yet the critics never quite succeeded in burying the image"(Paivio, 1976, p.47). He reasoned that the concept simply has intuitive appeal.

The revival of interest in the subject of mental imagery was primarily initiated by the extensive work of Paivio. Staying within the boundaries of the research principles proposed by the behaviorist school, Paivio considered mental imagery as a hypothetical construct that can be defined by operational procedures. He identified three sorts of operational procedures as the foundation for

the research on mental imagery (Paivio, 1972):

1. Instructing the experimental subjects to use mental imagery in their performance of psychological tasks.
2. Measuring the amplitude of image-evoking potential of the stimulus materials as reported by the subjects and the predictive potential of these reports in relation to the subject's psychological performance.
3. Determining the individual differences in terms of vividness of mental imagery experienced by subjects, and subject's performance in spatial manipulation tests.

Among the different areas of research in the first category of this list, the role of imagery in memory and human learning has attracted the greatest degree of attention (Richardson, J. 1980). The research interest might have been inspired by the accounts of ancient orators who used the mental strategy of making association among several things, and then visualizing them all together. Of the recent studies on imagery process, those related to verbal learning are the earliest and still the most reliable. Mental imagery has been tested across different types of verbal learning as paired association (Dilley and Paivio, 1968; Rohwer, Ammon, Suzuki & Levin, 1971; Wolff &

Levin, 1972), recognition (Nelson, 1971; Bird & Bennet, 1974; Nelson & Kosslyn, 1976; Perlmutter and Myers, 1976), recall (Rossi and Rossi, 1965; Bevan and Steger, 1971; Paivio and Csapo, 1973), and concept learning (Oxford, 1978; Katz and Paivio, 1975). It has also been examined on different types of learners from kindergarten to adult (Nelson, 1971; Hoffman and Dick, 1976; Kosslyn, 1975; Dirks and Neisser, 1977), and in relation to cognitive styles (Cullen, 1980; Pierce, 1980; Carrier, Joseph, Krey and LaCroix, 1983). These research studies have demonstrated that mental imagery is an effective memory aid in verbal learning.

In addition to the research evidence, common-sense experiences also indicate that forming mental images is a helpful mental strategy in the retention as well as the recall of verbal information. The ability to create mental images is part of one's cognitive development very similar to the development of language and motor behavior, although interpersonal and environmental conditions help them to flourish (Tower, 1983). Piaget (1952) explains that imaginal abilities develop as a result of neurological differentiation during the preoperational stage of a child's cognitive growth. So a certain degree of neurological maturation is necessary before thinking also can be represented in the form of images (Piaget & Inhelder, 1969).

Gradually as the brain develops, the left and right hemispheres become clearly lateralized and each specialized in certain functions--the left hemisphere processes verbal and sequential information and the right hemisphere, imaginal-pattern processing (Tower, 83). Imaginal abilities continue to grow as the potential of right hemisphere increases, also as a result of mastery of language and practice of symbol formation. However, these two systems, imaginal and verbal, develop independently, and become integrated only in middle childhood at about the mental age of seven years (Forisha, 1975).

Learning, as Winn (1982) defines it, involves internal processes by means of which perception, assimilation, interpretation, storage, and retrieval of information are achieved. He states that research and experience have indicated that individuals use only some of these processes proficiently. These processes, when can be used productively in learning are 'mental skills'. However, a mental skill could be considered a learning strategy only when it is applied to a specific learning task, either by the individual voluntarily, or as a result of direct instruction to do so. Mental imagery, as an internal process, is a mental skill in those learners who have the ability to create and manipulate mental images. When internal visualization is used to learn something, it

becomes a learning strategy. Several studies suggest that developing visualization skill is possible through instruction (Kosslyn, 1975; Paivio & Foth, 1970; Paivio, Yuille, & Smythe, 1966; Simon, 1972) and visual learning strategies could be achieved through training (Sternberg and Weil, 1980; Thorndyke and Stasz, 1980). Alan Richardson (1983) presents the necessity for an imagery training program by drawing a simple comparison. He states;

> one function of training programs designed to improve the vividness of voluntarily produced images is to make us more aware of what is continually taking place within us. Just as an art teacher may bring the usually unnoticed effect of light and shade on the trunk of a tree to the students'attention, so the imagery trainer may help the weak imager to relax and pay attention to the sensory details of similar internally represented events.(p.14)

It can be concluded from the above discussion that the development of visual skills and visual learning strategies is possible through instruction. Fleming suggests that "imagery strategy for processing and storing of information should be taught; together with other learning strategies, as one early and universal part of school curricula" (1977, p.45). Giving learners imagery instruction increases

learning and retention, for constructing mental images provide more pathways for the retrieval of information (Kulhavy & Swenson, 1975). Furthermore, creating images requires attention and active participation on the part of the learner. It also forces the individual to fit the new information with the already existing mental structure. Rosser and Nicholson (1984) believe that generating mental images is helpful for several reasons. First, to form images the learner must get actively involved. Second, creating mental images provide a rehearsal, so it leads to reflecting upon the stored information once more. Finally, images like pictures offer another source of information.

To test the role of individual differences in relation to induced mental imagery, the factor of field dependent/field independent cognitive style was examined in this research. Research by Witkin and his colleagues (1962) has distinguished clearly between the cognitive charactersitics of field dependent and field independent individuals by the manner they perceive, store and utilize information. Field independent individuals tend to have an analytical approach, while field dependent individuals prefer a holistic approach in their cognitive activities. The field independent individual has the ability to analyze and restructure the stimuli, in contrast, the field dependent individual lacks this capability. Forisha (1983)

remarks that it is possible to draw a loose connection between these two styles and right and left hemispheres of the brain.

The connection has been also drawn in relation to hemispheric specialization and imagery capabilities. Several studies have clearly indicated that imagery tasks are processed primarily in the right hemisphere of the brain (Galin and Ornstein, 1974; Richardson, A. 1978; Kimura, 1973). Considering the above studies, it is evident that the connection between imagery capabilities and field independent/field dependent cognitive style is through their relationship to right and left hemispheres of the brain.

STATEMENT OF THE PROBLEM

The problem was to investigate the effect of induced mental imagery, created through the auditory mode, on the learning of English prose among undergraduate college students. The effect of induced mental imagery in relation to field dependent/field independent cognitive style, and the degree of time lapse before recall constituted the other dimensions of this study.

PURPOSE OF THE STUDY

In the research literature on mental imagery, the studies on the effect of induced mental imagery to assist learning by listening to meaningful prose are few, especially in relation to testing the field dependent/field

independent cognitive style within the early stage of adulthood. The purpose of this study is to answer some of the related questions in these areas. The specific questions of concern in this investigation are:

1. Does induced mental imagery help individual learners in early adulthood learn meaningful prose?

2. Is there an interaction between the field dependent/field independent cognitive style and the presence or absence of induced mental imagery?

3. Is there an interaction effect between induced mental imagery and the degree of time lapse before recall (immediate or delayed)?

4. Is there an interaction among the induced mental imagery, field dependent/field independent cognitive style, and time lapse before recall?

HYPOTHESES

H1: Subjects receiving induced mental imagery instruction will perform better than subjects receiving no instruction on induced mental imagery under the condition of immediate recall.

H2: Subjects receiving induced mental imagery instruction will perform better than subjects receiving no instruction on induced mental imagery under the condition of delayed recall.

H3: Field independent subjects will benefit more from the mental imagery instruction than field dependent subjects; therefore, they will perform better under the condition of immediate recall.

H4: Field independent subjects will benefit more from the mental imagery instruction than field dependent subjects; therefore, they will perform better under the condition of delayed recall.

H5: The greatest degree of recall will occur under the condition combining induced mental imagery, field independent cognitive style, and delayed recall.

DEFINITION OF TERMS

The following definitions were used in this study:

COGNITIVE STYLES : The manner of perceiving, storing, and utilizing information, or in general, the information-processing habits of an individual.

COMPREHENSION : The process by which the receiver interprets linguistic signals.

FIELD INDEPENDENT/FIELD DEPENDENT : A cognitive style that relates to the individual's analytical or global style of information processing. A field independent individual can perceive items (parts) separate from their background, therefore, overcoming the influence of an embedded context. A field dependent individual is dominated by the total organization of perceptual field and perceives parts fused

into their background. This cognitive style was measured by the Embedded Figure Test (Witkin, Oltman, Raskin, and Karp, 1971).

INDUCED MENTAL IMAGERY : The individual's mental strategy to generate mental images in the absence of direct perceptual experiences.

MENTAL IMAGERY : A thought representation that has sensory quality. Mental images are constructed from memory and are similar in characteristics to their corresponding perceptual experiences from which they were derived.

PROSE : The spoken or written part of the language that does not contain the metric structure of poetry or verse.

RETENTION : The learning experience that persists during a period of time, with no opportunity for performance or practice, and becomes evident in the forms of recall, recognition or reproduction.

YOUNG ADULTHOOD : The period between eighteen and twenty-five years of age.

LIMITATION OF THE STUDY

There were several limitations involved in this study. First, because of some difficulties involved in getting the necessary number of subjects for the study, random sampling was not possible. Therefore, the participants were only those subjects who expressed interest in participating in

this study by signing up for it. Second, The subjects were all undergraduate students enrolled in an introductory psychology course. Any generalizations beyond the characteristics representing this group must be made with great caution. The third limitation concerned the type of instrument used to produce induced mental imagery. The image evoking capacity of the passages used in this study was not determined. Although the prose passages used in this study were taken from a standardized text, they were originally constructed for reading comprehension exercises, and not for listening comprehension. Finally, the content of prose passages dealt only with a few topics which might or might not have been of interest to this specific group of subjects. And in addition, the subjects' interpretations of the passages were made on the basis of their knowledge and background experiences. Any generalization in these respects may lead to an invalid conclusion.

SIGNIFICANCE OF THE STUDY

This study was designed to investigate the role of induced mental imagery in the learning of prose passages among young adults. The factor of field dependent/field independent in relation to the subject's ability to generate mental images shaped another dimension of this study. There were several reasons for attempting this research. First, it was a novel idea to test the three variables of mental

imagery, field dependence/field indepence cognitive style, and time lapse before recall simultaneously. Second, this study, by its design, created a classroom condition under which the students listened to information presented to them in the form of prose, and were required to retain it. For a long time, and for the most part, the emphasis in research has been on the traditional classical verbal learning (Baddeley, 1976). So, testing prose learning in a classroom type setting was somewhat more realistic and useful to the everyday classroom teaching. Third, considering induced mental imagery as an internal organizational technique, if it proved to be an effective learning strategy among young adults, it could have important implications for teaching where providing external strategies through the use of media is too costly. Finally, the research might indicate clearly that mental imagery was more beneficial among field dependent or field independent groups of the subject. If so, it could have been considered as a specific learning strategy for the group.

CHAPTER II

REVIEW OF RELATED LITERATURE

THEORETICAL BACKGROUND

Among the theories interpreting the role of imagery in the learning and retention of information, Paivio's dual-coding model (1971) has given the most meaningful theoretical framework to the existing research on mental imagery. The findings are founded on a large body of empirical data that has been gathered for a period of twenty five years. The model has integrated the conceptual peg mnemonic system and the theory of dual processing, and in the heart of it is imagery, playing a significant role in the interpretation of memory.

The great emphasis in the conceptual peg system is on the role of association in learning; however, the dual processing theory has inspired a greater degree of research. According to this theory, there are two major modes of coding for incoming experiences: verbal and visual. The verbal mode of coding involves sequential processing of information and is auditory-motor in nature. This procedure is most appropriate for abstract ideas and information

organized in a sequential manner, such as language. Imagery mode, on the other hand, integrates information into a single, simultaneus representation, and is best suited for spatial information like visual and concrete ideas.

Paivio's dual-coding theory is based on three psychological assumptions:

1. Images have qualities similar to perception. Since an image can be one integrated unit with traces of perception, it is stored and retrieved later as one integrated whole, so it facilitates memory.
2. Images are recalled by either verbal or visual cues.
3. Learning is a result of associations. The act of association in the verbal mode results a chain of words, and in the imaginal system, an integrated image.

According to this theory, abstract information typically is processed verbally, while the processing of the concrete materials is done in both verbal and nonverbal codes. Some factors which determine the activation of one or both systems are individual differences, the characteristics of the task involved, and the functional utility of the codes within the task. Regardless of these factors, the recall of concrete materials is better than that of abstract information because there are two retrieval

routes, imagery and verbal, available to obtain the stored information from memory. Also, because when items are processed through two systems, they become more resistant to forgetting.

Several research projects demonstrated a functional difference between the verbal and imagery mode of processing. Jensen & Rowher (1965) instructed their subjects to use imagery in free recall and serial learning. Brooks (1967, 1968) investigated modality-specific interference of the two coding systems of memory by presenting the subjects with simultaneous verbal and imagery tasks. Studies by Bower (1970, 1972), designed for the subjects to use interactive mental images in paired-associate learning, showed that a greater degree of recall occured in the dual setting. Paivio and Csapo (1969) conducted a study in which the stimuli (pictures and words) were presented at such a fast rate that the subjects were prevented from naming the pictures or imaging the words. They found no difference in recall between the two types of stimuli. However, at a slower rate, the results indicated the recall increased from abstract words to concrete words to pictures, respectively. It was concluded that ease of generating imagery for the concrete words and labeling of pictures enhanced the recall of these two items. This study perhaps gives the strongest support to the dual-coding

model.

In general, the imagery studies have been on two types of imagery learning conditions: (1) imposed imagery, in which the learner is presented with pictures, and (2) induced imagery, in which the learner has to generate mental images. Both types of imagery learning conditions have shown to be effective ways of learning and retaining verbal materials (Fleming, 1977, 1979; Pressley, 1977).

INDUCED IMAGERY

The effectiveness of mental imagery in the learning of prose materials depends on several variables. One crucial factor is age. Children in their first three years of elementary school can benefit from pictures, but not self-generated imagery (Dunham & Levin, 1979; Lesgold, Degood, & Levin, 1977). About the age of eight and nine, however, children gradually become capable of creating and using their own mental images when learning and retaining prose materials (Levin, Rohwer and Cleary, 1971; Guttman, Levin, & Pressley, 1977; Lesgold, McCormick, & Golinkoff, 1975; Pressley, 1976). Shimron (1975) using first and fourth graders as subjects, compared the the effect of four instructional sets: imagery (instruction to form mental images), pictures (related illustration), unstructured pictures (parts of the pictures were shown randomly), and control (no instruction). The result showed that the fourth

graders benefitted from imagery instruction, while pictures were more useful to the first graders. These findings indicate that there is a developmental aspect in relation to imagery capability as a prose learning aid.

Giving instruction has proven to be effective in helping subjects generate mental images. Lesgild, McCormick and Golinkiff (1975) instructed their subjects to draw cartoons explaining stories for several weeks. Gradually the cartooning was eliminated as the subjects learned to construct mental images. When tested, the experimental group remembered more than the control group from the instructional task. In another study, Pressley (1976) indicated that there is no need for extensive training. His experimental group recalled more with only twenty minutes of training in forming mental images. At the same time, giving instruction in constructing imagery seems to have no effect on older children (Kulhavy and Swenson, 1975; Mahjoor, 1979; Rasco, Tennyson, and Boutwell, 1975).

Some research also indicate that mental imagery may be of benefit to poor readers. Levin (1973) has identified two types of poor readers: the deficit poor reader, whose poor comprehension results from lack of necessary skills such as decoding and vocabulary knowledge, and the difference poor reader, who has difficulty in integrating the text. Using mental imagery instruction, Levin showed that difference

poor readers could improve their reading up to the level of good readers. This result is consistent with Rohwer and Matz's (1975) study which indicated when subjects have problem deriving meaning from test, they can benefit from imagery instruction. Smith (1979) found using mental imagery and oral presentation maximized reading comprehension among a group of 10 year olds who had reading problems. Mental imagery training has also significantly increased the recall of low achieving college freshmen in a study by Snowman, Krebs, and Lockhart (1980), the experimental group recalled twice as much information as the control group.

One basic hypothesis in relation to the use of imagery in learning of prose is that it constitutes an effective organizational strategy which will inhance one's comprehension and recall of prose. In this regard, it may simply be that the organizational feature of the imagery that facilitates the learning of those individuals who have reading comprehension problem (difference poor readers). Comparing the experimental-produced organization with the subject-generated organization, Cromer (1970) pointed out that since in the process of imaging the thematic content the difference poor readers had to attend to semantic characteristics and relationships, their reading comprehension improved.

PRESENTATION MODE

Another determining factor in the usefulness of mental imagery is the mode of presentation. Several studies have examined the role of oral presentation in the learning of prose passages among children in kindergarten through second grade (Lesgold, Levin, Shimron, & Guttman, 1975; Silvern, 1980). With older children, however, both presentation forms, oral and written have been used in learning prose materials (Haring & Fry, 1979; Jusczyk, Kemler, & Bubis, 1975; Levin & Berry, 1980; Schallert, 1980). The results of research in this area pointed to an interesting conclusion that both imposed and induced imagery facilitate learning under oral presenation mode rather than the written presentation mode. Brooks (1967), reporting on four experiment has described the conflict between reading and visualizing. He found that listening to the same information did not interfere with the vizualization, but the conflict with reading happened even when the subjects were previously allowed to see the materials. Two possible interpretations for this result was offered. One, visualization and reading are processed through the same neural pathways. Two, the reading process simply interfers with the reorganization of the materials from the perceived form regardless of what the referent is. The compatibility

hypothesis of coding system (verbal and imagery) with the presentation mode (reading and listening) was supported in studies by Levin and Divine-Hawkins (1974). Oral presentation and imagery proved to be superior to the written mode and imagery even with poor readers to the extent that they scored as high in recall as high readers (Maher and Sullivan, 1982). Levin and Lesgold (1978) conclude that when using pictures, the verbal information should be presented orally so information can be processed through both channels.

The conclusion from the above studies is that both imposed and induced mental imagery tend to be effective learning aids under the oral presentation condition, but with the written presentation, there is no conclusive result. According to dual-coding theory, imagery and oral presentation should reinforce and complement each other since they come through both channels. On the other hand, imagery and the written presentation form are both processed through the same channel, and therefore, would tend to interfere with each other.

COGNITIVE STYLES

Cognitive styles may also play a role in the usefulness of mental imagery in the learning of prose materials. The research on the interaction of cognitive styles and mental imagery is at the elementary stage, and among the different

types of cognitive styles only field independence/field dependence dimension has been researched in relation to imagery. In comparing field independence/field dependence cognitive style and cognitive abilities, field independent individuals tend to be more analytical and objective in their approach to problem-solving situations. On the other hand, the field dependent individuals have a global and subjective orientation. Field independent persons are less distracted by background information and are especially more capable of restructuring and reorganizing presented information, if it seems necessary to do so.

Walker, O'Leary & Chaney (1979) investigated the relationship between field independence and mental imagery. They hypothesized that field independent learners should benefit from imagery instruction since they depend on internal rather than external referents. The results confirmed the hypotheses. In a similar study, Pierce (1980) found a strong relationship between imagery-assisted prose recall and field independence cognitive style among third graders. The conclusion was that field independent children may have been more able to organize parts of a story to assist their recall. Seemingly, field independent individuals can benefit from mental imagery instruction, even if it is brief (Carrier, Joseph, Krey and LaCroix, 1983). The ability to perceive part-whole relationship and

organizing parts of a picture into a whole is vital in learning prose materials with imagery instruction. It is also possible that field independent individuals link mental images togather, and by imposing a structural framework, enhance the process of recall.

PROSE

During the 1970s, cognitive psychology evolved around the organizational function of verbal information and the traditional emphasis on learning and retention of word lists disappeared. Studies on this subject were mainly inspired by Bartlett's (1932) findings on memory for prose. There are some interesting features inherent in learning of prose which distinguish it from other types of verbal materials (Rosser and Nicholson, 1984). People seldom retain a sentence exactly the way it is presented , but they are able to recall the information. Another fact about learning prose is that although the order of words and sentences is of prime importance, it becomes insignificant in the process of recall. Another intriguing phenomenon about learning prose is that without realizing it, people tend to recall from prose information which they were not given in the text. They simply tend to make inferences (Fitch, 1984). Bartlett also found another interesting feature in prose learning that involves the subject's frame of reference. He indicated that the subjects' background experiences

determined the way they interpreted the text.

Regarding these findings, Pompi and Lachman (1967) concluded that the meaning of the text may be abstracted, and then stored in the form of integrated images or themes. Yuille and Paivio (1967) tested the recall as it relates to abstraction of the text. They found that when the thematic content was stored as images, the organizational effect of imagery was facilitative, and it was directly related to the concreteness of the passage. Whereas abstract materials could only be stored in sequential manner, and therefore holistic organization would not be helpful to them.

The effect of text organization and imagery was investigated by Steingart and Glock (1979) in two related experiments. The subjects were presented with three concrete prose passages which were organized in three forms. Half of the subjects were to visualize, and half to repeat the passage information to themselves. The evaluation format, in the study one, was multiple-choice questions, and in study two was written phrases. Result indicated that randomized text had the lowest recall, imagery was more helpful than the repetition method regardless of the organizational format of the text.

CONCLUSION

This chapter gives an overview of related theory and research on the concept of induced mental imagery. Some

determining factors for the effectiveness of self-generated imagery were examined, and if possible defined in the context of dual-coding model of Paivio. It was concluded that age plays an important role in the ability to generate mental images. Giving instruction and training in visualization seemed to be helpful in most cases, specially with the difference poor readers. The mode of presentation also seemed to be extremely important in effectiveness of induced mental imagery with oral presentation being superior to written in almost every case, regardless of learning task. Cognitive style also determined the usefulness of induced mental imagery. Field independent individual could benefit from imagery instruction, while field dependent individual had no use for it. The degree of concreteness of the text was another factor that facilitated the use of induced mental imagery.

CHAPTER III

METHODOLOGY

This study was designed to investigate the role of induced mental imagery through the auditory mode in the learning of prose, as measured by immediate and delayed recall among young adults. Also, the study attempted to determine the relationship of mental imagery to the learner's field dependent/field independent cognitive style.

SUBJECTS

The study consisted of a sample of 185 subjects, between the ages of 18-22, all enrolled in an undergraduate introductory course in psychology. The selection process contained the student's response to a sign-up form (see Sign-up Form in Appendix A) listing the criteria for participation in the study. To comply with the human subject testing policies of the University of Oklahoma Review Board, subjects of this study gave their written consent (see Student Permission Form in Appendix A). Also, to assure the confidentiality of the subjects, the last four digits of their social security number were used as the subject's identification number.

MATERIALS

The materials used in this study consisted of (1) instructional materials, (2) a questionnaire, (3) a test, and (4) the Group Embedded Figure test.

1. Instructional Materials : Three prose passages selected from the book "How to take Standardized Tests"(Oliver, 1981) were used as the medium to employ the instructional strategy on mental imagery. These passages dealt with three different and uncommon topics: lacrosse, London's fire, and bonsai; and each consisted of five paragraphs which ran between forty to one hundred words. To determine the level of difficulty of the prose passages, each piece was measured for its readibility index using the Fry's readability graph (Fry, 1968). According to the Fry's graph, the reading level of each of the passages was at the eight grade difficulty level. The "human interest" level of each piece was in the range of "interesting" to "mildly interesting" as determined by Flesch's chart (Flesch, 1949). The "human interest" level is an estimate of the attractiveness of the writing. These passages were specifically chosen because they were concrete instead of abstract to encourage the process of visualization. Mental imagery is more easily activated by concrete materials than abstract verbal messages. Then, the three passages were rewritten to be more appropriate for oral presentation than

reading, and different phrases were added at the beginning of each paragraph to signal the start of each paragraph. These changes included such phrases as "ok", "to proceed","let's see" and so forth. Some cuing phrases were also added at the end of each paragraph reminding the subjects of their task during the pauses between paragraphs. These concluding phrases differentiated between the instructional materials for the experimental group and those of the control group. For the experimental group, some of these concluding phrases at the end of paragraphs were "ok, form your images", "please form your images", and so on. The control group received the concluding phrases; "ok, try to relax", "please try to relax", and such (Appendix B). The three passages for the experimental and control groups were taped on an audio cassette with a fifteen second pause after each paragraph. There was a ten second pause at the start and between each of the three topics.

2. Questionnaire : To collect some related information on the characteristics of the subjects, a short questionnaire was prepared (Appendix C). It contained questions on the general characteristics and the visualization skills of the subjects based on their own judgments and activities. This information was collected to be used if further understanding of the data was needed.

3. Test : A test consisting of twenty four multiple

choice questions was constructed (Appendix, D), with an equal number of questions over each passage. The total of the correct responses in the test became each subject's score. The difficulty level of the items in this test was measured using item analysis procedure, and the content validity of the test was checked by conducting a pre and post test in a pilot study.

There were twenty eighth subjects with the same characteristics as the sample population in the pilot group. A test composed of fourty multiple-choice questions was prepared, and used as both the pre and the post test. The subjects, first in the pre test stage, took the test with no instruction, and then in the post test stage, received mental imagery instruction before taking the test. The level of test difficulty was controlled by selecting only those items which were answered correctly by 30%-75% of the population. The validity of the instructional method (imagery) was determined by containing all those item which received significantly higher score in the post test as compared to the pre test. The rest of the items were eliminated.

4. Group Embedded Figure Test : Group Embedded Figure Test was adapted from the original Embedded Figure Test which was designed for individually administered testing. This test was designed to determine the degree of

the subject's field dependence/field independence cognitive style. The test has indicated satisfactory reliability coefficient with regard to internal consistency and test-retest analyses (Kogan, 1971). The validity of Embedded Figure Test has also been established using numerous correlational and factor analytical studies (Witkin, Oltman, Raskin, and Karp, 1971).

In this study, the Group Embedded Figure Test (Witkin, Oltman, Raskin, and Karp, 1971) was used to measure each subject's cognitive style. This information was gathered to determine whether any relationship exists between field dependence/field independence and the ease of generating mental images while learning prose materials.

PROCEDURE

The subjects were divided in groups of 10-15 people and assigned to one of the two scheduled sessions: immediate-recall or delayed-recall. The specific session determined whether they would attend one session or two sessions, seven days apart. Each scheduled session was alternately for the experimental treatment or the control treatment. The study was conducted in one room, between the hours of 3 and 5 in afternoons. The procedural steps for the immediate-recall session began by having the students complete the Student Permission Form. Then, they participated in the Practice phase, the Learning Phase, the

Test Phase, took the Group Embedded Figure Test, and finally filled out the Questionnaire. The procedural steps for the delayed-recall in the first meeting was: completion of the Student Permission Form, the Practice phase, the Learning phase, and the filling out of the Questionnaire. The second meeting, after seven days, involved the Testing Phase and the Group Embedded Figure Test. A description for each of these activities follows.

Practice Phases : Promptly after the preliminary instructions, the subjects took part in the practice trial that involved listening to one paragraph of a text (see Practice trial in Appendix B). The subjects in the experimental group were asked to generate mental images on what occured in the paragraph, while the control group was instructed to relax for a period of fifteen seconds after the listening task. At the end of this time, the experimenter gave some examples of possible mental images on the paragraph to the experimental group, and informed the control group of the advantages of relaxing in the process of learning.

Learning Phase : After the practice phase, the subjects were presented with the learning task. The instructions for the experimental group were as follows:

> "You are going to listen to three prose passages consisting of fifteen paragraphs on three different

topics. There will be a pause of 15 seconds after each paragraph. During the pause between paragraphs, try to make a mental picture of what was described in the paragraph. Try to create images in your mind of the places, things, people, and what the people were doing. To get a complete picture, try to relate places, things and people together. There will be a 10 second break at the start and between each of the three topics."

The instruction for the control group was as follows:

"You are going to listen to three prose passages consisting of 15 paragraphs on three different topics. There will be a pause of fifteen seconds after each paragraph. During the pause between paragraphs, try to relax and put your mind at ease, so you can be ready for the next paragraph. There will be a 10 second break at the start and between each of the three topics."

Testing phase : The subjects were given the test on the passages with no time limit for the completion. On the average the subjects spent 10 minutes on the test.

ANALYSIS OF DATA

The subjects' scores on the Group Embedded Figure Test were analyzed, and the median score was determined. The

scores ranged from 0 to 20, with 13 as the median. In order to establish two distinct groups of field dependent subjects and field independent subjects, those subjects at the median were excluded from the sample. Therefore, by eliminating 15 subjects, the sample size decreased to 170. Those subjects who scored between 0 to 12 were categorized as field dependent, and those with scores between 14 to 20 were considered field independent. The data consisted of the total number of correct responses to the multiple-choice test on the three passages. They were organized into eight clusters as indicated in below.

1. Field dependent, mental imagery treatment, immediate recall.
2. Field dependent, mental imagery treatment, delayed recall.
3. Field dependent, no mental imagery treatment, immediate recall.
4. Field dependent, no mental imagery treatment, delayed recall.
5. Field independent, mental imagery treatment, immediate recall.
6. Field independent, mental imagery treatment, delayed recall.
7. Field independent, no mental imagery treatment, immediate recall.

8. Field independent, no mental imagery treatmemt, delayed recall.

To test the hypotheses, the three-way factorial design was applied, using the procedure for unequal cell size. In the computer program "Sample Calc" (based on Statistical Power Analysis for Behavioral Science, by Cohen, 1977), Anderson gives directions in calculating the cell size for a design of ANOVA. This program was used to determine the cell size for this study. The alpha was set at .10 level of significance for testing the hypotheses, with power of .8, and effect size of .40. Considering these criteria the cell size of 20 was needed. In this study the cell size ranged from 18 to 23 subjects.

CHAPTER IV

RESULTS

A three-way analysis of variance was conducted on the scores received from the test over the three pieces of prose. The independent variables were the instructional treatment (imagery vs no imagery), cognitive styles (field dependent vs field independent), and recall time (immediate and delayed). Figure 1 presents the 2 X 2 X 2 design for the interactions of the three factors, each with two levels.

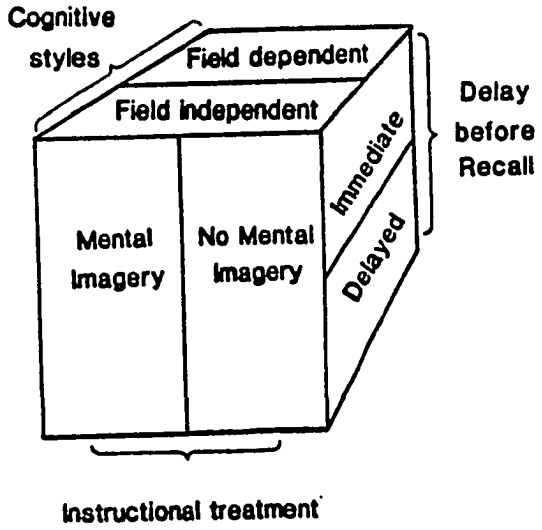

Figure 1. Model of interactions among the three factors each with two levels

Means and standard deviations were calculated for each of the eight groups of the sample. The results are presented in Table 1.

	Recall Time			
	Immediate		Delayed	
Instructional treatment	Imagery	No Imagery	Imagery	No Imagery
Field independent				
Mean	16.04	15.36	13.10	12.60
SD	3.59	2.61	2.65	2.38
Field dependent				
Mean	14.82	12.61	12.38	12.10
SD	3.96	3.42	3.27	3.05

Table 1. Means and standard deviations of scores by instructional treatment, cognitive styles, and recall time

Table 2 shows the result of the three-way analysis of variance that was conducted on the scores received from the multiple-choice test. The overall finding points out a

significant effect of the three independent variables (cognitive styles, instructional treatment, and recall time) on the dependent variable (scores on the test).

Source	df	MS	F	p > F
Cognitive styles (A)	1	70.83	7.05	0.01
Instructional treatment (B)	1	35.47	3.53	0.06
Recall time (C)	1	197.60	19.67	0.01
A X B	1	4.62	0.46	0.50
A X C	1	19.83	1.79	0.16
B X C	1	11.70	1.17	0.28
A X B X C	1	7.89	0.79	0.38
Within groups	162	10.04		

Table 2. The result of three-way analysis of variance for field dependent/field independent, imagery or no imagery instruction, and immediate or delayed recall

The ANOVA also showed that each of the three main effects produced a significant variance in the design. The effect of the cognitive styles dimension was significant at .01 level with the mean score of the field independent subjects being significantly higher than the mean score of the field dependent subjects.

The second main effect, the instructional treatment produced a effect significant at the .06 level. This significance was caused by the fact that the imagery instruction contributed to a higher degree of recall than no imagery instruction.

Finally, the main effect for recall time showed a significant difference between the test scores of those subjects who were tested immediately and those subjects who were given the test one week later. The difference was significant at .01 level, with immediate recall being the superior condition. Table 3 presents the mean differences of the three main effects.

The result of the three-way analysis of variance shows no first or second order interaction among the levels of each factor, and the factors themselves. The differences among the means of the eight groups are presented also in Figure 2.

Instructional treatment	Mean	Difference
Imagery	14.08	
		.91
No imagery	13.17	
Cognitive styles		
Field independent	14.27	
		1.29
Field dependent	12.98	
Recall time		
Immediate	14.71	
		2.17
Delayed	12.54	

Table 3. The detailed report of the differences between the means for the three main effects

In general, the statistics supported the first and second hypotheses. That is the subjects who received induced mental imagery instruction performed better than the

subjects who received no induced mental imagery instruction under both immediate and delayed conditions of recall. However, the third, fourth, and fifth hypotheses were not supported suggesting that, at least in this study, there was no interaction effect among the three independent variables.

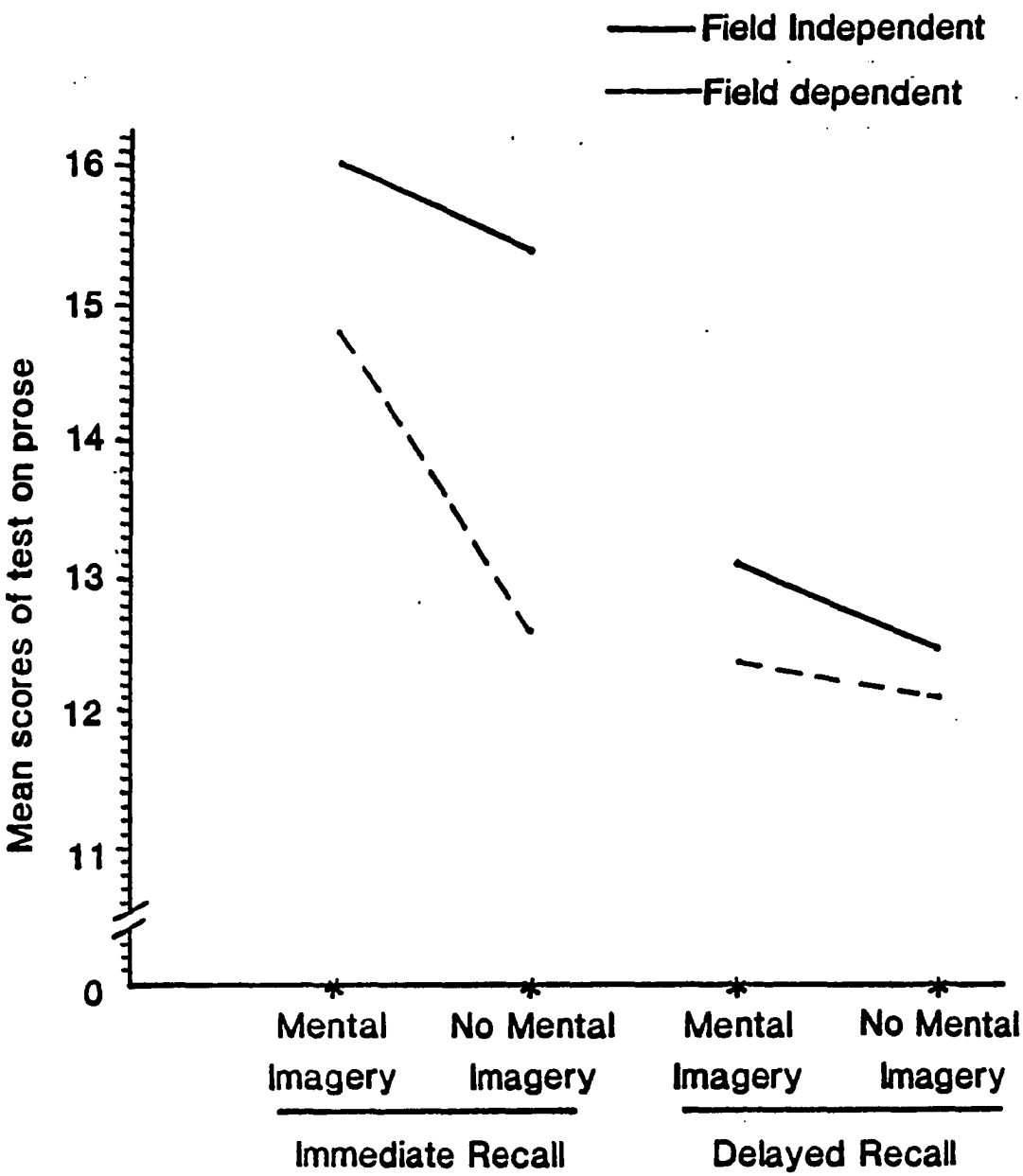

Figure 2. Instructional Treatment & Cognitive Styles & Delay before Recall using mean scores of the test on three pieces of prose.

CHAPTER V

SUMMARY, INTERPRETATION, CONCLUSION, AND SUGGESTIONS

SUMMARY

Although the concept of mental imagery has been investigated for many years, only recently has it become an acceptable topic for scientific research. The revival of interest in mental imagery was initiated by Paivio whose extensive research on this area led to the formulation of his dual-coding theory. Applying behavioral principles, Paivio identified three operational procedures as the foundation for the research on mental imagery. Among all the different aspects of research on imagery concept, its role in memory and human learning has attracted the highest degree of attention. Even now some of the earliest studies on mental imagery that relate to verbal learning are among the most reliable ones.

Learning is an internal experience that takes place as a result of mental processes such as perception, assimilation, interpretation, storage, and retrieval. As Winn (1982) reports only some of these processes are applied productively in learning, and they are considered mental skills. When a mental skill is applied to a specific

learning task, such as using mental imagery in learning of prose, it is a learning strategy. Studies have suggested that it is possible to develop visualization skills through instruction.

In this study, several factors were investigated. First, the effect of induced mental imagery produced through the auditory mode was examined. The role of this variable in relation to field dependent/field independent cognitive style and the delay before recall constituted the other dimensions of this research. It was hypothesized that mental imagery instruction would facilitate learning of prose material when presented orally. It was also hypothesized that field independent individuals would benefit more from induced mental imagery instruction than the field dependent individuals, and the delayed recall would enhance the retention.

The subjects were 185 students between the ages of 18-22 who voluntarily participated in this study. Based on their responses on the Group Embedded Figure Test, the subjects were put into two groups of field independent and field dependent. In order to establish two relatively distinct groups, those subjects who scored on the median were screened from the study. Consequently, there were 15 subjects whose scores were eliminated. The two groups, field independent and field dependent, each participated in

four experimental conditions; (1) mental imagery instruction, immediate recall; (2) mental imagery instruction, delayed recall; (3) no mental imagery instruction, immediate recall; (4) no mental imagery instruction, delayed recall, resulting a total of eight small groups. All the subjects had a practice trial prior to the learning task. During the learning task, the subjects listened to three pieces of prose on different topics. Then, they were instructed either to form mental images (experimental group), or relax (control group). Each group was tested over the passages either immediately, or exactly seven days later. The data consisted of the total number of correct responses to the multiple-choice test on the the three passages.

A three-way analysis of variance was performed to test the three main effects and any interaction effects among the variables. The statistic revealed a high degree of significance in the three main effects. However, the test showed no significant interaction effect among the three factors and the levels.

In general, this study indicated that the three factors of field independent cognitive style, mental imagery instruction, and immediate recall each independently, resulted in higher degree of recall of prose materials.

INTERPRETATION

According to Paivio's dual-processing model, there are two major modes of coding for incoming information: verbal and imaginal. In general, information becomes resistant to forgetting when it is processed through both verbal and visual modes. In this study, on the dimension of instructional treatment, the imagery instruction was more effective in learning and retention of information. The result indicated significantly higher scores for imagery instruction regardless of the degree of delay before recall and the cognitive style. Therefore, the finding is consistent with the dual-coding theory. The subjects were receiving the information verbally, so they processed it once through the verbal mode, and since they were also instructed to form images after listening to each paragraph, the information was processed by the imaginal mode also. From this result then, one can conclude that the dual-coding system facilitated the learning process in this study.

The findings on cognitive styles dimension was not consistent with the result from previous research in the area. In this study, the main effect for the cognitive style dimension was significant. The field independent subjects had significantly higher scores than the field dependent subjects, whether or not they were in the imagery or no imagery condition. This result was incongruent with

findings of the previous research (Walker, O'Leary & Chaney, 1979; Pierce, 1980; Carrier, Joseph, Krey and LaCroix, 1983), for it did not indicate any significant interaction between induced mental imagery and field dependent/field independent cognitive styles. One possibility may be due to the age range of the subjects in this study. It is also possible that the instrument used created the difference.

Examination of the dimension of delay before recall showed that the immediate recall produced significantly higher degree of correct responses than the delayed recall, as expected. However, there was no interaction with imagery instruction, as had been hypothesized. This result contradicted the findings of previous studies that have indicated mental imagery to show greater effect after a delay (Bower, 1972; Groninger, 1971).

CONCLUSION

The lack of conclusive result on the interaction among the three independent variables in this study might be due to several reasons. First, it is possible that the materials used were not completely appropriate. Rosser and Nicholson (1984) believe that the material being used, and the individual's developmental level are two important factors that determine the effectiveness of mental imagery strategy . In this study the degree of image evoking potential of the passages were not determined. Second, the

homogeneity of the sample as shown by their test score could have been another reason for the lack of interaction among the independent variables. On the Embedded Figure Test, although the scores ranged from the lowest to the highest possible point (Ø - 2Ø), they were not distributed evenly. With a median of 13, the scores were rather skewed toward the field independent tail of the continuum.

SUGGESTIONS

There is a need for further research on the use of induced mental imagery in learning of prose. As Jacob (1976) states "whereas curriculum developers would be particularly interested in research resulting from imposed paradigms, classroom teachers would be specifically interested in research findings generated from paradigms which manipulate induced strategies". The role of mental imagery instruction, specifically, among the field dependent individuals should be examined. Comparing the mean scores of field dependent with field independent subjects in four experimental conditions (Table 1) indicates the largest difference exist between imagery and no imagery under the immediate recall condition for field dependent subjects. In Figure 2, it is dramatically indicated that the field dependent individuals benefitted more from imagery instruction than the field independent individuals, specially in the immediate recall condition.

There is also a need to examine the effect of several time lengths before recall of prose materials, such two, four, and six days, and compare the results. The difference in the degree of imagery elaboration in recalling prose materials among field dependent and field independent individuals presents another research problem.

This study has investigated the role of induced mental imagery in learning of prose materials. It has also examined this variable in relation to field dependent/field independent cognitive styles and the delay before recall. The results have answered some of the questions stated, and also it has raised some questions for further research. One definite conclusion from this research is that encouraging students to form mental images during classroom teaching is an effective instructional strategy.

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APPENDIX A

FORMS

EXPERIMENT NAME MENTAL STRATEGY TYPE

EXPERIMENTER Fatemeh Olia NUMBER OF CREDITS One

OCATION Gould Hall(Geology) Rm.112 FACULTY SUPERVISOR Dr. Jay Smith

SPECIAL INSTRUCTIONS AND/OR SUBJECT RESTRICTIONS:

You should be at least 18 years of age

PLEASE DO NOT SIGN UP IF YOU HAVE ALREADY PARTICIPATED IN MENTAL IMAGERY-V

DATE/ TIME	SUBJECT NAME & PHONE #	SECTION # & INSTRUCTOR	TEAR OFF THIS REMINDER SLIP TO CONFIRM APPOINTMENT
Feb.			Mental Strategy- Gould Hall Feb.
Feb.			Mental Strategy- Gould Hall Feb.
eb.			Mental Strategy-Gould Hall Feb.
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eb.			Mental Strategy- Gould Hall Feb.
eb.			Mental Strategy- Gould Hall Feb.
eb.			Mental Strategy- Gould Hall Feb.

EXPERIMENT NAME MENTAL STRATEGY TYPE

EXPERIMENTER Fatemeh Olia NUMBER OF CREDITS two

LOCATION Gould Hall(Geology)RM.112 FACULTY SUPERVISOR Dr. Jay Smith

SPECIAL INSTRUCTIONS AND/OR SUBJECT RESTRICTIONS:

You should be at least 18 years of age

You should be able to attend both meetings that are Feb. & Feb.

PLEASE DO NOT SIGN UP IF YOU HAVE ALREADY PARTICIPATED IN MENTAL STRATEGY-V

DATE/ TIME	SUBJECT NAME & PHONE #	SECTION # & INSTRUCTOR	TEAR OFF THIS REMINDER SLIP TO CONFIRM APPOINTMENT
Feb. &			Mental Strategy- Gould Hall Feb. &
Feb. &			Mental Strategy- Gould Hall Feb. &
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Feb. &			Mental Strategy- Gould Hall Feb. &
Feb. &			Mental Strategy- Gould Hall Feb. &

STUDENT PERMISSION FORM

This study surveys the effect of a specific learning strategy in learning of prose. The result of this research may bring some change in the development of some instructional techniques. Your cooperation is necessary in the following activities:

1. listening to three prose passages, and answering some related questions;
2. filling out a short questionnaire; and,
3. taking a test of visual perception.

Please give your best effort when working on the different parts of this study. Your scores will be confidential, since you will be assigned a code number to identify your materials. If you are interested in participating in this study, please sign in below.

I am 18 years of age, and I agree to take part in this study.

_____ _____

Date Participant's signature

APPENDIX B

INSTRUCTIONAL MATERIALS

PRACTICE TRIAL

The most common means of vegatative propagation is through the use of a stem cutting--that is, taking a leaf and stem from a plant such as an African violet and putting it in water or a soil mixture until roots appear. When roots emerge, the cutting is ready to be planted. Tubers, such as potatoes, can also be reproduced in this fashion. A potato is cut into several pieces, thereby allowing many plants to be produec from each piece.

INSTRUCTIONAL MATERIALS FOR EXPERIMENTAL GROUP

PROSE #1

Lacrosse which is a sport once played by the North American Indians for pleasure and to help them prepare for battle continues to be played today and has recently gained popularity as a team sport in both the U.S. and Canada. Although lacrosse in its original form was a wild and violent free-for-all with few rules and no set limits, the modern-day version has been much modified. Even an indoor version now exists. (pause) Before I continue form your images.

To continue, The object of lacrosse is, as with all games, to score points. To do this the players of one team move a ball from the center of the playing field to the opposing team's goal. Players can not touch the ball with their hands; instead they must pass the ball or carry it by using a playing stick called a CROSSE (spell the word). A crosse is similar to a short pole with a net pocket that is called a "throat"- at one end. A player carries the ball in the throat of his crosse as he runs down the field. (pause) Now form your images.

Now, A lacrosse team consists of 1Ø players: 3 attack players, 3 middle field players, 3 defense players, and a goalkeeper. Everyone except the goalkeeper plays opposit players on the other team. A lacrosse field is divided by a center line, and each team must keep at least 4 men in the defensive half of the field and at least 3 men in the attack half. (pause) OK, form your images.

OK, A lacrosse game begins by having the 2 centers face each other in the middle of the field; the referee then places the ball between their crosses and blows his whistle. At the sound of the whistle, each center tries to get the ball and move down the field. A game of lacrosse lasts for about one hour. This hour is divided into four fifteen-minute portions; the teams change goals after each period. (pause) Please form your images.

In conclusion, Lacrosse is an exciting, fast-moving game that is almost as fun to watch as it is to play, and although more and more people are learning about it and

playing it, it deserves much greater popularity than it currently enjoys. (pause) Form your images.

This is the end of the first passage.

PROSE #2

On the night of September 2, 1666, a fire broke in baker's shop near Fish Street Hill in London. Before the flames were finally extinguished, almost the entire city had been reduced to ashes. Over thirteen thousand homes, fifty churches, and numerous public buildings and hospitals were lost in the blaze. For all practical purposes, London was destroyed. (pause) Please form your images.

Now, the Great Fire was not seen as a total tragedy. The city's deplorable conditions had been attacked by physicians and humanitarians for years before the fire. Since the opportunity was clearly present to create a shining new city, artists and craftsmen from all over England hurried to submit their designs for the rebuilding of London. (pause) OK, form your images.

To proceed, among those who submitted plans was Sir Christopher Wren, one of England's leading architects and the Surveyor General of London. The task of rebuilding the city was given to him. Wren realized that the Great Fire would not have been so damaging if the city had been better laid out. He wanted broader streets to replace the crooked, narrow alleys which had been overhung with dilapidated wooden houses and shops. He also felt that redesigning the main thoroughfares of London would result in increased and more effective transportation within the city. (pause) Now, form your images.

OK, shortly after Wren began working on his first drafts for the rebuilding, King Charles I issued a proclamation prohibiting the construction of any house or shop within the city limits until after the plans were completed. However, when the plans were unveiled to the citizens of London, they were overwhelmingly rejected. The most vocal leaders of the opposition were the landlords, who feared that such a drastic widening of the streets would reduce the amount of land available for development. (pause) All right, form your images.

To sum, because winter was approching, it was necessary for the rebuilding to proceed at once. Permission was, therefore, granted for the townspeople and landlords to begin reconstruction of their houses and shops at the sites where they had been before the fire. Had the need for

immediate action not been so pressing, some kind of compromise would likely have been reached. This was not to be, however, and the ideas that could have made London one of the world's most beautiful cities never came to pass. (pause) Please form your images.

This is the end of this passage.

PROSE #3

The art of growing dwarf trees, or "bonsai" as their Japanese creators call them, is becoming increasingly popular in the United States. Growing bonsai can be facinating hobby for anyone who enjoys plants and creating beautiful effects with them. Elaborate equipment is not required to grow these lovely, tiny trees, but time, patience, and a sense of natural beauty are. (pause) OK, form your images.

To proceed, there are four important guidlines to follow in growing bonsai. First, you must be careful in choosing the type of tree. Not all species of trees can be made into bonsai, since the growing conditions are unusual. Varieties of pine with small needles and hardwood trunks are especially suitable. (pause) All right, form your images.

OK, second, you must be careful in choosing the size of the container the bonsai will be placed in. This is necessary because the major growth of bonsai is kept confined to the tree's trunk and leaves, not its root system-- a process quite unlike what is done with other plants. (pause) Please form your images.

Let's see, another thing the bonsai-grower must do is trim the roots and branches of the tree periodically. Unless this is done, the plants will not have proper proportions and will look unnatural. The Japanese ideal for bonsai is to have trees which look just normal trees in everything but size. The last thing one must do is to be careful to keep the miniature trees well-watered. Because bonsai are grown in smaller-than-usual containers, they often need more water than ordinary houseplants. (pause) OK, form your images.

In conclusion, as you can see, the art of bonsai-growing requires a certain amount of time and effort. The satisfaction that growing bonsai brings can be great, however. Imagine a stately pine tree, 100 years old, standing two feet high; imagine having such a tree in your living room and passing it down through several generations of your family. That is actually what bonsai-growing is all about: establishing a tradition of beauty which lasts for years and years and is a symbol of the beauties of the

natural world. (pause) Now form your images.

This is the end of last passage.

INSTRUCTIONAL MATERIALS FOR CONTROL GROUP

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This is the end of last passage.

APPENDIX C

QUESTIONNAIRE

QUESTIONNAIRE

Age: 18-20 ___ 20-22 ___ 22-25 ____ above ___

Sex: Male ___ Female ___

Classification: Freshman ___ Sophomore ___
Junior ___ Senior ___

GPA ____

Did you find the three prose passages interesting?

exteremly __ above average __ average __ below average __ at all __

What mental strategy do you usually use to retain prose materials?

What are your favorite subjects in school?

Do you have a hobby (hobbies)? What?

Are you involved in any type of artistic activity? Explain.

APPENDIX D

TESTING MATERIALS

TEST

1. Why did the North American Indians play lacrosse?

   a. revenge and tribal competitions
   b. pleasure and tribal competitions
   c. pleasure, and preparation for battles
   d. preparation for tribal competitions

2. What other equipment does the play stick (crosse) look like?

   a. butterfly net
   b. golf club
   c. hockey stick
   d. tennis racket

3. How many men are required to remain in the defensive half of the field?

   a. three
   b. four
   c. five
   d. six

4. In the game of lacrosse, the ball is moved by carrying it in the throat of the crosse and _____.

   a. kicking
   b. passing
   c. throwing
   d. no other way

5. The original form of lacrosse was played with _____.

   a. many rules and no time limits
   b. few rules and time limits
   c. free-for-all and time limits
   d. few rules and no time limits

6. When did the Great Fire of London breakout?

   a. on the night of September 2, 1666
   b. on the night of September 22, 1666
   c. on the night of December 2, 1666
   d. on the night of December 22, 1666

7. Why was not the Great Fire of London considered as a total tragedy?

a. Charles I had already asked the architects and artists to design for the reconstruction of the city
b. The living conditions of the city were extremely poor
c. The architectural design of the buildings had been attacked by many for long.
d. The landlords had been attacking the city's condition for long

8. What were some of the reasons for the Great Fire of London?

a. Crowded districts with shops and homes
b. narrow streets and wooden buildings
c. crooked thoroughfares and wooden homes
d. narrow streets and crooked thoroughfares

9. Where did the Great Fire of London breakout?

a. Fish market
b. Baker street
c. Baker's shop
d. Fish street Hill

10. Who was Sir Christopher Wren?

a. the leading architect, and the army general of London
b. the leading architect, and the Surveyor General of London
c. one of the leading architects, and the Surveyor General of London
d. one of the leading architects, and an army General of London

11. Growing bonsai _____.

a. can be a hobby for anyone
b. is a traditional chinese art
c. has been popular in U.S. for long
d. is only for the expert gardeners

12. What are the major areas of growth in bonsai?

a. roots and trunk
b. roots and branches
c. branches and leaves
d. trunk and leaves

13. Compared to other houseplants, bonsai trees often need _____.

a. lots of light
b. lots of water
c. small size pot
d. minimum care, but lots of time

14. On what parts do the bonsai trees need trimming?

a. roots and branches
b. roots and leaves
c. branches and leaves
d. all parts

15. What does growing bonsai require?

a. special equipment
b. special skill
c. lots of time and patience
d. special container

16. How does the game of lacrosse begin?

a. the center players place the ball between their crosses
b. the center players face each other, and wait for referee to signal
c. the referee rolls the ball between the center players'crosses, and blows his whistle
d. the referee places the ball between the center players'crosses and blows his whistle

17. In the game of lacrosse, when do the teams change goals?

a. every hour
b. every half an hour
c. every fifteen minutes
d. every ten minutes

18. In regard to popularity, the game of lacrosse _____.

a. has been popular in Canada for a long time
b. is becoming increasingly popular in Canada in recent years
c. is regaining its popularity among the North American Indians in Canada and the U.S.
d. is gradually losing its popularity in Canada and the U.S. in recent years

19. Why was it necessary to rebuild London quickly?

a. winter was approaching
b. Charles I had granted premission
c. landlords had offered help
d. people needed a place to live

20. What happened to the plans for reconstruction of London?

a. they were modified and adapted
b. they were never completed to the people's satisfaction
c. they were followed, but in small ways
d. they were completely rejected

21. What remained as a result of the Great Fire of London?

a. few public buildings
b. few shops and a church
c. few homes and shops
d. nothing just ashes

22. How many ways are there to grow bonsai?

a. one
b. two
c. three
d. four

23. What one should do to make sure a bonsai tree looks natural?

a. choose a type of tree with hardwood trunk
b. water the plant a lot
c. choose the right size container
d. trim the tree periodically

24. What would be an appropriate title for the third passage?

a. how to grow bonsai
b. an artistic expression
c. growing bonsai and its problems
d. bonsai- a tradition