AN EXPERIMENTAL STUDY TO COMPARE THE AFFECTIVE AND COGNITIVE RESPONSES OF FEMALE AND MALE COLLEGE STUDENTS TO SINGLE-IMAGE, MULTI-IMAGE, AND TIME COMPRESSED SINGLE-IMAGE PRESENTATIONS.

by

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TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF TABLES

LIST OF FIGURES

Chapter 1

INTRODUCTION

According to Trohanis (1975), the first use of a multi-image presentation occurred in 1927 when the Frenchman Claude Autant-Lara used multiple images to depict a gold hunting expedition to the Far North. Since that time the medium of multi-image communication has been used by world's fairs, federal government agencies, businesses, universities, and schools. Despite the extensive usage of this medium by numerous organizations for various reasons, little visible effort was made to understand its applications or its effects on the audience until the 1960's. In 1963 Allen and Cooney described the existing literature as mainly descriptive; consisting of pre-theoretical experimentation and formulation. It was Perrin (1969) who first attempted to develop an operational definition to distinguish multi-image communications from other media. This distinction was based upon the use of simultaneous images, the size of the screen, and the density of the information presented. Perrin's theoretical work provided a basis for experiments to determine the practical applications of the multi-image medium as an instructional tool.

Westwater (1972), in a study concerned with teacher-user perceptions of a multi-image program, concluded that the actual field worth or utility of instructional multi-image presentations had not been demonstrated. Beckman (1975), in his role as president of the Association for Multi-Image, stated that the multi-image medium's ability to convey information effectively had not been proven and indicated that studies were needed to determine if the multi-image medium might be used as a 'great' teaching and motivating device. If multi-image presentations, however, are not an effective teaching and motivating device, then other means of instruction should be pursued.

Need for the Study

Gagné and Briggs (1974) indicated that the sequencing of information within an individual lesson is of critical importance in the design of instruction, particularly when the instructional situation requires the learner to use intellectual skills (e.g., analysis, synthesis, or problem-solving). Bruner (1967), in developing his "theory" of instruction, went beyond Gagné and Briggs' emphasis on the individual lesson to point out that every student will not be able to learn from the same sequence of information presented at the same rate. He also indicated that the exploration of alternatives will be affected by the sequence in which material to be learned becomes available to the learner. Thus, while various sequences are usually possible for each lesson, no unique sequence exists for all learners; the optimum sequence in any particular case is dependent on the individual learner (Bruner, 1967). This lack of a unique sequence for all learners is even greater in the area of visual perception, as pointed out by Gibson (1950). Gibson stated that visual perception is not the result of a static visual field but is dependent on the rapid eye movements that take place in normal vision, and the basis for the visual world is the sequential pattern of the images rather than their anatomical pattern. Gibson went on to state that visual information is extracted from the sequential order of images on the retina. The sequential order of visual images and information in most projected instruction programs is determined for the viewer, and all viewers are restricted to that same pattern of images. This method of presentation may work for some individuals but not for others, such as haptic individuals who have difficulty in mental retention from visual image to image (Whitley, 1977), or for males, who tend to be less visually stimulated than females (Caukins, 1970). Also, Kovacevich (1970), in his study of teaching sight vocabulary to young children, found that when visual stimuli were used in instruction different instructional strategies were required for males and females. Males and females were also compared in a research study concerned with the teaching of affective responses to role modeling on instructional television by Albert(1974). She found that undergraduate females scored higher than undergraduate males in a test on cognitive information about the programs, but that no significant difference existed between females and males in their affective scores (the learner's attitude toward the method being used to present the instructional information). Albert stated the need for more research on the differential effects of the structure of learning environments on male and female young adults. Despite Albert's non-significant findings in the affective responses of learners, Simonson, Thies, and Burch (1979), in their review of media-attitude research, indicated that a positive link exists between the learner's attitude toward content information and achievement and that the learner's attitude toward the method of instruction has an effect on achievement. Moldstad (1974) in his review of studies on the effectiveness of instructional media stated that learners preferred mediated instructional programs to traditional instruction. This learner preference is consistent with Marsh's (1979) theoretical model for message design which hypothesized that students will assign higher affective values to those messages having higher "diversity values," with diversity defined as the number of possible stimuli at any one moment that the learner can perceive which will contribute to instruction. Marsh defined a multi-media presentation as one which has high diversity as opposed to a classroom situation which has low diversity. Marsh went on to state that a practical test of his model would be to construct increasingly complex parallel messages of differing diversity and measure the difference in their relative success at conveying content to establish a guide to be followed by message designers. Marsh's suggestion can be applied in the area of comparing the attitude of learners toward various media as discussed in Simonson, Thies, and Burch (1979). Simonson, Thies, and Burch suggested experiments comparing two treatments or one treatment and a control in order to determine which method was preferred by the subjects involved in the treatment. Because a single image presentation and a multi-image presentation present information in different sequential patterns they may have different effects on a learner's achievement. Felicetti (1975) was concerned with the ineffective use of temporal sequencing (i.e. one slide following another, thus determining their interrelationship) of visual stimuli, which is characteristic of slide presentations. In his conclusions, Felicetti (1975) indicated that means other than temporal sequencing of slides should be investigated. Gropper (1970), in a paper prepared for the Bureau of Naval Personnel, stated that spatial organizations (e.g., one image next to another) of stimulus materials has a potential for diverse applications, especially in learning situations which require discriminating among stimuli, generalizing across stimuli, and associating stimuli and responses. The medium of multi-image presents information in the spatial organizations that Gropper (1970) mentioned rather than in a temporal or linear organization. The linear formats, film, television, graphic material and audio tape have been the centers of most major research efforts. Allen (1974), Cochran (1974), and Schramm (1977) accused the media field of having "media myopia" in believing that a single format could provide answers to all educational problems. Some instructional problems could be solved by better design of current media (Allen, 1974) or by exploring designs of new media (Heinich, 1973). Fleming (1970), in his final report on a research project funded by the United States Department of Health, Education, and Welfare, stated that designers of instructional materials lacked a reliable, researched base of information in the areas of perception and media and indicated a need for more information in these two areas; Meierhenry (1974), in his work <u>Research in Educational Media and Technology</u>, indicated the need for more research dealing with the application of media to the improvement of instructional programs.

With the apparent need for more research of media design and of instructional use of media and with the importance of image sequencing in visual perception, a study of the comparison of the affective and cognitive response difference of college students to a single-image slide presentation and a multi-image presentation conveying the same message seemed appropriate.

Purpose of the Study

The purpose of this study was four-fold. First was to determine if any difference existed between the cognitive (amount of information retained) responses of male and female college students or between the affective (attitude toward the medium) responses of male and female college students to questions about a single-image presentation. The second was to determine if any difference existed between the cognitive responses of male and female college students or affective responses of male and female college students to questions about a multi-image presentation. The third was to determine if any difference existed between the cognitive or affective responses of male subjects viewing the single-image presentation and male subjects viewing the multi-image presentation. The fourth was to determine if any difference existed between the cognitive or affective responses of female subjects viewing the single-image presentation and female subjects viewing the multi-image presentation. A third presentation, the time compressed single-image presentation, was used to control for the time difference between the multi-image and single-image presentation. Answers to these questions may provide instructional developers and other designers of instructional messages some guidance in making decisions concerning the application of single-image and multi-image programs in instructional situations. The information from this study might be used to fill a small gap in the overall research in multi-image communication.

In order to investigate the affective and cognitive responses of college students to a single-image slide presentation and a multi-image slide presentation conveying the same message, the following research questions were considered:

1. Will there be any difference in the amount of cognitive information retained because of the format by which it is presented?

2. Will there be any difference in the amount of cognitive information retained because of the sex of the subject?

3. Will there be a preference shown for any one of the presentation formats?

4. Does the sex of the subject have any effect on preference for a particular format of presentation?

5. Is there any correlation between cognitive retention and attitude of the subject toward the presentation?

Definition of Terms

The following terms are defined for the context of this study:

Affective domain. This domain of behavior contains responses and objectives which have some emotional overtones. It encompasses likes and dislikes, attitudes, values, and beliefs. (Kibler, Barker, and Miles, 1970)

Cognitive domain. This domain of behavior emphasizes intellectual learning and problem solving tasks. Behaviors in this domain range from performing simple recall tasks to placing previously learned material into new contexts and synthesizing bodies of learned information. (Kibler, Barker, and Miles, 1970)

Evaluative meaning. The discriminative judgment made by an experimental subject on a series of scales of a semantic differential. (Bollman, 1970)

Fixation. A point at which the eye stops for two to eight-tenths of a second during the examination of a visual. (Goldstein, 1975)

Multi-image. A form of presentation in which two or more separate but related pictures are simultaneously projected on one large screen or two or more separate screens. (Perrin, 1969)

Semantic differential. A measurement and scaling technique in which subjects indicate their value judgments both in direction and intensity on a multi-point bi-polar scale. (Osgood, Suci, and Tannenbaum, 1957)

Single-image. A form of presentation in which images are presented separately on the screen, with each image disappearing as the succeeding image appears. (Allen and Cooney, 1963)

Time compressed single-image presentation. A form of presentation in which the images are presented in the same manner as a single-image presentation but presented at a rate equivalent to that of a multi-image presentation.

Visual. Any stimulus material that has the ability to convey information through the sense of sight.

Organization of the Study

The succeeding chapters are organized in the following manner:

1. Chapter Two contains a review of the literature and research related to the three major factors differentiating multi-image from other mediums, single-image versus multi-image projection, sex of the student as a factor in learning, and the semantic differential as a measurement of attitude.

2. Chapter Three contains the procedures followed in conducting the study and the research methodology used in treating the data.

3. Chapter Four presents the results of the study.

4. Chapter Five includes the summary, discussion, and recommendations for further research.

Chapter 2

REVIEW OF THE LITERATURE

Three areas of concern were dealt with in the review of the literature for the purpose of this study: the comparison of multi-image presentations with single-image presentations; the sex of the student as a factor in learning; and the development and use of the semantic differential and its use as a means of measuring a subject's attitude.

Comparison of Multi-image Presentations and Single-image Presentations

Perrin (1969) in formulating "a theory of multi-image communication," identified three major areas that distinguish multi-image presentations from single-image presentations: (1) simultaneous images, (2) screen size, and (3) information density.

Millard (1964) stated that simultaneous images can be used advantageously in that instructional situations which require comparisons, the development of interrelated concepts, illustrations of relationships, or in the presentation of dimensional and spatial characteristics of objects. All of these instructional situations require association, which is one of the most basic mechanisms of learning, according to Gagné (1965). The number of instances available to the viewer to make associations by visual comparison are greater with simultaneously presented images than with sequentially presented images according to Perrin (1969). Low (1968) pointed out that in single-image presentations one image follows another, thus determining the interrelationship between images. In multi-image presentations several images appear simultaneously and "interact upon each other at the same time, and this is of significant value in making comparisons and relationships." (Perrin, 1969, p. 90) The viewer's ability to determine his own individual relationship between the images has an effect on memory and recall as indicated by Low (1968) and Berger (1973). Low stated that no single image can trigger certain memory combinations, but a group of images preceived simultaneously often triggers long forgotten memories. Berger (1973) found that multi-image techniques are effective in expediting the recall of events and thought-feeling associations in analytic psychology. The triggering of memories and the recall of events attributed to simultaneous images may be a function of the viewer's freedom to select the sequential order in which he views the images, as Gagne and Briggs (1974) and Bruner (1967) have indicated; that is, the sequential ordering of information plays a major role in learning and retention. Therefore, as Perrin (1969) pointed out, presenting images simultaneously and allowing the viewer to select his own sequence in ordering the images may have an effect on the learning taking place. Roshka (1958), Malandin (cited in Perrin, 1969), and Allen and Cooney (1963) found simultaneous presentation of images effective in instruction with younger children. Roshka (1958) found that simultaneous images had less effect with older children, and Allen and Cooney (1963) stated that simultaneous images had a significant effect on learning of sixth graders, but not eighth graders. Malandin (cited in Perrin, 1969) found that primary classes had difficulty with recall from sequential images, but grouping the images permitted an increase in the number of recollections and better organization of the recollections. These studies support Perrin's (1969) view that image simultaneity is a significant factor in some learning situations. Goldstein (1975) stated that the simultaneous presentation of multiple images is in many respects "like the environment, it contains meaningful material, it surrounds us, and it is constantly changing."(p. 63)

Perrin (1969) stated that large screens are also comparable to real environments for many training purposes. Blackwell (1968) indicated that some specific instances which might benefit from the use of large screen presentations are tasks requiring high visual acuity such as detecting differences in texture or patterns. Two of the factors affecting the usefulness of large screens were identified by Schlanger (1966) as visual impact and visual task factor. Visual impact is the amount and forcefulness of information available to the sense of sight. Visual impact is proportional to the amount of the viewer's field of view that the screen occupies. According to Blackwell (1968), visual impact on the viewer is greater in large screen presentations because more of the viewer's field of vision is occupied by the projected image therefore limiting the chance of distraction from the surrounding environment. Visual task factor is the amount of work the viewer must do in order to extract the necessary information from the image. Schlanger (1966) stated that large screens can produce information rich in much detail for the visual channel and simulate real environments, but Blackwell (1968) warned that any channel of communication loaded with information details may be distracting if the details are irrelevant to the learning situation. Travers (1966), while attempting to deal with excess details, hypothesized that line drawings would be advantageous because they eliminated superfluous detail; however, his experiments indicate poor transfer of learning from over-simplified drawings to real situations in real environments. Blackwell (1968) stated that the advantage of a large screen to reduce the visual task factor is conditional. The images presented must have enough relevant detail to convey the proper message (which may not have been the situation in Travers' experiments) but not so much detail as to distract the learner, as pointed out by Blackwell.

Barr (1963) stated that the large screen opens up the frame and gives a greater sense of continuous space. The more open the frame, the greater the impression of depth; the image is more vivid and involves the viewer more directly. Barr (1963) stated that it is the part of the image extending into the peripheral vision that makes the experience so vivid. Perrin (1969) stated that the viewer perceives himself as a part of the environment instead of "looking through a window."(p. 101) The openness of the large screen encourages the viewer to explore and to select for himself, giving a greater sense of reality and participation, according to Perrin (1969).

Perrin (1969), in his theory of communication of multi-image presentations, suggested that the use of simultaneous images increases the information density. For certain learning situations such as identifying relationships or making contrasts and comparisons, this increased information density reduces the task of memory, a dimension of visual task factor, and enables the viewer to make immediate comparisons. The ability of visual images to communicate complex information rapidly was indicated by Langer (1942) when she compared the difference between verbal and visual forms of information articulation. She said the laws that govern verbal syntax are quite different from the laws of visual syntax. Verbal syntax tends to communicate in a linear format, and according to Langer (1942), this syntax limits the complexity of the discourse to "what the mind can retain from the beginning of an apperceptive act to the end of it." (p. 93) Single-image presentations have tended to follow the syntax of language in their presentation of information according to Barr (1968). Langer (1942) stated that visual forms are not discursive and do not present their information successively, but simultaneously, so that relations concerning a visual structure are grasped in one act of vision. Thus the complexity of the information available visually should not be limited by the maximum complexity of verbal discourse and therefore the amount of information presented visually can be greater and more complex than that presented verbally (Langer, 1942). Goldstein (1975) stated that just as sentences are far more than the sum of their parts, the same is true for multiple visual images. He continued that what is important to the viewer is the meaning transmitted in a number of images, and if the images are presented in a specific sequential order, the meaning may be different than if they are presented simultaneously. Hubbard (1961) and the U.S. Army (1959) reported that the use of multi-image presentations decreased the time needed for instruction because information was more quickly learned. Allen and Cooney (1963), however, stated that the results of both the Hubbard experiment and the U.S. Army experiment could be as easily attributed to the instructional design of the programs as to the fact that multi-image presentations were used. Fleischer (1969) stated that the mind and eye have proven to be capable of tremendous speed and versatility in accepting multiple impressions and that during a multi-image presentation the viewer's eyes explore the entire screen and keep the viewer very conscious of what is happening. In contrast, Goldstein (1975) indicated that multi-image presentations may cause information overload by presenting more information than the viewer can process and thus create arousal through frustration. He went on to say that this arousal may cause multi-image presentations to be highly motivating but not very informative. Goldstein stated that when presenting specific concepts or highly technical information, multi-image presentations should be used with restraint. Perrin (1969) concluded that it is clear that great densities of information can be perceived during a multi-image presentation, but he went on to question whether great amounts of information were learned from these perceptions.

Several studies have compared different aspects of single-image and multi-image presentations. Lombard (1969), conducting a cognitive study, used both a single-image and multi-image format to teach synthesis skills in history to eleventh-grade students. Showing a multi-image presentation and a single-image presentation to separate groups of low achievers, average achievers, and high achievers, he found no significant difference in males between the single-image and multi-image presentations at any achievement level, and the only female group to demonstrate any significant difference were the low achievers. These low achiever females who received the multi-image presentations surpassed both the males and females in the average and high achiever groups who received the single-image format. Some of the procedures used in Lombard's study, however, make the accuracy of his finding dubious. Twenty-eight slides were used in both presentation formats; thus some slides appeared only once in the single-image presentation. In addition, the sound track for the multi-image version was longer and contained more lengthy comments or questions than the sound tract of the single-image program (Lombard, 1969).

Conducting a study to explore the affective impact of multi-image presentations, Bollman (1970) tested two hypotheses. First, he tested to see if there was any difference in the amount of shift in evaluative meaning of audiences viewing multi-image presentations and audiences viewing single-image presentations. Second, he tested to ascertain if the subjects' relationship to the screen had any effect on shifts in evaluative meaning. In his conclusions, Bollman (1970) stated that this experiment did not produce significant statistical evidence for conclusive answers to the two research questions.

Atherton (1971) conducted a study to determine if a multi-image slide presentation would result in greater affective and cognitive learning than similar content presented by a 16mm film. Two separate tests were conducted: one to measure affective learning, the other to measure cognitive learning. No significant difference was found between groups in the amount of attitudinal change elicited as a result of the presentation, and no significant difference was found between treatment of groups relative to the cognitive learning resulting from viewing the presentations. These analyses indicated that one treatment was not significantly more effective than the other in producing positive increases in affective or cognitive learning (Atherton, 1971).

Westwater (1972), in conducting a descriptive study to gather information about the field use of a multi-image presentation, found that about eighty percent of the teachers who participated in the study would like to use the presentation to a greater degree. Westwater, however, pointed out two major limitations to the development of multi-image presentations:

> Few teachers are familiar with WMP's (wide screen multi-image presentations) -- their characteristics, capabilities and how to use them creatively. And the body of knowledge about the educational WMP and its utility is lacking. What little has been generated is not widely known. (Westwater, 1972, p. 53-4)

Didcoct (1972) conducted a study of the cognitive and affective responses of college students to single-image and multi-image presentations. He hypothesized that no difference would be found in attitude or cognitive retention between a group viewing a single-image presentation and a group viewing a multi-image presentation. Testing immediately after the presentations, one week after the presentations, and six weeks after the presentations, he found no significant difference between the group viewing the single-image presentation and the group viewing the multi-image presentation in either affective or cognitive responses.

Reid (1970) conducted a study comparing a multi-image presentation and a 16mm film as agents of attitude change. He hypothesized that the multi-image presentation would cause viewers to give more time and money to religious causes than the 16mm film. These hypotheses were tested at three locations. At two of these locations, the group that viewed the multi-image presentation pledged more time and money than the group that viewed the 16mm film. At the third location no significant difference was found between the two groups.

Sex of the Student as a Factor in Learning

Several areas have been explored in the research of sex of the student as a factor in learning. The fact that males outperform females on specific spatial tests is not generally disputed, but the explanations for the differences are controversial according to Eliot and Fralley (1976). Researchers have suggested that the difference may be caused by cultural bias (Glickman, 1976a; Veroff, 1975), cultural bias and biological differences (Stewart, 1977), biological differences only (Draper, 1975; Vaid and Lambert, 1978; Waber, 1977), cognitive style (Lewis, 1968; Ogletree and Mandujana, 1975), social class (Reppucci, 1969), or biased testing techniques (Nelson, 1977; Waetjen, 1977). For the purposes of this study, the topics of primary interest in the area of sex of the student as a factor in learning were verbal, spatial, and problem-solving skills.

Jacklin and Maccobry (1972), in a review of the early literature, concluded that females learn language earlier than males and may always continue to have a small lead over males. By the fourth grade, males are superior to females in spatial abilities, and this difference increases in high school students. Glickman (1976b) stated that at about age eleven, males begin to perform better than females in solving visual problems and that females display superiority in verbal abilities, and that this divergence between the sexes increases through high school and possibly beyond. On the other hand, Fairweather (1976) concluded that few convincing sex differences exist and that the apparent sex differences that begin to occur at about age ten or eleven and increase through high school are culturally based. Waetjen (1977) stated that the assumption that males are innately superior in analytical and quantitative skills and that females are superior in verbal skills holds true only at certain times in the life cycle of each sex. He went on to state that cultural attitudes rather than innate sex differences account for the differences in achievement. Fennama (1976), in reviewing the literature, stated that many studies crediting males with more mathematical ability than females were carried out on populations in which the males had actually studied more math than the females. Burton (1979) pointed out that culturally, mathematics has been a masculine domain and has been a detriment to the intellectual development and career progress of females, and thus females tend to underrate their ability in mathematics, even when it is exceptional. Parsons (1976) found that females are culturally encouraged into the role of "learned helplessness" and that females have lower initial expectations for success than males. Brainard and Ommen (1977) found that females had lower academic expectations than males and found significant statistical differences between males and females in preference for structure, content, and mode of instruction in classroom situations.

Lawson (1975) administered five tests, two Piagetian manipulation tests, two conservation tasks, and the Longeot pencil and paper formal reasoning test to high school students. In all five tests, the males' mean scores were higher than the females' mean scores, and this difference in scores might be attributed to the tendency for males to be more field-independent than females. Hyde, Geiringer, and Yen (1975), however, produced research to indicate that sex differences in tests of field independence are not conclusive evidence that females are less analytical than males. In the areas of learning strategies and memory, Cole (1972), in his study of rate and method of learning in elementary school students, found that females exhibited more efficient learning strategies, while males were dependent upon immediate feedback, and Dungan (1978), in her study of memory for prose, determined that females, whether high or low comprehending readers, scored significantly better than males in the remembering and retelling of prose.

In research in cerebral organization and functioning, Harris (1975) dealt with a neurological model for sex differences in spatial ability which indicated that some brains are further specialized for spatial analyses than others and that these "further specialized" brains are more frequently male than female. She also indicated that an alternative model for sex differences in spatial ability suggests that females prefer to code information phonologically (because of their earlier language development) and that males prefer to code information visually. Glickman (1976a) stated that arguments for cognitive sex differences being based on any brain specialization have not yet been substantiated. She also stated that those findings which indicate females are more verbal and males more analytical could be the result of cultural expectations. Sherman, in separate studies, presented evidence that the largest sources of cognitive difference between the sexes can be traced to cultural factors (1977), concluded that most of the research which indicates that one sex is superior in any cognitive ability can be shown to be questionable (1978), and stated that empirical support for biologically based hypotheses concerning the sex-related cognitive differences is "weak and most inconsistent" (1979).

Semantic Differential

Ordinarily to find out what something means to a person we ask him to tell us. The responses, however, one receives "when he asks what something means are usually quite different from those he gets when he asks for association." (Osgood, Suci, and Tannenbaum, 1957, p. 18)

By asking for associations with a selection of successive alternatives, one may gradually eliminate uncertainty as to the object or to the concept being thought about, and so selection between successive pairs of common verbal opposites should gradually isolate the meaning of the stimulus sign. To increase the sensitivity of such an instrument, a scale may be inserted between each pair of terms so that the subjects can indicate both direction and intensity of each judgement. (Osgood, Suci, and Tannenbaum, 1957)

The semantic differential is essentially a combination of controlled associations and scaling procedures which indicate both direction and intensity of each judgment. Karwoski and Odbert (1938) pioneered this semantic differential technique while investigating the phenomenon of synthesis which is the effective cross-circuiting of sensory responses because of certain stimuli, such as seeing a particular color when a given musical chord is struck. The results of Odbert, Karwoski and Eckerson's (1942) research indicated that stimuli from several modalities, visual, auditory, emotional and verbal, may have shared significance or meanings creating the possibility of cross-modality stimulus equivalence. A subject, therefore may view a stimulus and rate that stimulus on a hard - soft scale or on a loud - quiet scale. Osgood (cited in Osgood, Suci, and Tannenbaum, 1957) found that visual, emotional, and verbal shared significance is a fundamental relationship operating within the human species rather than a function of cultural effect. Karwoski, Odbert, and Osgood's (1942) work indicated that language, emotion, and auditory or visual stimuli can represent semantic relationships which can be described as "the parallel alignment of two or more dimensions of experience, definable verbally by pairs of polar adjectives." (Osgood, Suci, and Tannenbaum, 1957, p. 231)

The semantic differential represents a standardized and quantified procedure for measuring the connotations of any given concept for the individual. Each concept is rated on a seven-point graphic scale as being more closely related to one or the other of a pair of verbal opposites. (Anastasi, 1968)

Summary

Multi-image techniques have been in use for more than fifty years with a rapid expansion of their use in the last two decades (Trohanis, 1975). Much use, however, was haphazard until Perrin (1969) first attempted to develop a theory which indicated the three major areas that distinguish multi-image communication from other media. Simultaneous images, screen size, and information density are the three areas.

Theoretically, simultaneous images might be used advantageously in instructional situations which require association (Millard, 1969; Perrin, 1969). Simultaneous images also allow the viewer to determine his own individual order of viewing and thus the relationship between the images, which has an effect on an individual's learning, memory, and recall (Berger, 1973; Bruner, 1967; Gagné and Briggs, 1974; Low, 1968). Allen and Cooney (1963), Malandin (cited in Perrin, 1969), and Roshka (1958) have indicated that simultaneous presentation of images is effective in instruction with younger children.

The second area, screen size, may be beneficial in the presentation of instructional material that requires high visual acuity (Blackwell, 1968). Schlanger (1966) stated that large screens through their richness in detail can simulate real environments, but Blackwell (1968) warned that any channel of communication loaded with information details may be distracting. Large screens extend the image into the peripheral vision creating a sense of continuous space (Barr, 1963). Perrin (1969) states that this apparent openness of the large screen encourages the viewer to explore and to select for himself, giving a greater sense of reality and participation.

Increased information density, the third area identified by Perrin (1969), is a result of projecting simultaneous images. This increased information density may be helpful in instructional situations such as identifying relationships or making contrasts and comparisons. The ability of visual images to communicate complex information rapidly was indicated by Langer (1942). Langer (1942) indicated that visual forms present all their information simultaneously, rather than successively. Just as sentences are far more than the sum of their parts, the same is true for multiple visual images (Goldstein, 1975). The increased information density in multi-image presentations was credited with increasing the rate at which information was learned by Hubbard (1961) and the U.S. Army (1959); however, Allen and Cooney (1963) pointed out that the results of those two experiments may be caused by factors other than the use of multi-image presentations. Fleischer (1969) stated that the mind and eye are capable of accepting the myriad of visual impressions that occur during a multi-image presentation; however, Goldstein (1975) suggested that multi-image presentations may cause information overload and thus create arousal through frustration. Perrin (1969) concluded that great amounts of information can be perceived during a multi-image presentation but questioned whether great amounts of information are learned from these perceptions.

The fact that males and females perform differently on spatial and verbal tests is not a generally disputed fact (Eliot and Fralley, 1976). The earlier development of language by females gives them a verbal advantage over males which they always maintain (Jacklin and Maccobry, 1972). The observation that males develop visual problem-solving skills in early adolescence and thus a divergence between the sexes is begun that increases through high school and beyond was made by Glickman (1976). Conversely, Fairweather (1976) and Waetjen (1977) indicated that female verbal superiority and male visual superiority are culturally based. Parsons (1976) found females to have lower expectations for success than males and observed females to be culturally encouraged into roles of "learned helplessness." In a study of over 3,000 community college students, Brainard and Ommen (1977) found females to have significantly lower academic expectations than males.

Lawson (1975) found males to perform better than females on manipulation tests, conservation tasks, and formal reasoning tests. Other research, however, has indicated that tests of field-independence are not conclusive evidence for male superiority in analytical reasoning (Hyde, Geiringer, and Yen, 1975). In dealing with cerebral organization and functioning, Harris (1975) stated that some brains are further specialized for spatial analysis and that these brains are more often male than female. She also indicated that females tend to code information phonologically while males code information visually. These biologically based hypotheses concerning sex-related cognitive differences were challenged by Glickman (1976a) and Sherman (1979). In the final analysis, most of the research that indicates that one sex is superior in any cognitive ability can be shown to be questionable (Sherman, 1978). The cognitive difference, therefore, between males and females should be further investigated.

An extensive review of <u>Current Index to Journals in Education</u> <u>Dissertation Abstracts</u>, <u>E.R.I.C.</u>, <u>Psychological Abstracts</u>, and <u>Social Sciences Citations</u> indicated that no study has been conducted to determine if any significant difference exists in the written cognitive and written affective responses between male college students and female college students concerning concrete instructional information presented in either a single-image presentation or a multi-image presentation. If any difference is found, it may be of assistance to instructional developers and media designers in providing a possible alternative approach to the learning of material.

Chapter 3

RESEARCH METHODOLOGY

Introduction

Three major areas of investigation were addressed in this study. The first area of investigation dealt with the ability of a single-image presentation, a multi-image presentation, and a time compressed single-image presentation to convey concrete cognitive information. The second area of investigation dealt with the attitudinal response of the subjects to the presentation format viewed and how the attitudinal response related to the individual's score on a cognitive test. The third area of investigation dealt with subject responses grouped by sex. Male and female responses on an attitudinal test were analyzed to determine if any measurable preference was displayed toward any of these methods of presentation. In addition, male and female responses on a cognitive test were analyzed to determine if any of these methods of presentation resulted in a greater retention of cognitive information.

Participants

The population represented in this study was the undergraduate student body of Clarion State College, which is located in the northwestern part of Pennsylvania. Clarion State College is a public four-year institution with an enrollment of approximately 5,000 undergraduates. The 99 subjects who participated in this study were freshmen and sophomores enrolled in introductory courses in the School of Communication. The students were allowed to enroll in the classes of their choice; therefore, randomization was not possible. One student was enrolled in two of the classes used in the study, and one student was enrolled in all three of the classes used in the study. These two subjects' responses were systematically removed before the data were analyzed to insure that all subjects tested had viewed only one of the presentations. Of the 97 subjects whose responses were used, 45 were male and 52 were female. As students enrolled in courses taught in the School of Communication, these subjects had been previously exposed to various instructional techniques such as lecture, slide tape (both single- and multi-image), television, programmed instructional materials, and self-paced labortory experiences. The use, therefore, of slides to present instructional information, as in this research study, was not an unusual occurrence for these students.

Four criteria were established for the selection of subjects. First, all classes had to be introductory level classes in the School of Communication at Clarion State College. Second, each class had to have an enrollment of at least 25 students. Third, each class had to be comprised completely of freshmen and sophomore students. Fourth, neither sex could represent more than 60% of the total class population. The three classes of students selected met all of the criteria.

The student roll for each of the classes selected was checked to insure that all of the subjects included in the data analysis had viewed only one of the presentations. Two persons were found to be present in more than one of the treatments. The responses of these two subjects were excluded from the analysis of the data.

Each of the classes selected was randomly assigned to one of the presentation formats by a blind drawing. The first class of subjects, which consisted of 15 males and 18 females, viewed the multi-image presentation. The second class of subjects, which consisted of 14 males and 18 females, viewed the single-image presentation. The third class of subjects, which consisted of 16 males and 16 females, viewed the time compressed single-image presentation.

Selection of Instructional Content Materials for Presentation

Three presentations were used in the experiment: a single-image presentation, a multi-image presentation, and a time compressed single-image presentation. In order to make the cognitive information consistent among all three presentations, the same instructional content material was used for each. The instructional content material was selected on the basis of several criteria. It had to:

1. be readily presentable in slide format
2. have general and specific characteristics around which concepts could be developed
3. be material with which the subjects would not have had previous instructional contact in any classes taught at Clarion State College
4. be a subject that would produce a minimum positive or negative emotional response

5. be a simple enough concept in order that it could be taught in fewer than fifteen minutes.

These criteria for the selection of appropriate instructional content material were discussed with the instructional developer at Clarion State College, and, as a result, information concerning the three different types of ancient Greek architectural columns was selected for use as the subject of instructional content material.

Production of the Media

All three presentations used in this study were slide programs utilizing a single channel for communication. That is, all of the information was presented so as to be perceived by one sense, in this case the sense of sight.

Although three presentations were used in this experiment, only two sets of slides needed to be assembled because two presentations, the single-image and the time compressed single-image, utilized the same set of slides with different rates of projection. The two sets of slides were produced by following a concept development outline to insure that the instructional content of both sets of slides would be the same. The concept development outline (See Appendix A) followed the format of presenting the concept by beginning with general forms and leading to the more specific and detailed forms, which is the method of concept development espoused by Gagné (1965). The concept development outline for these slide programs consisted of twelve unique items. Each one of these twelve items of the outline dealt with a particular feature of ancient Greek architectural columns, such as a particular base style or a particular crown style. Appropriate examples of each of the twelve unique items were located. A portable copy stand was equipped with a 35mm single-lens reflex camera, and a macro focusing lens was used to copy these examples of columns or column parts from illustrated books on architecture. Illustrations of each of the twelve items of the outline were photographed on Kodak's Direct Positive Film, and the film was processed to yield black and white transparencies which were mounted into two-inch by two-inch cardboard mounts. Twelve title slides were made, one for each of the twelve items of the outline. These title slides were used in the slide programs to indicate the transition from one group of illustrations of one item to a group of illustrations of the next item.

The available length of time of the subjects and the capacity of a slide tray were two other considerations in the production of the slide program. Since the subjects were available for a period of 45 minutes, and of this time, 25 minutes were needed for reading directions and testing, a maximum presentation length of 20 minutes was established. The other factor to be considered was that a standard Carousel slide tray would accommodate a maximum of 80 slides; therefore, the slide programs were designed with a total of 72 slides. The number 72 was selected because it is the nearest number lower than 80 that is divisible by 12, a prerequisite required to insure that each of the 12 items in the outline of the concept development would have an equal number of illustrations in the slide programs.

The parameters of the design of the slide program having been established, the first program constructed was the slide program used for both the single-image presentation and the time compressed single-image presentation. This slide program consisted of a title slide followed by five illustrations for each item of the concept development outline. The slides were arranged to follow the concept development outline, that is, from general to specific formats. An illustration of this set of slides in their order in appearance is included as Appendix B. The slides in this program were projected on the area marked "Screen B" in Figure 1. The second slide program was constructed as a multi-image presentation utilizing an exact duplicate set of slides of the first slide program. An illustration of this set of slides in their order of appearance on the screen is included as Appendix C. The slides in this program were projected onto the screen areas marked "A," "B," and "C" in Figure 1.

In order to insure the content accuracy of the slide program, one set of slides was shown to two art historians. Each art historian viewed the slide program independently of the other. Each art historian indicated the same error in the identification of a certain column. Both persons indicated that with this one error corrected, the program would be totally accurate in its portrayal of the three types of ancient Greek architectural columns. A substitute slide was produced and shown to both persons, and they agreed that it was a correct illustration for that item. The slide substitution was made in the slide programs.

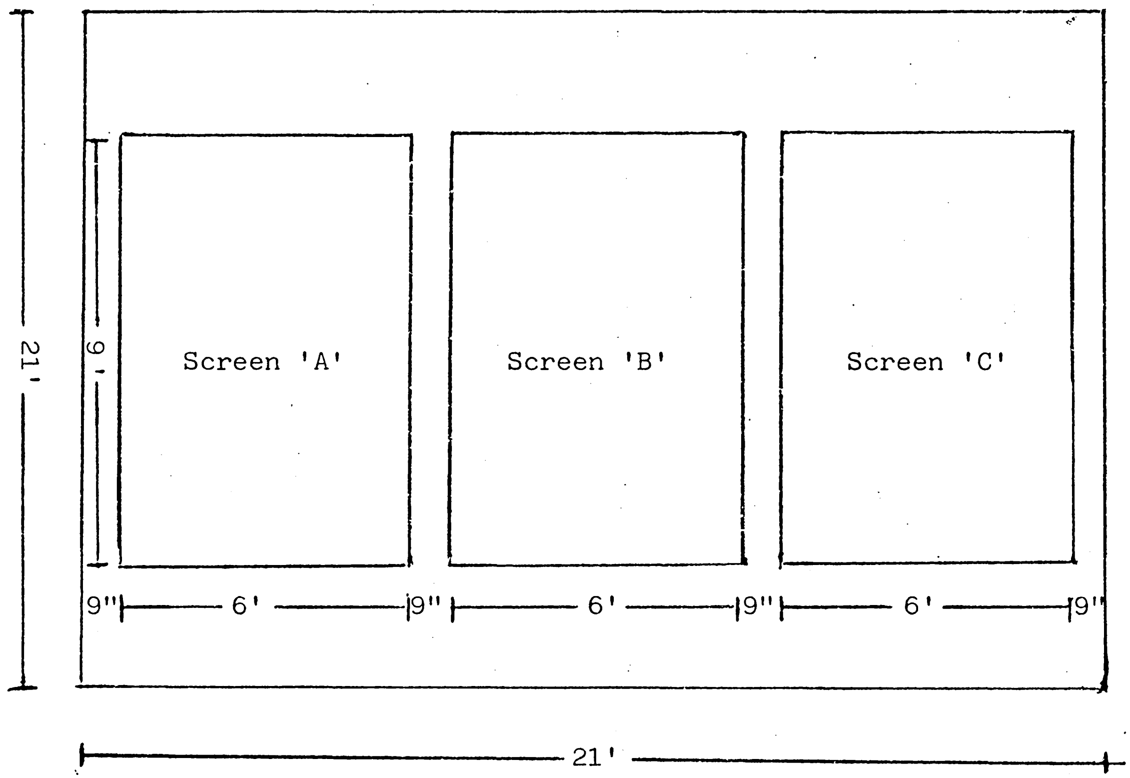

Figure 1. Illustration of the Screen Areas on which the three presentations were projected.

Construction of the Cognitive Instrument

In order to determine the information recalled about ancient Greek architectural columns by each individual, a cognitive test was constructed. This cognitive test was designed to assess learning on each of the 12 items (3 general, 9 specific) of the concept development outline. One question each concerning the three general items (general column shape, general crown shape, general base shape) and two questions each concerning the nine specific items (Doric column, Doric crown, Doric base, Ionic column, Ionic crown, Ionic base, Corinthian column, Corinthian crown, Corinthian base) were contained in the cognitive test. A copy of the 21 questions used in the cognitive test is included as Appendix D. The possible range of correct scores on this test was zero to 21. The validity of this test was established by criterion referencing each question.

The criterion referenced cognitive test was constructed in the following manner. Sixty-three answer slides were selected from a set of slides identical to those used in the presentation. Twenty-one of these answer slides were the correct answers, one for each question; 42 of these answer slides were the incorrect answers, two for each question. The 21 questions were recorded on an audio tape at 15-second intervals. The test program slides and audio tape were synchronized so that as a question was heard, three slides, one correct answer and two incorrect answers, would appear simultaneously on the three screens indicated in Figure 1. Screens were designated Screen A, Screen B, and Screen C, being left, center, and right respectively. The subjects indicated which slide they chose as the correct answer by marking either "a," "b," or "c" on their answer sheet.

Construction of the Affective Instrument

Each subject's attitude toward the presentation that he viewed was measured by using the semantic differential technique developed by Osgood, Suci, and Tannenbaum (1957). Their development of this testing technique is discussed in Chapter Two of this paper. This measurement instrument consisted of 50 pairs of bi-polar words with a five-point scale between them. The following example is taken from the semantic differential instrument.

	closely related	slightly related	neutral	slightly related	closely related	
good	1_____	2_____	3_____	4_____	5_____	bad

The 50 word pairs used in this test instrument were compiled in the following manner. A list of 250 sets of bi-polar words were selected from listings of paired words in The Measurement of Meaning by Osgood, Suci, and Tannenbaum (1957). A selection committee of ten members was asked to select independently from this list of 250 pairs of words the 50 pairs that would best describe a slide-tape presentation. The group consisted of a Director of Learning Resources, an Audio-Visual Coordinator, a Library Coordinator, a Learning Laboratory Coordinator, and six students. The 50 pairs of words which were selected most often by this group were used as the test instrument. The final copy of the semantic differential is shown in Appendix E. The possible range of scores on this test was 50 to 250. A score of 50 indicated the highest possible negative attitude while a score of 250 indicated the highest possible positive attitude. A score of 150 indicated a neutral attitude.

Pilot Test

Five work-study students in the Audio-Visual Department at Appalachian State University were asked to participate in the pilot test of the materials. These five students viewed the single-image presentation that would be shown to the control group, were read the directions for the semantic differential, which they completed, and were then given the cognitive test. These students were then asked if they had any difficulty with viewing the presentation, understanding the directions, or completing the tests. All five stated that they had no problems, and a review of the tests indicated that they had followed the directions correctly. The scores on the cognitive test for this pilot ranged from 13 to 18 correct responses. As a result the actual experiment was executed in the same manner as the pilot test.

Immediately prior to the conducting of the experiment, all three presentations were viewed to insure the proper technical functioning of the equipment and proper ordering of the slides.

Procedures

The single-image presentation consisted of 72 slides projected in a linear format. Each slide was projected for 15 seconds, producing a presentation that was 18 minutes in length. For the multi-image presentation a duplicate set of the 72 slides was used. These slides were projected concurrectly in sets of three. Each set of three slides was projected for 15 seconds, producing a presentation that was six minutes in length. In order to determine if the difference in the time length between the 18-minute single-image presentation and the six-minute multi-image presentation was a significant factor, a third presentation was developed. This third presentation consisted of the same 72 slides presented in the same order as the single-image presentation; however, each slide was projected for five seconds instead of 15 seconds, producing a presentation six minutes in length. Figure 2 presents an illustration of the time relationship among these three presentations.

Two studies indicate that five seconds is sufficient time for recognition and memory of pictures. Subjects of the Standing, Conezio, and Haber (1970) study achieved over 90% recognition of 120 pictures presented for one second each. Potter and Levy (1969) found that subjects could remember pictures well if they were presented for one or two seconds. Goldstein (1975) stated that "the results show that observers differentially fixated certain areas of the picture and that these highly fixated areas were the areas that were rated highest in 'informativeness'." (p. 40) He continued "that most of the picture is never fixated!" (Goldstein, 1975, p. 39) and a fixation usually lasts from about two-tenth to eight-tenths of a second. This rate of fixation means that the observer spends about

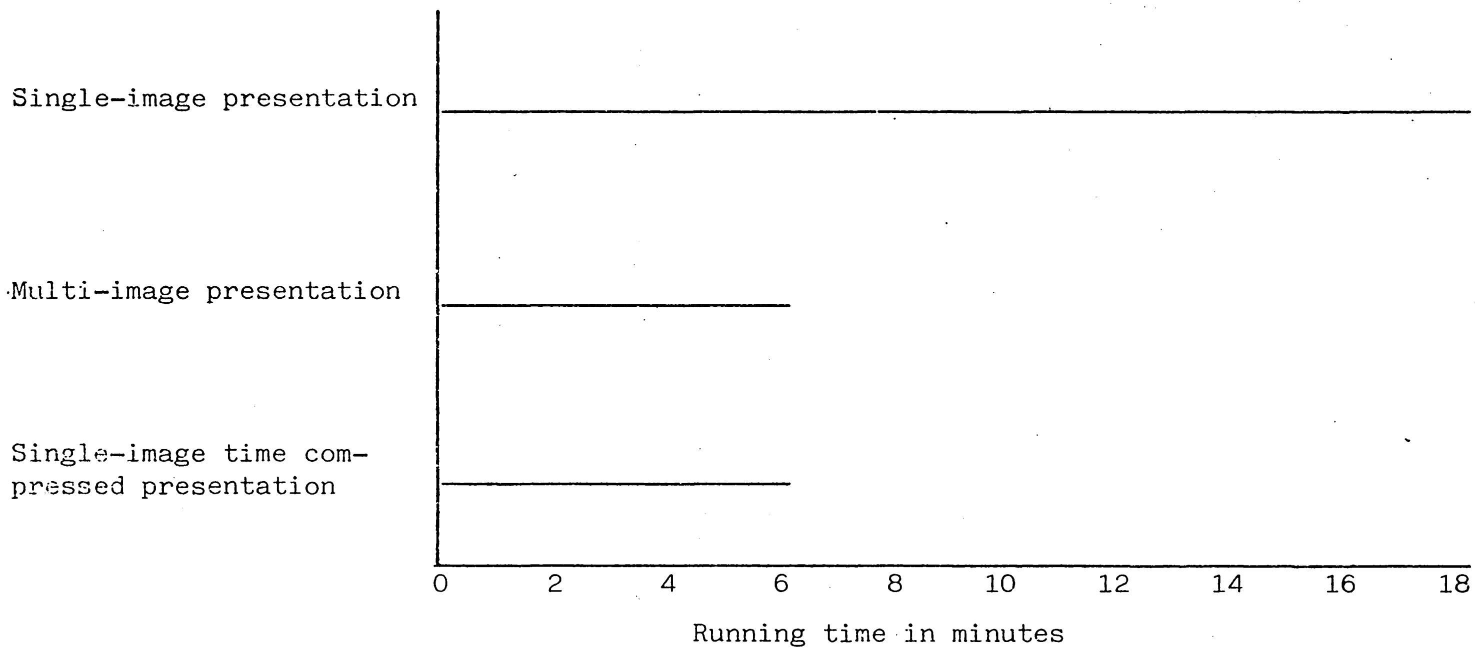

Figure 2. Illustration of the time relationships among the three presentations.

95% of his time fixating. Thus the subjects in this experiment were able to make as many as 25 fixations on information areas in each slide for 95% of the time, or 4.75 seconds, which is sufficient time for recognition and memory of pictures.

The timing and sequencing of the slides in all three presentations was controlled automatically by a Spindler/Sauppe Media Mix programmer which controlled the appearance of visuals on the screen within one sixteenth of a second. This equipment provided for consistent repetition of the timing of the appearance of the slides on the screen. Two projectors were used for the single-image presentations, and six projectors were used for the multi-image presentation. All projectors used were Kodak Carousel Model B-2 equipped with four-inch to six-inch zoom lenses. The images appeared as shown in Figure 1. Each image was nine feet high and six feet in width. The image size was dictated by the amount of screen area and the aspect ratio of the 35mm slides that were used. The aspect ratio of a 35mm slide is three units to two units. Three images, each six feet in width, used 18 of the 21 feet of the screen. This image size allowed nine inches of latitude between images and at the screen edge. This nine-inch margin prevented images from overlapping or spilling from the edge of the screen. The six-foot by nine-foot image was the largest that the screen could accommodate and still afford a safety margin. This safety margin was necessary because the Kodak Carousel B-2 slide projector does not produce perfect registration at the screen. That is, each slide does not project in exactly the same location as the previous slide. The safety margin allowed for this slight lateral drift.

A six-foot by nine-foot image was quite large but was an acceptable image, according to Schlagger (1966), who stated that for average viewing distance, experience indicates that about ten and a half inches of image width can be projected within acceptable limits for each millimeter of film width. Following this rule, a 35mm slide allows for approximately 30 feet by 20 feet of viewable screen image. The six-foot by nine-foot image fell well within this limitation.

The experiment was conducted during the period the students normally attended the selected class. All three classes followed the same procedure during their participation in the experiment. The classes were assembled in the classroom where the projection equipment had been set up, and the presentations were ready to be viewed. All three classes viewed their assigned presentation in the same classroom at different times. Immediately after viewing the assigned presentation, each group was tested in the following manner. The lights were turned on, and each subject was given an opscan general coding form (an example of this form, which was used in both tests, is included as Appendix F), a copy of the semantic differential, and a sharpened number two lead pencil. Then the directions for the completion of this test were read by the investigator, and questions posed by the subjects concerning the proper completion of the test were answered. The directions which were read can be found in Appendix G.

Osgood, Suci, and Tannenbaum (1957) indicated that a college student can complete an average of 20 items per minute on a semantic differential form. Five minutes, therefore, were allowed for the completion of this test. In all three groups every subject completed this test within the five minutes allowed. The opscan forms and tests were then collected. The semantic differential was administered first so that the taking of the cognitive test would not color the attitude of the students toward the presentation.

Immediately following the collecting of the semantic differential, the cognitive test was administered. A second opscan general coding form was distributed, one to each subject. The lights were lowered to a pre-determined level, bright enough to allow students to see and to mark their forms, yet dark enough to allow slide projection. The slide/tape test discussed earlier in this chapter under the Construction of the Cognitive Test section was administered. This test lasted five minutes and 15 seconds. At the end of this test the opscan form and pencils were collected.

In the general directions at the beginning of each test each of the subjects was asked to record the following information on the general coding form: sex, group number, social security number, and test number (group number and test number were supplied to the subjects). As the opscan forms were collected at the end of each test they were segregated by sex of the subject so that it could be verified that the indicators for sex, group, and test had been correctly encoded. It was found that all subjects had correctly encoded this requested information.

All of the opscan general coding forms were processed at the computer center at Appalachian State University where the information on each form was mechanically transferred to a computer punch card. The information on these cards was used by the computer in the analysis of the data.

Analysis of the Data

The data gathered during this experiment was analyzed using the standard SAS computer programs. First the means, standard deviations, and minimum and maximum scores were found for the dependent variables, affective scores and cognitive scores; then the means, standard deviations, and minimum and maximum scores were found for the independent variables sex (two cases) and treatment (three cases) for both the affective scores and the cognitive scores.

A two-way Analysis of Variance (ANOVA), which was designed for use with unequal cells, was used to analyze the results of the affective test (semantic differential). This analysis considered the independent variables of sex (two cases) and treatment (three cases) and the interaction of sex and treatment. Because the number of cases per cell were uneven in this study, and because this unbalanced design effects the partitioning of the sum of squares between groups (SS_B) used in the calculations, this test was done twice, once with sex as the first factor and once with treatment as the first factor in order to control for the effect on the sum of squares. A visual representation of this design is displayed as Figure 3. This same manner of analysis was applied to the results of the cognitive test and is visually represented by Figure 3. A Pearson's product-moment correlation was used to test for the correlation between the affective scores and cognitive scores of each individual.

Hypotheses

The following null hypotheses were tested:

H_{01}: No difference exists in the amount of cognitive information retained by subjects among the three presentation formats viewed (i.e., single-image, multi-image, or time compressed single-*image)*.

H_{02}: No difference exists between males and females in the amount of cognitive information retained.

H_{03}: No interaction exists between presentation format and the sex of the subject on the amount of cognitive information retained.

H_{04}: No difference exists in the attitudinal responses of subjects among the three presentation formats viewed.

H_{05}: No difference exists between males and females in the attitudinal responses concerning the presentations.

H_{06}: No interaction exists between the presentation format and the sex of the subject concerning the attitudinal responses.

H_{07}: No correlation exists between the amount of cognitive information retained and attitudinal response for any of the subjects.

Sex of the Subject		Single-image	Multi-image	Single-image time compressed
	Female			
	Male			

Type of Presentation

Figure 3. Illustration of the 2 x 3 Factorial Design for the Two-Way ANOVA for Affective scores and Cognitive Scores.

Summary

This chapter presented the research methodology and procedures used to examine the differences between the affective and the cognitive responses of male and female college students to either an instructional single-image presentation, an instructional multi-image presentation, or an instructional time compressed single-image presentation. Ninety-seven freshmen and sophomores from entry level classes in the School of Communication at Clarion State College in Clarion, Pennsylvania, were the subjects. Thirty-two subjects viewed the single-image program, 33 subjects viewed the multi-image program, and 32 subjects viewed the time compressed single-image program. Immediately after viewing a particular presentation, subjects were asked to complete a semantic differential which was used to measure attitudes toward the method od presentation; next subjects completed a mutliple choice test concerning the cognitive information presented in the program viewed. A two-way ANOVA was used to analyze the results of the cognitive test and the semantic differential. A Pearson product-moment correlation was used to test for correlation between the cognitive and affective scores. The results and findings are presented in Chapter Four.

Chapter 4

ANALYSIS OF THE DATA

This study considered the effects of presentation format and the sex of the subject on the retention of cognitive information and the attitude of the subject toward the presentation viewed. The variables in the study were sex of the subject and the format of the instructional presentations, single-image, multi-image, and time compressed single-image. The effects of these variables on the retention of cogntive information was measured by means of a 21-item multiple choice test. The effect of these variables on the attitude of the subjects toward the presentation viewed was measured by means of a 50-item semantic differential. The range of scores on the multiple choice test was five to 21. The range of scores on the semantic differential was 116 to 182. See Appendix H for individual scores.

The results of the test for retention of cogntive information and the results of the semantic differential were analyzed using the Statistical Analysis System General Linear Models Procedure, which was designed for use in all models having unequal N's in cells. This method of analysis produced two F values for the test of each of the main effects and one F value for the interaction test. In a one-way ANOVA the SS_{total} is broken down into $SS_{between}$ and SS_{within}. In a two-way ANOVA the $SS_{between}$ is further separated into sums of squares for rows, columns, and interaction. When the *experimental design, however, has unequal N's in the cells, several* ways exist to break the $SS_{between}$ into three separate parts. Because of this situation, the apportioning of the $SS_{between}$ was approached in two separate ways. First, a sum of squares for sex was pulled out while ignoring any effects for presentation format or interaction. With the variation attributed to the sex of the subject now eliminated, the sum of squares for presentation format was pulled out while continuing to ignore any effect for interaction. Given that the variation for both sex and format have been removed, the remainder is the sum of squares for interaction. This procedure might be denoted as:

SS_{sex}	[= sex ignoring format and interaction]
$SS_{format/sex}$	[= format eliminating sex, but ignoring interaction]
$SS_{interaction/format,\ sex}$	[= interaction eliminating both sex and format]

Then in the second approach a sum of squares for format was pulled out, then a sum of squares for sex, and then the sum of squares for interaction. This procedure might be denoted as:

SS_{format}	[= format ignoring sex and interaction]
$SS_{sex/format}$	[= sex eliminating format, but ignoring interaction]
$SS_{interaction/format,\ sex}$	[= interaction eliminating both format and sex]

Note that the last step was the same in both approaches; therefore, only one test for interaction was needed. This procedure was used to determine the effect of sex of the subject, presentation format, and the interaction of both on the retention of cognitive information and the results of the semantic differential.

The results of the test for retention of cognitive information and the scores on the semantic differential were compared using the *Pearson product-moment correlation. This test was used to determine* if there was any correlation between the scores on the test for retention of cognitive information and the scores on the semantic differential. The hypotheses tested and the results of the above analyses are included in this chapter. An alpha level of .05 was the criterion for a statistically significant difference throughout.

Analysis of the Null Hypotheses

Null Hypothesis One. No difference exists in the amount of cognitive information retained by subjects among the three presentation formats viewed (i.e., single-image, multi-image, or time compressed single-image).

As may be seen in Table 1 differences in presentation format did not produce differences in cognitive information scores, either when variance for sex of the subject and interaction are ignored, $F(2,96) = 2.39$, $p = .098$ or when variance for sex of the subject is eliminated, $F(2,96) = 2.61$, $p = .079$. Null Hypothesis One, therefore, was not rejected.

Null Hypothesis Two. No difference exists between males and females in the amount of cognitive information retained.

As may be seen in Table 1 the sex of the subject was associated with differences in cognitive information test performance both when variances for presentation format and interaction was ignored,

Table 1

Summary Table of the two-way ANOVA of the Scores on the Test for the amount of Cognitive Information Retained by Presentation Format, Sex of the Subject, and the Interaction of these two variables.

Source	df	Sum of Squares	Mean Square	F	p>F
Between	5	305.89	61.18	3.11	.012*
Within	91	1790.15	19.67		
Total	96	2096.04			
Sex	1	78.76	78.76	4.00	.048*
Format/sex	2	102.52	51.26	2.61	.079
Interaction/sex,format	2	124.62	62.31	3.17	.047*
Format	2	93.94	46.97	2.39	.098
Sex/format	1	87.33	87.33	4.44	.038*
Interaction/sex,format	2	124.62	62.31	3.17	.047*

*p< .05

Table 2

Mean Scores on Tests by Sex and by Format

	Males		Females		Combined	
	Cognitive Information	Semantic Differential	Cognitive Information	Semantic Differential	Cognitive Information	Semantic Differential
Multi-image	11.14	149.50	14.83	149.72	13.22	149.63
Single-image	13.00	152.13	16.33	150.33	14.82	151.15
Time compressed Single-image	16.25	153.94	14.94	149.69	15.59	151.81
Combined	13.58	151.96	15.39	149.92	14.55	150.87

*$F(1, 96) = 4.00$, $p = .048$ and when variance for format was eliminated, $F(1, 96) = 4.44$, $p = .038$. Null Hypothesis Two, therefore, was re-*jected in favor of the alternative that females ($\bar{X} = 15.39$) clearly did better than males ($\bar{X} = 13.58$) on average. This result, however, should be viewed in the light of the interaction effect discussed below.

Null Hypothesis Three. No interaction exists between presentation format and sex of the subject on the amount of cognitive information retained.

As may be seen in Table 1, the association between sex of the subject and cognitive test performance under differenct presentation formats was not constant. A significant interaction is evident, $F(2, 96) = 3.17$, $p = .047$, reflecting the fact that females out performed males for both the mutli-image presentation and the single-image presentation, but males performed better on the time compressed single-image presentation. Null Hypothesis Three, therefore, was rejected. This interaction is illustrated in Figure 4.

Null Hypothesis Four. No difference exists in the attitudinal responses of subjects among the three presentation formats viewed.

As may be seen in Table 3, there was no statistical difference in the attitude of the subjects toward the presentation viewed because of the presentation format. This finding was observed when variance *for sex of the subject and interaction was ignored,* $F(2, 96) = 0.20$, *$p = .821$, and when variance for sex of the subject is eliminated,* $F(2, 96) = 0.18$, $p = .837$. Null Hypothesis Four, therefore, was not

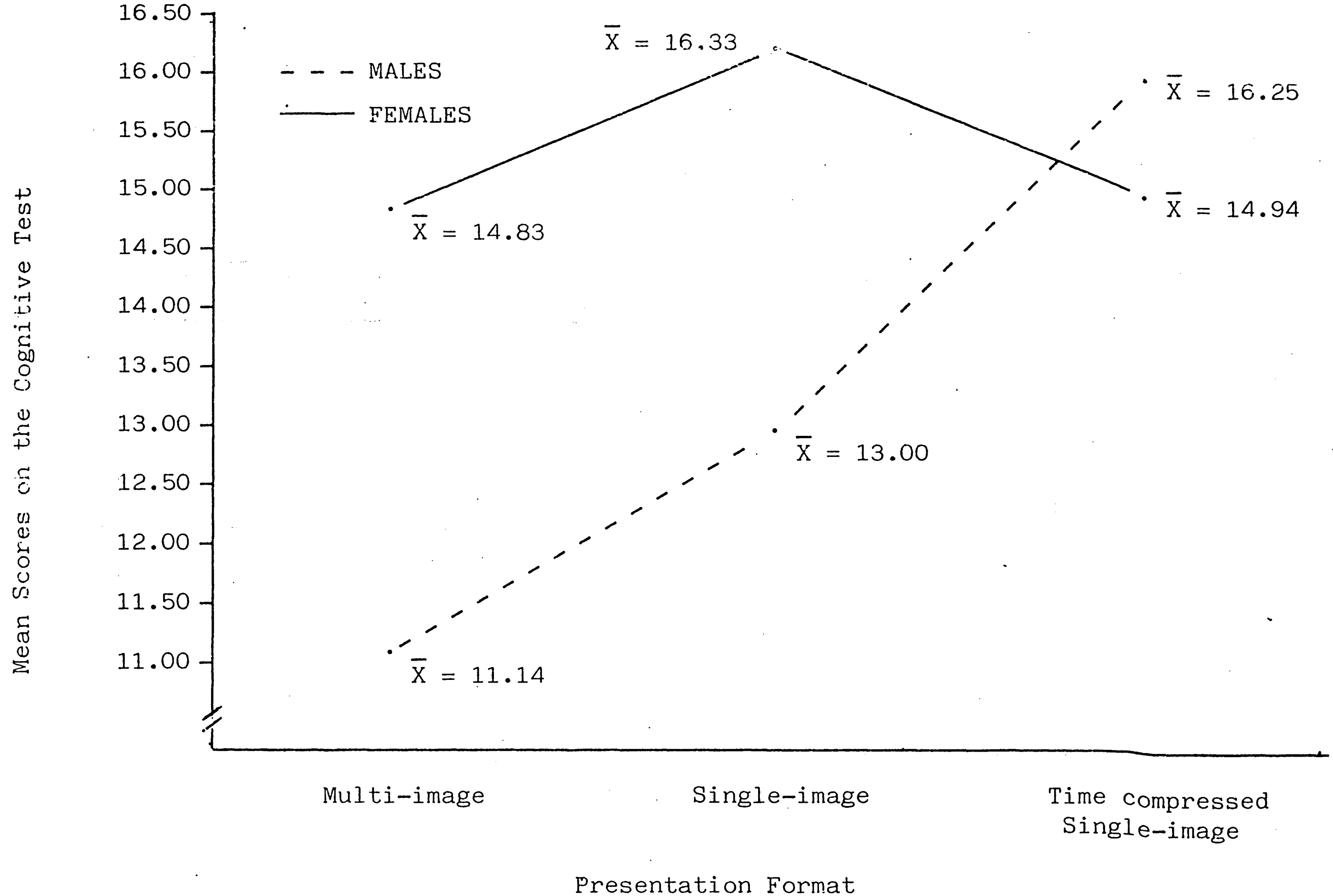

Figure 4. Effect of the Interaction of the Sex of the Subject and Presentation Format on the Cognitive Test.

Table 3

Summary Table of the two-way ANOVA of the scores on the Semantic Differential by Presentation Format, Sex of the Subject, and the Interaction of these two Variables

Source	df	Sum of Squares	Mean Square	F	p>F
Between	5	252.04	50.41	0.25	.939
Within	91	18513.22	203.44		
Total	96	18765.26			
Sex	1	99.65	99.65	0.49	.486
Format/sex	2	72.72	36.36	0.18	.837
Interaction/sex,format	2	79.66	39.83	0.20	.823
Format	2	80.64	40.32	0.20	.821
Sex/format	1	91.74	91.74	0.45	.504
Interaction/sex,format	2	79.66	39.83	0.20	.823

rejected.

The mean scores by presentation format showed little difference with multi-image being the lowest ($\bar{X}$ = 149.63), then single-image next ($\bar{X}$ = 151.15), and then the time compressed single-image ($\bar{X}$ = 151.81).

Null Hypothesis Five. No difference exists between males and females in the attitudinal responses concerning the presentations.

A comparison of mean scores (Table 2) on the semantic differential indicated little difference between females ($\bar{X}$ = 149.92) and males ($\bar{X}$ = 151.96). As may be seen in Table 3, these differences were not statistically significant. This finding was observed when variance for presentation format and interaction is ignored, $F(1,96) = 0.49$, $p = .486$, and when variance for presentation format is eliminated, $F(1, 96) = 0.45$, $p = .504$. Null Hypothesis Five, therefore, was not rejected.

Null Hypothesis Six. No interaction exists between the presentation format and the sex of the subject on the attitudinal responses.

As may be seen in Table 3, the association between sex of the subject and attitudinal responses under different presentation formats was not statistically significant, $F(2, 96) = .200$, $p = .823$. Null Hypothesis Six, therefore, was not rejected.

Null Hypothesis Seven. No correlation exists between the amount of cognitive information retained and the attitudinal responses toward any of the presentation formats for any of the subjects.

As calculated from the scores on the test for the amount of cognitive information retained and the scores on the semantic differential (both sets of scores are included in Appendix H), the Pearson product-moment correlation of $r = -0.05$ between the amount of cognitive information retained by a subject and that subject's attitude toward the presentation was not statistically significant. Null Hypothesis Seven, therefore, was not rejected. A scatter plot of the scores for both tests is included as figure 5.

Summary

The two-way ANOVA of the test for the amount of cognitive information retained indicated that there was a significant difference between the males and females in the amount of cognitive information retained with the females retaining more that the males. There was a significant interaction between presentation format and sex of the subject on the amount of cognitive information retained. Females out performed males for both the multi-image presentation and the single-image presentation, but males performed better on the time compressed single-image presentation.

The two-way ANOVA of the semantic differential scores indicated no significant difference in the attitude of the subjects toward any presentation format.

The correlation between scores on the test for amount of cognitive information retained and the scores on the semantic differential was -0.05.

Included in Chapter 5 are a summary of the study and its findings, a discussion based on the data analysis, and recommendations for further research.

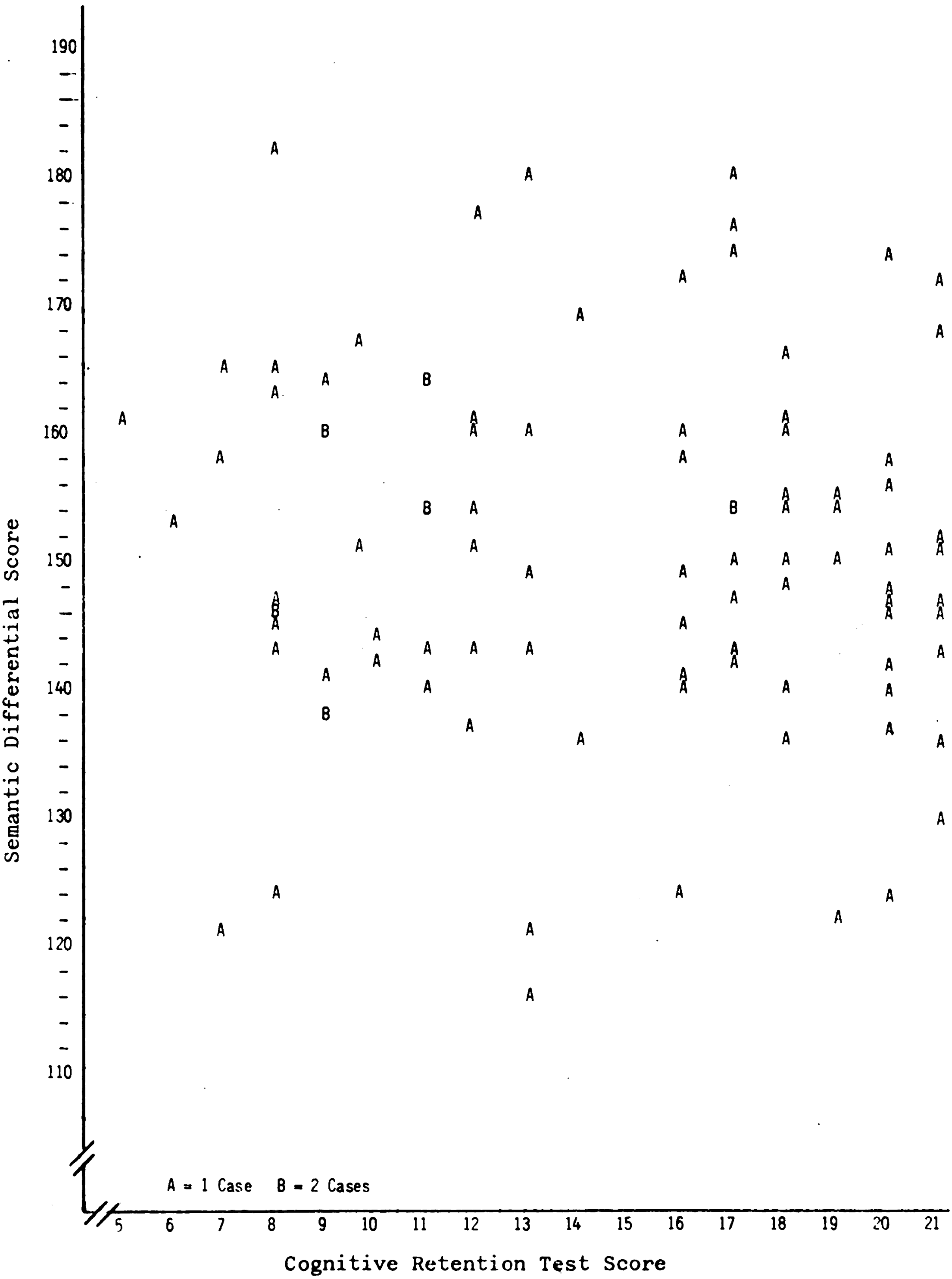

Figure 5. Scatterlot of Scores of the Semantic Differential and the Test for Cognitive Retention.

Chapter 5

SUMMARY, DISCUSSION AND RECOMMENDATIONS FOR FURTHER RESEARCH

In recent years there has been an increase in the use of slide presentations in instructional situations. The use of multi-image presentations in instructional situations has been vigorously promoted by the manufacturers of equipment designed solely for the production of multi-image presentations. These promotions credit multi-image presentations with many instructional capabilities. Most of these promotional claims, however, have little or no basis in research. This study began the investigation of one of these claims, that is, that a multi-image presentation would convey more concrete instructional information in a shorter period of time than a single-image presentation of the same information. In addition, this study investigated whether males and females differed in performance on a cognitive test or an attitudinal test concerning the same information presented in either a single-image, a multi-image, or a time compressed single-image presentation.

Summary

Purpose of the Study. The purpose of this study was four fold. First was to determine if any difference existed between the cognitive (amount of information retained) responses of male and female college students or between the affective (attitude toward the medium) responses of male and female college students to questions about a single-image presentation. The second was to determine if any difference existed between the cognitive responses of male and female college students or affective responses of male and female college students to questions about a multi-image presentation. The third was to determine if any difference existed between the cognitive or affective responses of male participants viewing the single-image presentation and male participants viewing the multi-image presentation. The fourth was to determine if any difference existed between the cognitive or affective responses of female participants viewing the single-image presentation and female participants viewing the multi-image presentation.

Procedure. Ninety-seven freshman and sophomore communication majors at a small public college were the participants in this study. These subjects were members of three separate classes. The first class had 14 males and 18 females, the second class had 15 males and 18 females, and the third class had 16 males and 16 females. Three presentations were developed for this experiment: a single-image presentation, a multi-image presentation, and a time compressed single-image presentation. The classes and presentations were matched by a random drawing. Each class viewed its presentation using the same procedures and under the same conditions. After viewing the assigned presentation each subject completed a semantic differential and a multiple choice test. The results of these two tests were analyzed using a two-way ANOVA. The independent variables considered were type of presentation viewed and sex of the subject. The Pearson r was used to determine the correlation between scores on the cognitive test and scores on the semantic differential.

Findings. No significant difference was found in the mean scores of males and females in the amount of cognitive information retained as a result of presentation format; however, there was a significant difference in the mean scores of males and females in the amount of cognitive information retained because of the subject's sex. Females scored higher than males on both the multi-image presentation and the single-image presentations; the males, on the other hand, scored higher than the females on the time compressed single-image presentation. No significant difference was found in the mean scores of males and females on the semantic differential for either presentation format viewed or sex of the subject. The correlation between the scores on the semantic differential and the cognitive test scores was -0.05, thus little or no relationship.

Discussion

This study used ninety-seven cases which were observed within intact classes. Since randomization was not possible, this study may not provide a basis for broad generalization of the results. Several points within this study are worthy of comment, however.

A slight tendency was found for the three formats to differ in mean cognitive scores. Multi-image had the lowest score ($\bar{X} = 13.22$), then single-image ($\bar{X} = 14.82$), and then time compressed single-image ($\bar{X} = 15.59$). Although this tendency was not statistically significant at the .05 level, it was interesting, nonetheless, because it was the reverse of the trend that might have been expected. Hubbard (1961), Lombard (1969), and the U.S. Army (1959) reported that the use of multi-image presentations increased the amount and speed of the learning of concrete cognitive information. Hubbard (1961) compared twenty minutes of three screen projection with a narrated sound track to fifty minutes of standard lecture, and the U.S. Army (1959) replaced thirty-two hours of regular classroom instruction with nineteen and a half hours of three screen multi-image material. Allen and Cooney (1963), however, commenting on both Hubbard (1961) and the U.S. Army (1959), stated that the results of both experiments could be as easily attributed to the instructional design of the programs as to the use of multi-image. Also a close examination of the procedures in Lombard (1969) produces a similar question concerning the effect of the actual design of the instructional material on the results of the study. Lombard (1969) did not construct parallel programs. His multi-image program contained more visuals, repeated some images several times, and had lengthier comments than his single-image presentation. Low (1968), Millard (1964), and Perrin (1969) suggested that the use of multiple images might enhance learning by allowing the viewer to determine his own interrelationship between images. Confusion or misinterpretation of the instructional message, however, may result from the viewer's inability to select the 'correct' relationships between the images. This confusion might result in the learning of less information or, even worse, the learning of incorrect information. Goldstein (1975) cautioned that in instructional situations multi-image presentations should be used with restraint, and Perrin (1969) questioned whether great amounts of information were learned from multi-image presentations. Roshka (1958) and Allen and Cooney (1963) found that the simultaneous presentations of images became less effective in instruction as the average age of viewers increased. It could be that freshmen and sophomore college students are too old for multi-image presentations to be used effectively in instructional situations, and age might be a consideration in the use of the multi-image format.

Another interesting point was that the sex of the subject was related to the amount of cognitive information retained. Females generally ($\bar{X}$ = 15.39) performed better than males ($\bar{X}$ = 13.58). This finding is interesting because it is the opposite of the trend that might have been expected. Males are credited with greater visual *problem solving abilities than females by Glickman (1976b), and there*-fore, would be expected to score higher on a cognitive test concerning information presented in a visual format. More importantly significant interaction was found between sex and format concerning the amount of cognitive information retained. It is interesting to note that both Atherton (1971) and Didcoct (1972), who conducted similar experiments, did not separate the subjects' scores by sex. In both of these experiments no significant difference was found as a result of the presentation format. Lombard (1969), however, did separate his subjects' responses by sex and found that the female group which viewed the multi-image presentation, even though they were considered low achievers, performed better than both male high achievers and female high achievers who viewed the single-image presentation. The interaction of the sex of the subject and the presentation format, therefore, may be an important factor to consider in the design of instructional media. Jacklin and Maccobry (1972) and Glickman (1976b) indicated that at an early age males begin to develop superior spatial abilities than females and out perform females in solving visual problems. Gickman continued that this difference increases through high school and possibly beyond. In this study the task is not visual problem solving; the task is the identifying and remembering of visual images. Cole (1972) projected image pairs for 2.2 seconds per pair with a four second intertrial interval, and required the subjects to match pair of images from memory. She found females exhibited more efficient learning strategies, especially benefiting from separating the storage and the retrieval processes, while males were dependent upon immediate feedback. Either of these factors could have had an effect on the results of the cognitive test. It could be that females are superior to males in the identifying and remembering of visual images.

Females out performed males on the cognitive test for both multi-image and single-image presentations, but males performed better than females on the time compressed single-image presentation. This situation may be the result of the limited population studied, and replication of this experiment may be needed to determine if this was a chance happening.

In each of the treatments no significant difference was evident in the attitudinal responses of subjects, either by sex of the subject, presentation format viewed, or the interaction of these two variables. Atherton (1971), Bollman (1970), and Didcoct (1972) all had findings that were in agreement with this result. The finding of no significant difference in attitudinal response and the finding that no significant correlation existed between a subject's scores on the cognitive test and the semantic differential leave the finding of the differences of the scores on the cognitive test as the only differences observed between the males and females in this experiment. No indication was found in the data, nor can any inferrences be drawn, to indicate whether this difference is biologically based as indicated by Harris (1975) or culturally based as suggested by Glickman (1976a) and Sherman (1979).

The analysis of the data of this study indicated some significant results; however, the limitations of this study should be noted. The visuals used in the presentations were taken from books; none of these book illustrations were intended for projection and enlargement. Because of this limitation several of the images used were small in size and lacked clarity and detail. The location of larger, more detailed illustrations of these few examples would strengthen the visual presentations by increasing the visual information available to the viewer.

The number of screens used and the orientation of these screens may have been a factor in the results of this study. The number of screens, in this case three, was a determining factor in the number of possible answers on the multiple choice test. The addition of more choices, such as all of these and none of these, on each of the questions might increase the reliability of the cognitive test by reducing the chance of guessing.

The design of the facility used in this study determined the projection of the images in a left, center, right pattern. This pattern, however, may have had an effect on the order in which the images were viewed because of our cultural bias of reading from left to right. The simultaneously presented images might be shown in other patterns, such as stacked vertically or randomly placed on a large screen. This randomization might be done by dividing a large screen into twelve, fifteen, or more areas and randomly assigning each image to one of the areas. Goldstein (1975) stated "many nerve cells in the visual cortex respond only weakly to steady illumination but respond with a burst of nerve impulses to moving stimuli or stimuli that are turned on and off" (p. 41). Images appearing and disappearing on the screen area could be thought of as being turned on and off. Goldstein (1975) also indicates that observers differentially fixate areas of a picture which are highest in "informativeness." It could be that the viewers would also fixate areas of a screen which have the highest "informativeness," that is, the areas on which the images are projected irrespective of their location on the screen.

The instructional design of the program content should be expanded to include more detailed information, such as the addition of other aspects of ancient Greek architecture. This increase in information would allow for an increase in the number of items on the cognitive test thus allowing for a possible improvement in this test's reliability and validity. Also a delayed re-administering of the cognitive test would allow for a more accurate appraisal of the actual retention of information. The impact of all the multiple image in a short period of time may overload some of the cognitive processes, such as sorting and ordering of information. Mandler (1972) indicated that on verbal lists the correlation between recognition and organization was higher after a two-week delay than during an immediate recognition test. Phillips (1977) found evidence of visual memory having components analogous to the short-term and the long-term components of verbal memory. It might be, therefore, after a period of a few days or a few weeks some of this information may be better ordered and more easily recalled by the viewer than it is immediately after the presentation.

The results of this study must be considered tentative. It is hoped that this experiment will be improved and replicated so that more broadly applicable conclusions can be drawn. It is further hoped that this study will serve as a small help to future researchers in investigations of single-image and multi-image presentations and their effects.

Recommendations

Based on the procedures and findings of this study, the following recommendations are made:

1. Replications of this study should be considered using a greater diversity in age level of subjects, from primary grade students through adults, to provide further indications of the validity of the results. The simultaneous presentation of images becomes less effective in instruction as the average age of viewers increases according to Roshka (1958) and Allen and Cooney (1963). Also the differences between males and females in visual and verbal skills may hold true only at certain times in the life cycle according to Waetjen (1977).

2. Studies should be conducted to investigate the relationship between the patterns of images on the screen during a multi-image presentation and the retention of cognitive information by the viewer. The placement of images in a left, center, right pattern, as used in the study, may have an effect on the order in which images are viewed because of our cultural trait of reading from left to right. The projection of images in vertical patterns or in groups of three with individual images assigned to one of many, say fifteen or eighteen, possible locations on a large screen may affect the order in which images are viewed.

3. Studies concerning the retention of cognitive information from single-image presentations and multi-image presentations should be conducted with delayed recall tests being given at varying intervals to determine the effects of presentation format and sex of the subject on long-term memory. The presentation of multiple images of the rapid

rate of presentation in the multi-image presentation may overload the viewer's ability to sort and to process all of the information being received. After a period of time, however, this information may be better ordered and easier to recall than it was immediately after viewing the presentation.

4. Another area of study, which was not covered in this experiment, but might be of interest to future researchers is interference in learning as it relates to the perception, storage, and recall of information from single-image and multi-image presentations.

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APPENDIX A

CONCEPT DEVELOPMENT OUTLINE

I. Types of Ancient Greek Architectural Columns

A. General design of a column

1. Illustrations of general column shapes
2. Illustrations of general column crowns
3. Illustrations of general column bases

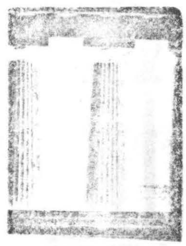
B. Specific parts of the three types of columns

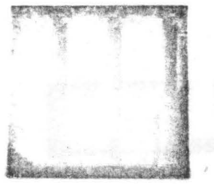
1. Doric column illustrations
2. Doric crown illustrations
3. Doric base illustrations
4. Ionic column illustrations
5. Ionic crown illustrations
6. Ionic base illustrations
7. Corinthian column illustrations
8. Corinthian crown illustrations
9. Corinthian base illustrations

APPENDIX B

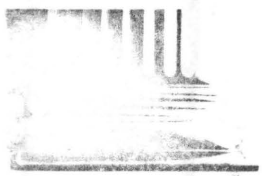
THE SLIDES OF THE SINGLE-IMAGE AND TIME COMPRESSED SINGLE-IMAGE PRESENTATIONS IN THE ORDER OF THEIR APPEARANCE

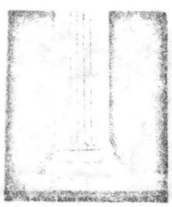
COLUMN

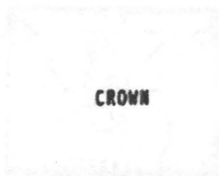




BASE



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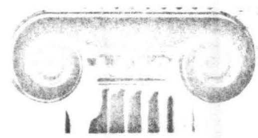

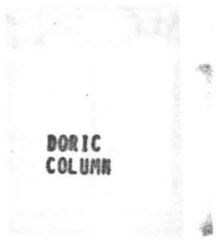
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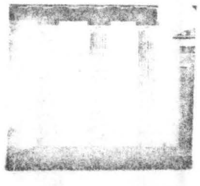

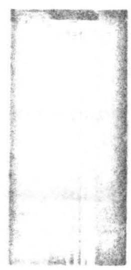

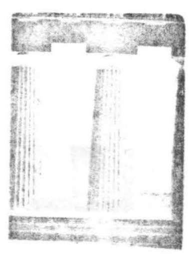

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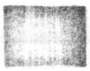

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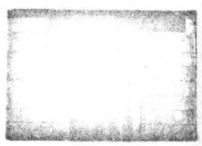

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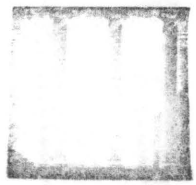

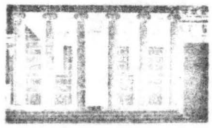


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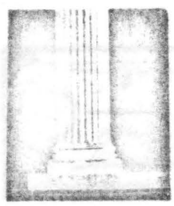

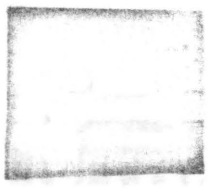

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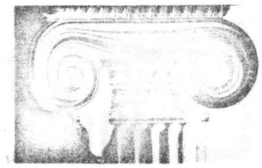

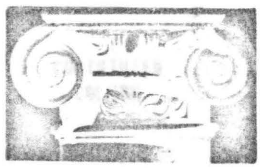

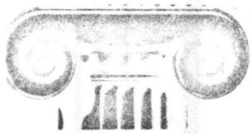

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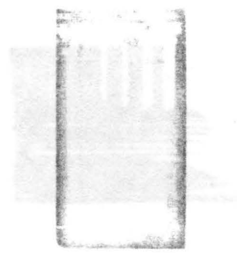

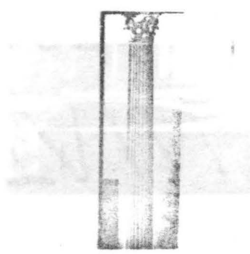

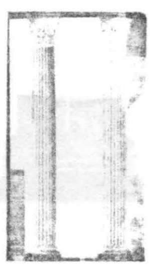

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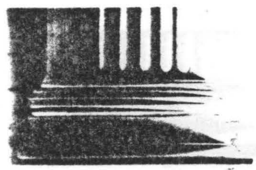

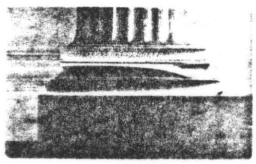

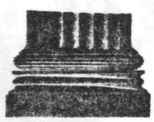

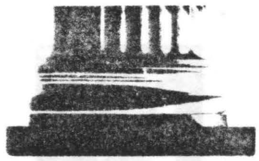

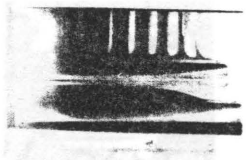

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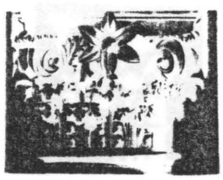
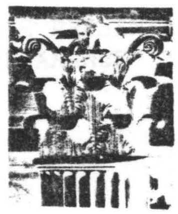
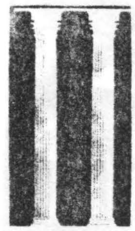


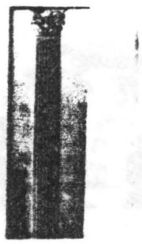


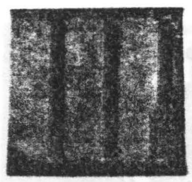
APPENDIX C

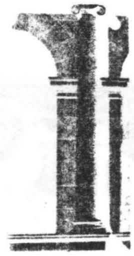
THE SLIDES OF THE MULTI-IMAGE PRESENTATION IN THE ORDER OF THEIR APPEARANCE

COLUMN









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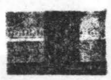

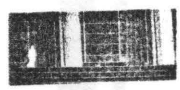

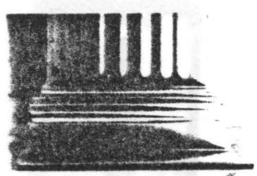

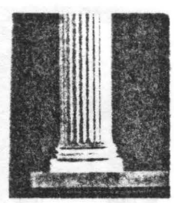

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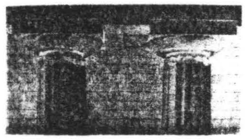

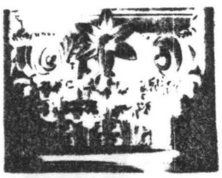

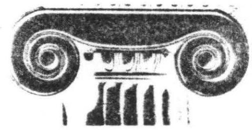

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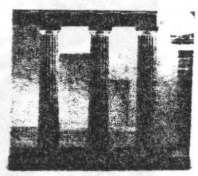

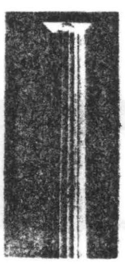

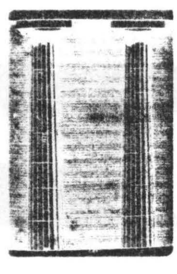

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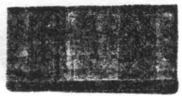

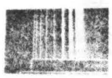

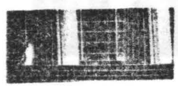

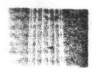

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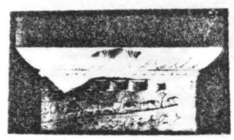

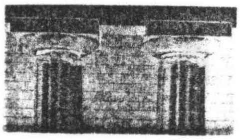

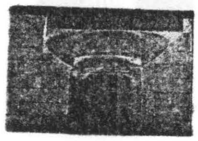

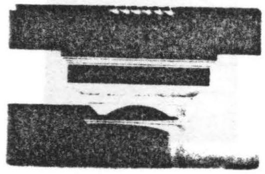

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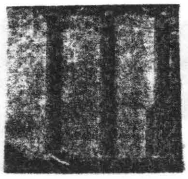

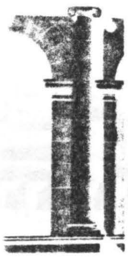

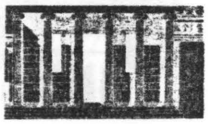

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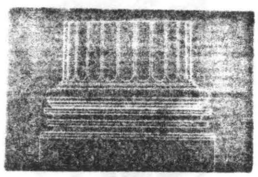

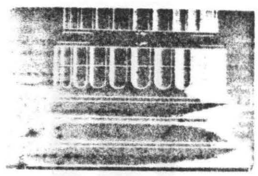

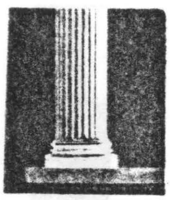

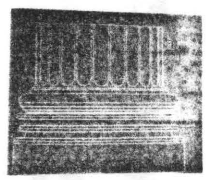

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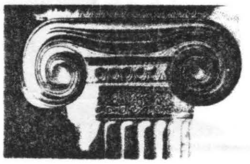

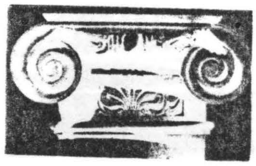

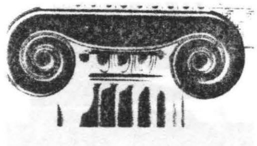

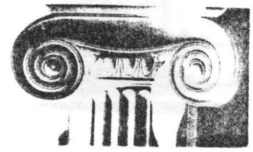

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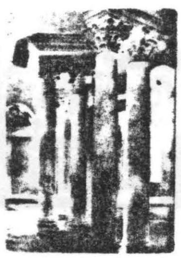

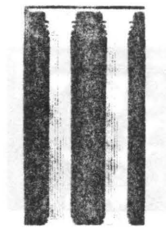

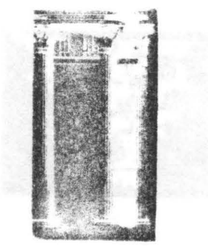

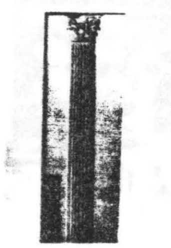

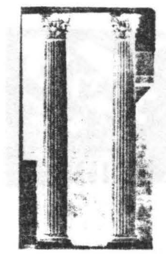

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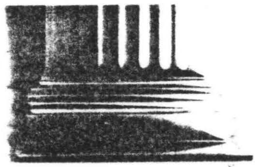

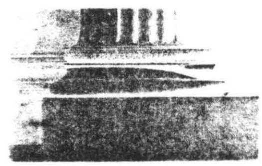

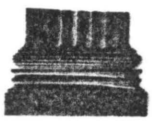

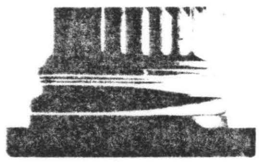

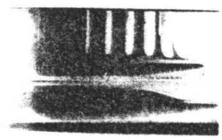

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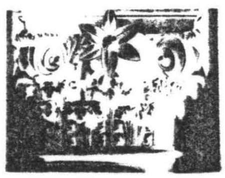

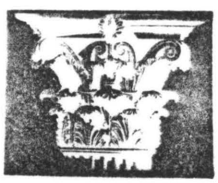

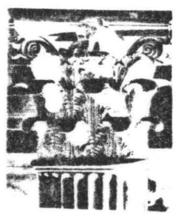

APPENDIX D

THE TEST FOR THE AMOUNT OF COGNITIVE INFORMATION RETAINED

1. Which of these three is a crown?
2. Which of these three is a base?
3. Which of these three is a column?
4. Which of these three is a Doric base?
5. Which of these three is an Ionic column?
6. Which of these three is a Corinthian base?
7. Which of these three is an Ionic crown?
8. Which of these three is a Doric column?
9. Which of these three is a Ionic base?
10. Which of these three is a Doric crown?
11. Which of these three is a Corinthian base?
12. Which of these three is an Ionic crown?
13. Which of these three is a Doric column?
14. Which of these three is a Corinthian crown?
15. Which of these three is an Ionic base?
16. Which of these three is a Corintian column?
17. Which of these three is a Doric base?
18. Which of these three is a Corinthian crown?
19. Which of these three is an Ionic column?
20. Which of these three is a Doric crown?
21. Which of these three is a Corinthian crown?

APPENDIX E

THE SEMANTIC DIFFERENTIAL

	closely related	slightly related	neutral	slightly related	closely related	
1. good	1	2	3	4	5	bad
2. small	1	2	3	4	5	large
3. beautiful	1	2	3	4	5	ugly
4. hard	1	2	3	4	5	soft
5. strong	1	2	3	4	5	weak
6. clean	1	2	3	4	5	dirty
7. worthless	1	2	3	4	5	valuable
8. cruel	1	2	3	4	5	kind
9. soft	1	2	3	4	5	loud
10. deep	1	2	3	4	5	shallow
11. pleasant	1	2	3	4	5	unpleasant
12. happy	1	2	3	4	5	sad
13. ferocious	1	2	3	4	5	peaceful
14. heavy	1	2	3	4	5	light
15. sacred	1	2	3	4	5	profane
16. relaxed	1	2	3	4	5	tense
17. short	1	2	3	4	5	long
18. nice	1	2	3	4	5	awful
19. honest	1	2	3	4	5	dishonest
20. passive	1	2	3	4	5	active
21. rough	1	2	3	4	5	smooth
22. fresh	1	2	3	4	5	stale
23. slow	1	2	3	4	5	fast
24. vibrant	1	2	3	4	5	still
25. repetitive	1	2	3	4	5	varied
26. chaotic	1	2	3	4	5	ordered
27. superficial	1	2	3	4	5	profound
28. blatant	1	2	3	4	5	muted
29. meaningful	1	2	3	4	5	meaningless
30. simple	1	2	3	4	5	complex
31. obvious	1	2	3	4	5	subtle
32. serious	1	2	3	4	5	humorous
33. violent	1	2	3	4	5	gentle
34. static	1	2	3	4	5	dynamic
35. unique	1	2	3	4	5	commonplace
36. emotional	1	2	3	4	5	rational
37. masculine	1	2	3	4	5	feminine
38. vague	1	2	3	4	5	precise
39. usual	1	2	3	4	5	unusual
40. controlled	1	2	3	4	5	accidental
41. formal	1	2	3	4	5	informal
42. calming	1	2	3	4	5	exciting
43. complete	1	2	3	4	5	incomplete
44. timely	1	2	3	4	5	untimely
45. awkward	1	2	3	4	5	graceful
46. pleasurable	1	2	3	4	5	painful
47. positive	1	2	3	4	5	negative
48. objective	1	2	3	4	5	subjective
49. interesting	1	2	3	4	5	boring
50. sane	1	2	3	4	5	insane

APPENDIX F

OPSCAN GENERAL CODING FORM

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
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9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

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2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

DS 2970 A

APPENDIX G

THE DIRECTIONS FOR THE SEMANTIC DIFFERENTIAL AND THE TEST FOR THE AMOUNT OF COGNITIVE INFORMATION RETAINED

DIRECTIONS FOR THE SEMANTIC DIFFERENTIAL

On this page you will find fifty pairs of bi-polar words, that is a pair of words that are opposite in meaning. Between each pair of words you will find a scale of five numbers. Please make all judgments on these scales based on your own personal feelings about the program that you just viewed. If you feel that the program was closely related to the word in the left-hand column, then mark space one on your answer sheet for that pair of words. If you feel that the program was slightly related to the word in the left-hand column, then mark space two on your answer sheet for that pair of words. If you feel that the program was equally related to both words or that the program was not related to either of the words, then mark space three on the answer sheet for that pair of words. If you feel that the program was slightly related to the word in the right-hand column, then mark space four on the answer sheet for that pair of words. If you feel that the program was closely related to the word in the right-hand column, then mark space five for each pair of words. Please read each pair of words carefully, and respond with your first impression. Do you have any questions?

DIRECTIONS FOR THE TEST OF THE AMOUNT OF COGNITIVE INFORMATION RETAINED

On the screen in front of you will be shown a series of sets of slides. Each set will contain three slides. Immediately after a set of slides appears on the screen you will be asked a question about the information that is in that set of slides. One of the slides will present the correct answer; the other two slides will present incorrect answers. Please mark your answer sheets with either a mark in the first column if the correct answer slide is on the left side of the screen, with a mark in the second column if the correct answer slide is on the center part of the screen, or with a mark in the third column if the correct answer slide is on the right side of the screen. Please answer each question. Do you have any questions?

APPENDIX H

INDIVIDUAL TEST SCORES

CASE-N	SEX	GROUP	TEST COGNITIVE SCORE	SEMANTIC DIFFERENTIAL SCORE
1	1.	1.	8.	182.
2	1.	1.	8.	165.
3	1.	1.	7.	121.
4	1.	1.	13.	181.
5	1.	1.	8.	163.
6	1.	1.	8.	124.
7	1.	1.	18.	166.
8	1.	1.	13.	116.
9	1.	1.	9.	141.
10	1.	1.	9.	164.
11	1.	1.	7.	158.
12	1.	1.	21.	143.
13	1.	1.	19.	123.
14	1.	1.	8.	146.
15	1.	2.	9.	160.
16	1.	2.	20.	137.
17	1.	2.	12.	137.
18	1.	2.	12.	148.
19	1.	2.	12.	151.
20	1.	2.	8.	145.
21	1.	2.	17.	180.
22	1.	2.	11.	143.
23	1.	2.	9.	138.
24	1.	2.	18.	150.
25	1.	2.	11.	165.
26	1.	2.	7.	165.
27	1.	2.	11.	154.
28	1.	2.	19.	154.
29	1.	2.	19.	155.
30	1.	3.	14.	170.
31	1.	3.	12.	177.
32	1.	3.	17.	142.
33	1.	3.	13.	161.
34	1.	3.	12.	161.
35	1.	3.	16.	172.
36	1.	3.	21.	172.
37	1.	3.	20.	140.
38	1.	3.	17.	155.
39	1.	3.	18.	155.
40	1.	3.	13.	121.

SEX: 1-Male 2-Female

CASE-N	SEX	GROUP	TEST COGNITIVE SCORE	SEMANTIC DIFFERENTIAL SCORE
41	1.	3.	20.	142.
42	1.	3.	17.	151.
43	1.	3.	16.	145.
44	1.	3.	16.	159.
45	1.	3.	18.	140.
46	2.	1.	21.	168.
47	2.	1.	20.	146.
48	2.	1.	9.	160.
49	2.	1.	12.	143.
50	2.	1.	21.	136.
51	2.	1.	16.	161.
52	2.	1.	21.	130.
53	2.	1.	16.	141.
54	2.	1.	10.	167.
55	2.	1.	12.	160.
56	2.	1.	11.	165.
57	2.	1.	20.	148.
58	2.	1.	11.	140.
59	2.	1.	21.	152.
60	2.	1.	9.	138.
61	2.	1.	8.	147.
62	2.	1.	8.	146.
63	2.	1.	21.	147.
64	2.	2.	21.	146.
65	2.	2.	8.	143.
66	2.	2.	17.	148.
67	2.	2.	17.	174.
68	2.	2.	17.	176.
69	2.	2.	11.	154.
70	2.	2.	16.	125.
71	2.	2.	20.	147.
72	2.	2.	16.	149.
73	2.	2.	17.	143.
74	2.	2.	10.	151.
75	2.	2.	18.	160.
76	2.	2.	19.	150.
77	2.	2.	20.	151.
78	2.	2.	17.	155.
79	2.	2.	16.	140.
80	2.	2.	14.	136.

SEX: 1-Male 2-Female

CASE-N	SEX	GROUP	TEST COGNITIVE SCORE	SEMANTIC DIFFERENTIAL SCORE
81	2.	2.	20.	158.
82	2.	3.	6.	153.
83	2.	3.	20.	156.
84	2.	3.	12.	155.
85	2.	3.	20.	124.
86	2.	3.	18.	136.
87	2.	3.	13.	143.
88	2.	3.	18.	154.
89	2.	3.	10.	142.
90	2.	3.	18.	161.
91	2.	3.	5.	161.
92	2.	3.	21.	151.
93	2.	3.	20.	174.
94	2.	3.	18.	148.
95	2.	3.	17.	144.
96	2.	3.	10.	144.
97	2.	3.	13.	149.

SEX: 1-Male 2-Female

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AN EXPERIMENTAL STUDY TO COMPARE THE AFFECTIVE AND COGNITIVE RESPONSES OF FEMALE AND MALE COLLEGE STUDENTS TO SINGLE-IMAGE, MULTI-IMAGE, AND TIME COMPRESSED SINGLE-IMAGE PRESENTATIONS

by

Charles Michael Kreszock

(ABSTRACT)

This was an experimental study to compare the affective and cognitive responses of female and male college students to single-image, multi-image and time compressed single-image presentations. Three initial sets of 120 images were produced so that each presentation contained the same visual information, and no narration or sound track was used with any of the presentations.

Ninety-seven subjects, in intact classes, participated in the experiment. Each class was shown one of the three slide presentations in a special projection room. Immediately after viewing a particular presentation, subjects were asked to complete a semantic differential which was used to measure attitudes toward the method of presentation; next subjects completed a multiple choice test concerning the cognitive information presented in the program viewed.

The two-way analysis of variance of the semantic differential scores indicated no significant difference in the attitude of the subjects toward any presentation format.

The two-way analysis of variance of the test for the amount of *cognitive information retained indicated that there was a significant* difference between the males and females in the amount of cognitive

information retained with the females retaining more than the males. There was a significant interaction between presentation format and sex of the subject on the amount of cognitive information retained. Females out-performed males for both the multi-image presentation and the single-image presentation, but males performed better on the time compressed single-image presentation.

The Pearson product-moment correlation between scores on the test for amount of cognitive information retained and the scores on the semantic differential was -0.05.