EFFECTS OF STUDENTS' SEATING DISTANCE AND ANGLE FOR VIEWING A FILM IN THE CLASSROOM ON THEIR PERCEPTION OF INFORMATION

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ABSTRACT

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The main purposes of this study were to investigate the effects of students' seating distance and viewing angle from the screen's central focus, and of cues given before showing an instructional film, on their amount of perceived information in terms of visual discrimination learning (VDL) and listening comprehension (LC).

Two research instruments, (a) The Inventory and (b) The Performance Tests, were developed and administered to 124 college students enrolled in a family child ecology class at Michigan State University. The Inventory Test was responded to before showing of a film, and part of it was also used as a pre-test. The Performance Test was divided into two parts (a multiple-choice on the film content, and open questions on students' self-evaluation after viewing the film).

Seating distance and viewing angle did not produce significant effects on students' perception of information (VDL + LC). Region in the classroom did affect the students who received cues before viewing the film.

Based on the findings of the study, the following major conclusions were drawn: (1) seating distance and seat's angle from the screen's central focus in front of the room do not have a significant effect on students' amount of perceived information presented throughout a film; (2) the region of the room does matter when the student has cues before viewing the film.

Based on the findings and conclusions of the study, recommendations included the following: (1) to measure the effects of seating distance and viewing angle, more concrete variables should be used as indices of students' perception of information (VDL + LC); (2) to measure the effects of classroom regions, more concrete variables should be used as indices of students' perception of information (VDL + LC); (3) better scales should be developed to investigate distance, viewing angle, and cue effects on students' perception of information; and (4) further research on perception of information should be undertaken in terms of visual discrimination learning and listening comprehension (which is affected by seat's distance and angle), and giving cues when using different audiovisual instructional resources in the classroom.

This dissertation is dedicated to

my father, my teacher, and my friend, FERNANDO, "com saudades";

my mother, IRACEMA, with respect and love;

my youngest niece and nephew, JUSSYMARA and RICARDO, with hope.

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CHAPTER I

INTRODUCTION AND RATIONALE OF THE STUDY

Introduction

Human beings, as living organisms, have been considered open systems because they function together as a whole to maintain life and its activities in their environment. Sociologists have studied this functioning in terms of the relationship and adjustment of human beings to the environment.

As organized systems, human beings follow certain principles. They define, or reserve for themselves, personal space in their environment, making this space known to other human beings. Thus, it has been assumed that protection of personal space is a mechanism used for controlling, not only social interaction (Patterson, 1981) but also informational processes (Biggs, 1968). Being imbued with meaning, spatial arrangement is also assumed to affect the attitude and behaviors of those in a specific environment (Patterson, 1981).

The principle of defining or reserving personal space can also be applied to the classroom situation and its "confined territory" (Wang, 1972). According to Sommer (1967)), the theory of classroom ecology concerns all factors that may affect (1) the physical environment, such as room dimension and shape, room density, and spatial arrangements; (2) methods of teaching and learning, consistent with the nature and type of activity; and (3) the students and their individual- and emotional-space arrangements.

Given this delineation of classroom ecology, sociologists have assumed that different spatial arrangements of the classroom (e.g., traditional straight-row, horseshoe, or circular arrangements) will influence students' seating preferences, depending on the subject matter and/or instructional activities (e.g., educational psychology lecture, individualized instruction through videotape, instructional videotape production, slides, or film projection).

Therefore, it seems reasonable to assume that a student's test performance will depend, among other things, on his/her attention and visual field--the area a person can see with his/her head and eyes held stationary. It is important to note that "the area of detailed vision is quite small" (Goldstein, 1975, p. 36). It seems appropriate to question how much information is perceived by students seated in different positions in the classroom. One method of measuring the effect of seating position on students' perception of information is through the use of a graph, as depicted in Figure 1, where, for instance,

1. One student occupies seat number 100 of the LEFT side of the ROOM (RLS), in column 1 and row m, by the exit door of the classroom; and

2. Another student occupies seat number 9 on the RIGHT side of the room (RRS), in column a and row u, by the wall.

In other words, the student in seat number 1(100)m would be, in a horizontal plane, at the RIGHT side of the SCREEN (SRS), 16.97 feet

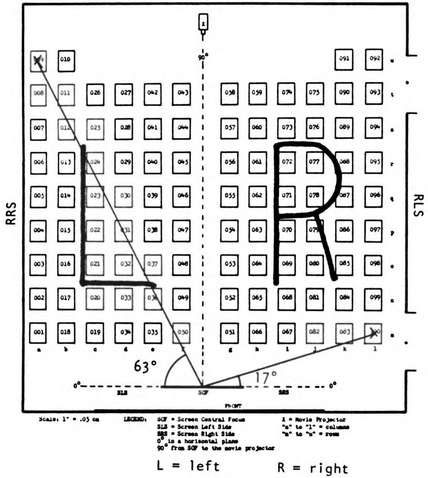


Figure 1.--Students' seating position in a straight-row arrangement for 100 seats.

from the screen's central focus (SCF), at 17 degrees RS (i.e., from the right side of the screen in front of the classroom). The student in seat number a(9)u would be, in a horizontal plane, at the LEFT side of the SCREEN (SLS), 33.5 feet from the screen's central focus (SCF), at 68 degrees LS (i.e., from the left side of the screen in front of the classroom).

Statement of the Problem

The problem of the study was to determine whether students bearing the same entering behaviors and ability learn at a different rate from a sound motion instructional film because their seating positions--distance and angle--from the screen's central focus in front of the classroom are different.

Purposes of the Study

The purposes of this study were as follows:

1. To examine the possible effects of students' seating position on their performance in perceiving information (visual discrimination learning/listening comprehension) when viewing an instructional film in a straight-row classroom arrangement.

2. To investigate students' personal preference for seating distance and angle from the SCF when viewing an instructional film in a straight-row classroom arrangement.

3. To analyze the possible effects of students' seating position in a straight-row classroom arrangement on their perceived information (visual discrimination learning/listening comprehension), as

related to (a) distance of seats and viewing angle from the screen's central focus in the front of the classroom and (b) cues given to the students before viewing the instructional film.

Importance of the Study

The investigator taught and supervised student teachers in a Brazilian university during the 1979-80 school year. The students' internships were carried out in local junior and senior high schools. During that year, the researcher began to observe the learners' seating positions as well as their behavior and attitude toward the instructors and instructional media used in the classroom. The writer observed that instructors were so eager to teach the subject content that they did not have time to notice whether the students were seated in an optimal position to view the media presentations in front of the room.

The room's shape (narrow or wide) and the number of students in the classroom affected the spatial arrangement of the classroom. Hence, a straight row in the same floor plane was the only possible spatial arrangement. Thus, the physical condition of the room was not adequate for screening visual materials. Patrie (1966) called media specialists' attention to the problem of learner seating for viewing projected media (films and television) and to the lack of research on this matter. The few studies done on instructional television are mentioned in Chapter II of this study.

The importance of the present study to educational technology is that it should bring together the management of ideas, procedures, and hard and softwares (1) for planning physical devices (projected and nonprojected instructional media) that mediate information transmission, (2) for planning and organizing students' seating distance and viewing angle from the screen's central focus and in accordance with the hard and soft instructional media to be used in the classroom, and (3) for timing tasks to be developed in class by students seated at different distances and viewing angles from the central focus of the instructional media being used.

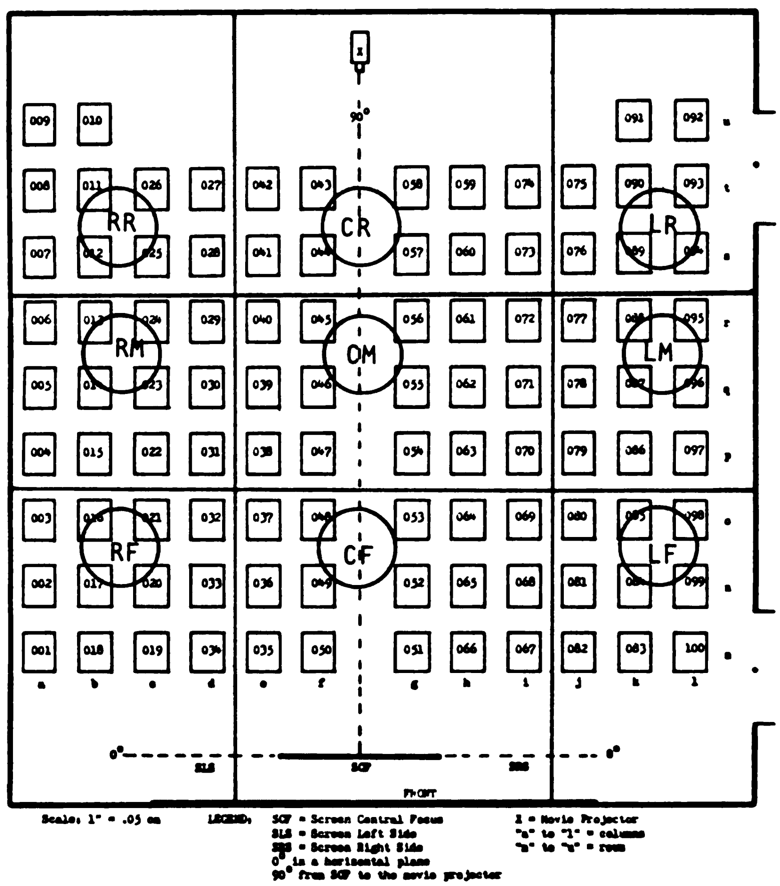
In conducting this study, it was assumed that classroom ecology, including methods of teaching, the use of instructional media, and physical spatial arrangement, should be designed carefully and planned by the instructor and the educational technologist, according to the subject matter being taught. An effort was made to obtain necessary information on students' personal preferences for seating location, related to distance and viewing angle from the screen's central focus, when exposed to a film projection in the classroom.

The main purpose of the study was to examine the effects of students' seating-position distance and angle from the screen's central focus on their performance in perceiving information when viewing an instructional film in a straight-row classroom arrangement. Results of this study should help media specialists and teachers seat their students in more optimum locations to perceive and retain projected information.

Limitations of the Study

The study was carried out on an experimental basis. The sample used was a group of 124 undergraduate students enrolled during Fall Term 1984 in a Family Child Ecology course in the College of Nursing at Michigan State University (MSU). The main limitations, in addition to the selected film and its content, were as follows: (1) the audience could be classified as a sophisticated group of students who had developed their own habits and styles for learning from film projection in the classroom; (2) most students had had previous experience with the content of the film. Except for seven students who had not taken any course in human biology, all of the students in the sample had taken at least one course in the film's subject matter (human biology area); (3) the cues' effect was limited by subjects' experience with the film content. For the pilot study, samples were drawn from undergraduate and graduate students (master's and doctoral degree candidates) enrolled for Summer and Fall Terms 1984 in different programs and colleges at MSU.

In the present study, by changing the approach to seating-position regions identified in a horizontal plane by angle (e.g., 30, 60, and 90 degrees) and distance measured in feet from the screen's central focus in front of the room, it seemed reasonable to assume that the student's perceived information (VDL/LC) would be affected by his/her seating position in the classroom, as depicted in Figures 2 and 3.



LR = left rear of room
LM = left middle of room
LF = left front of room
CR = center rear of room
CM = center middle of room
CF = center front of room
RR = right rear of room
RM = right middle of room
RF = right front of room

Figure 2.--Straight-row-seating classroom arrangement for projecting an instructional film, identified by regions.

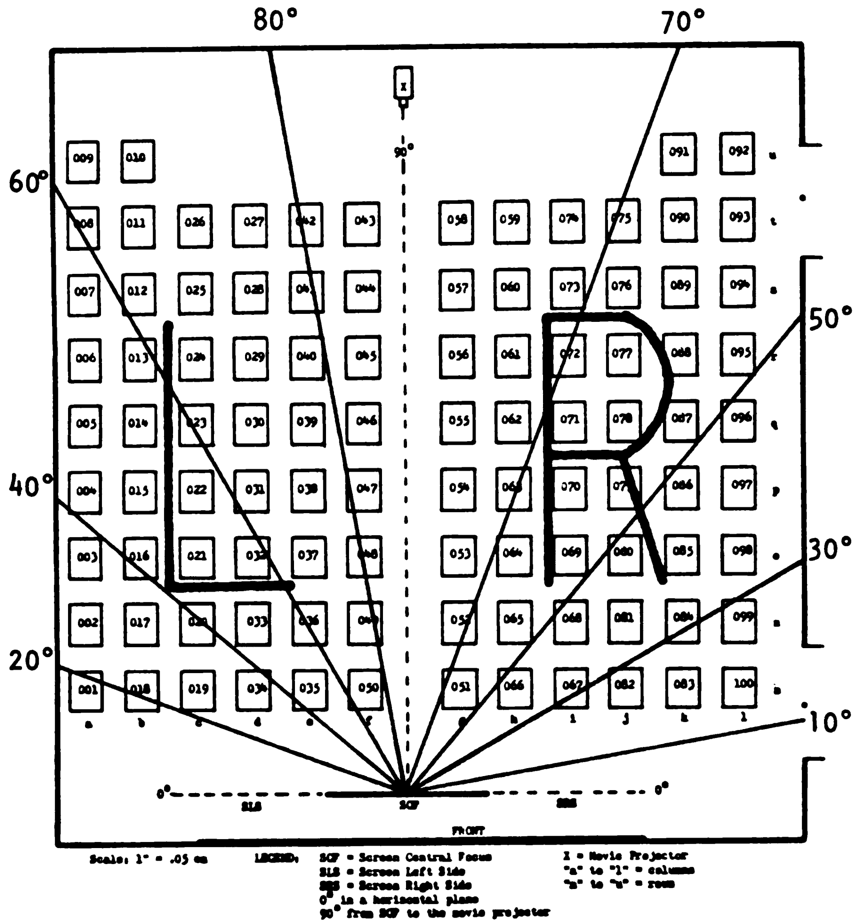


Figure 3.--Straight-row-seating spatial arrangement for projecting an instructional film, identified by angles (at left and right from SCF) in a horizontal plane, in front of the room.

Hypotheses

The following research hypotheses were formulated to test the data collected in this study:

Hypothesis 1: Holding constant the student's angle of vision and other key independent variables, the farther the student is from the screen's central focus, the more information he/she will perceive.

Hypothesis 2: Holding constant the student's seat distance from the screen's central focus and other key independent variables, the smaller the seat's angle on the left or the right side of the screen's central focus in a horizontal plane in front of the room, the less information the student will perceive.

Hypothesis 3: Students who receive cues before a film is shown will perceive more information than those who receive no cues.

The interaction effects involving distance, angle, and cues were also studied.

Definition of Important Terms

The following terms are defined in the context in which they are used in this dissertation:

Action seats--Those seats "in the front and center seating positions of a classroom" (Totusek & Staton-Spicer, 1982, p. 162).

Classroom ecology--The physical environment, including room dimension and shape, room density, and spatial arrangements; the methods of teaching and learning in accordance with the nature and type of activity; and the students and their individual and emotional spatial arrangements (Sommer, 1967).

Environment--The physical territorial area surrounding a person "in relation to certain social-psychological dimensions" (Liben, Patterson, & Newcombe, 1983, p. 228).

Foveal area--"The part of the human retina that is specialized for detailed vision" (Levine & Shefner, 1981, p. 73).

Informational process--The process by which an individual perceives, thinks about what he has perceived, and behaves (Biggs, 1968).

Listening comprehension (LC)--Interpreted similarly to perceived information; that is, a viewer's experience of meaningful information through listening, which imposes a qualitative approach on the viewer.

Perceived information--A viewer's previous experience of meaningful information, which inherently imposes a qualitative approach on the viewer in creating new insights (Csikszentmihalyi & Rochberg-Halton, 1981).

Peripheral vision--"The area of vision lying just outside the line of direct sight" (Webster, 1979, p. 1057); vision that falls in the peripheral retina, responding when the lights are dim--details are not seen (Kaufman, 1979).

Personal space--"A form of territoriality found in humans--a flexible, portable area surrounding an individual which has been viewed as a 'line of demarcation' . . . between him and his environment" (Frankel & Barrett, 1971, p. 95).

Seating position--For the purposes of this study, defined in terms of

1. Seat distance--the distance of the seat, in feet, from the screen's central focus in front of a straight-row classroom arrangement.

2. Seat angle degree--The seat position at an angle degree to the left or right side in a horizontal plane from the screen's central focus in front of a straight-row classroom arrangement; "the area immediately surrounding the individual in which the majority of his interactions with others take place" and "the area around an individual in which his own interactions occur" (Little, 1965, pp. 237, 245).

Seating preference--The seating position preferred by a student, in terms of distance and angle from the screen's central focus in front of a straight-row classroom arrangement.

Visual discrimination learning (VDL)--For purposes of this study, the same as perceived information; that is, a viewer's experience of meaningful visual information, which imposes a qualitative approach on the viewer.

Visual field--That area of space a person can see with head and eyes held stationary (Goldstein, 1975).

Summary and Overview

The background, problem, and purposes of this study were identified in Chapter I. The importance of the study was explained and the research questions and hypotheses stated. Definitions of key terms were provided, as well.

Chapter II contains a discussion of related literature and research pertinent to this experimental study. The methods and procedures used in conducting the investigation are explained in Chapter III. In Chapter IV, the results of the statistical analysis of data collected in the research are discussed. Conclusions of the study and recommendations for further research are included in Chapter V.

CHAPTER II

REVIEW OF RELATED LITERATURE

Experimental research on motion pictures as instructional media in a classroom setting began about 1915. Then, one of the pioneers in the experimentation phase, Weber, investigated the "values of the motion picture . . . in the development of informational learning" in the classroom. Freeman, another pioneer, investigated the "modes of presentation of motion pictures with other visual and nonvisual methods of instruction" (Hoban, 1937, pp. 307-308).

Knowlton and Tilton (1932) investigated the "use of films in relation to size of the instructional group. . . . Average-sized class groups were shown historical photoplays in the classroom in addition to the regular verbal instruction, and groups over two hundred pupils were shown the same films in the school auditorium" (in Hoban, 1937, p. 356). The findings of this study demonstrated that pupils in a classroom setting performed better on a factual test over an instructional film than did pupils who were shown the film in a school auditorium. In the researchers' opinion, the difference in performance was due "not to the differences in physics involved, but to the differences in pupil attitude and activity which differentiate classroom and auditorium periods" (Knowlton & Tilton, 1932, p. 670).

In commenting on the results of Knowlton and Tilton's study, Hoban (1937) hypothesized that the difference in student achievement occurred because the school auditorium was "used for assemblies, entertainments, . . . and as such produces a different 'mental set' in the pupils than does the classroom, which is the normal situation for instruction" (p. 356).

Thus, assuming that a classroom environment affects students' performance and attitude toward the educational activities carried out in class, including the showing of instructional films, educational technologists should consider the importance of planning and building classrooms to be used by both instructors and students.

Educators, media specialists, and architects, among others, have developed programs, plans, and recommendations for using multimedia rooms for teaching. Designers must consider: How well can students see? How well can they hear? Are students located appropriately with respect to the images to be viewed? Are students comfortable? (Haviland, 1970).

During World War II, the United States Army and Navy developed, produced, distributed, and used an unprecedented variety and volume of multisensory aids to train millions of personnel in different technical skills. These aids were also used to build up "their morale under the dire stress of war by touching both their emotions and their understandings." Manuals and guidelines were prepared, describing "the needs served by specific aids when and only when good utilization techniques" were followed. Instructors were urged "to maintain the best possible classroom conditions," such as "proper ventilation [and] seating of students" (Miles & Spain, 1947, pp. v, 59).

Thus, instructors should consider the principles and rules for optimal film projection in the classroom setting. Buchanan (1951) suggested a number of factors affecting the use of 16 mm film. Of these factors, the following are applicable to the present study:

> . . . the size of the hall or classroom, and particularly the length of it in relation to the probable distance between projector and screen.
>
> . . . the size of the screen in relation to the size of the room . . . , for its dimensions govern the focal length of the projector lens required;
>
> . . . the screen . . . placed at a convenient height to allow people in the middle and back row to obtain a comfortable view without needing to peer round the heads of those in front. (pp. 183, 186)

Buchanan also considered students' seating location as an important element in providing favorable conditions for projecting an instructional film in the classroom. He recommended that

> no one should sit on the extreme right or left of a screen for, from these positions, the pictures appear distorted. Also if space permits, it is wise to keep the front row a reasonable distance from the screen, say two or three times its length, for being too near also creates distortion, and is an uncomfortable viewing position. (p. 192)

Cohen (1970) suggested certain practices that would help instructors reach their educational goals by using films in the classroom. For instance, he said there is a right time and place to show an instructional film. The place for screening visual material is more important than the time of showing because students' seating comfort has a greater effect on their written and/or verbal responses, particularly for feature films lasting longer than a 50-minute class period.

With the development of portable equipment (e.g., slides and motion-picture projectors), the classroom has become the central place for screening visual material. Thus, having certain technical knowledge, like the type of screen surface, helps the instructor plan students' seating location in the classroom. For example,

> For persons seated not more than 22 degrees from the center of the screen, beaded screens give a brighter image than a matte, or smooth white, screen. For this reason, the matte screen is recommended for classrooms that are approximately square, since the image can be seen clearly and without distortion from all parts of the seating area. (Cohen, 1970, p. 182)

In addition, the classroom should be arranged so that every student is able to see and hear clearly without strain or distortion when exposed to an instructional motion picture (Erickson, 1965; Dale, 1969; Wittich & Schuller, 1973).

Erickson (1965) recommended that instructors use audio-visual materials to accomplish the main goals of education and to achieve teaching-learning objectives. In other words, instructional resources used under the appropriate physical conditions facilitate the student's learning and classroom performance. According to Erickson, the physical-control principle states that

> details relating to physical facilities and conditions for using audiovisual materials should be handled or arranged by the teacher in a manner that safeguards material and equipment and provides for economy of time and optimum learner attention. (p. 110)

Teachers must ensure the appropriate placement of projectors, projection, and pupils. One rule of thumb that it is important and easy for instructors to follow is to "avoid seating pupils closer to the screen than two picture widths and no farther away than six picture widths" (Erickson, 1965, p. 114).

According to Gausewitz (1964):

> Improper applications of audio-visual equipment in large groups communication and instruction result more from a lack of an understanding of the limitations of the equipment than from any other source. . . .
>
> Television and film showings have entirely different screen viewing characteristics. . . . A TV screen usually has a brightness on the order of 100 lumens per square foot, while a motion picture screen is of the order of 10 lumens per square foot. Thus the film projection requires a darkened room while the TV screen does not. (pp. 4, 7)

Using the principles of design, Gausewitz developed a graphic process to solve such problems as those related to planning a classroom arrangement for projecting media (films and television). Knowing the characteristics of a particular projecting medium, an educational technologist can calculate the useful seating area and side-viewing angle in a horizontal plane from the screen's central focus for that medium. The elements involved in this process are "room dimensions, occupancies and occupied areas to screen, screen brightness, projector distances, types of screen, characteristics of gain and the relations of lamp lumens to screen width." Gausewitz also suggested that:

> the practical limit for the closeness at which one can comfortably review the film (measured in screen widths) is determined . . . by the amount of eye scanning the viewer must do to comfortably enjoy and perceive the field of the film. (p. 4)

Wheeler (1966) stated that the classroom should have a flexible seating arrangement according to "the optimum viewing angle of the screen surface" (beaded, 60 degrees; matte, 90 degrees; lenticular, 100 degrees) (p. 11). Eastman Kodak (Kodak Projection Calculator, n.d.) also recommends seating the viewer according to the screen surface, given the following viewing areas: beaded, 50 degrees; matte, 60 degrees; and lenticular, 90 degrees. Kodak recommends that the instructor "not seat [students] closer to the screen than two times (2H) nor farther than eight times (8H) the height of the projected image unless the quality or size of the visual dictates otherwise."

According to Hayman (1963), results of research on the use of instructional films to train personnel in the United States armed forces suggested that "viewer location makes a difference where visual aspects of the presentation are important" (p. 27). Gibson's findings on Air Force trainees indicated that "only if extreme demands were made on visual acuity did position relative to the screen affect learning, and even then a viewing angle up to 45 degrees was satisfactory" (in Hayman, 1963, p. 27). Ash and Jaspen demonstrated that their U.S. Navy subjects "performed better with a viewing angle of 30 degrees or less and a distance from the screen not greater than 12 screen widths" in assembling part of an anti-aircraft gun, a task that demanded visual acuity.

In a study of instructional television, Hayman (1963) investigated the relationship of subjects' distance and viewing angle from the television's central focus, using a televised Spanish course for fourth-grade pupils. The subjects were randomly selected from all fourth graders in the Denver, Colorado, schools. The 24 classrooms selected were used without any modifications. That is, the pupils' seating locations were already arranged in an area approximately 24 feet by 18 feet, at a 40-degree angle from each side of the center of the television screen, either at the front center or side center of the room. Hayman implied that subjects personally selected their seating locations; he noted that "teachers were asked to fill in the seating chart at the beginning of the first TV lesson and to make sure that pupils occupied the same seats for subsequent lessons" (pp. 29-30).

Hayman found that when visual perception (in this case, learning to pronounce Spanish words) was required of the subjects, they "had to see clearly and accurately the lip and tongue movements of the instructor" (p. 29). Therefore, seating location was an important factor in the learning process. Hayman found that fourth-grade pupils seated in the center and rear of the viewing area performed better on the speaking test (pronouncing Spanish words) than did pupils seated on the side of the room. He concluded, "Viewer location relative to the TV screen is definitely a factor in learning from instructional television" (p. 31).

Another study on instructional television was conducted by Westley and Severin (1965), who investigated the relationship between subjects' seating distance from a television set and their achievement on a televised mathematics course. The sample comprised nine classes of ninth-grade pupils in Madison, Wisconsin. Because the "natural setting" used for this study included many classrooms of different sizes and shapes, teachers were asked to measure the distance between pupils' seating location and the television set.

Although the authors investigated the relationship between seating distance from a television set and a number of variables, their main concern was the relationship between seating distance and student achievement. Study findings indicated that "the farther the student sat from the [television] set, the greater was his achievement" (p. 272). In their conclusions, Westley and Severin stated,

> Hayman regrets that he was unable to test the limits of this effect since all of his subjects sat within 24 feet of the set. We cannot shed any light on this point of diminishing returns either. All we know is that in classrooms of normal size and with no student more than 50 feet from the set, distance and achievement appear to be positively related. (p. 274)

The findings of Westley and Severin's research are questionable because of the lack of important information such as television-screen width, viewing angle, and seating area (the classroom teacher measured the distance between seat and television set in five 10-foot intervals), as well as the uncontrolled seating arrangement in the classrooms. The researchers' lack of control over the seating arrangement is understandable, but not their failure to consider the other information. Also, in terms of their findings, one may ask, How far was "farther"? Were the students' seating locations within the limits recommended by Gausewitz (1964), that is, 4W minimum and 16 maximum for a television projection?

A third study on instructional television was carried out by Mayers (1967), who termed the relationship between students' viewing angle from the central focus of the screen and learning or performance the "'cone effect' because the area within the presumably 'optimal' angle of view is in the shape of a cone with the apex placed at the center of the screen" (p. 170).

Mayers investigated the relationship between students' viewing angle from the television screen's center and responsiveness under certain conditions (teachers acting as role models and observers) in a televised Spanish course. Fifth-grade public school classrooms were used without any modification. The classroom seating areas, approximately 24 feet x 24 feet, were arranged in a precise straight-row arrangement. The television screens measured 21 inches diagonally and were placed in the center of the rooms. The straight-row classroom arrangement was designed in such a way as to permit "unequivocal identification of pupils inside a cone of 60 degrees wide (i.e., viewing from an angle of 30 degrees or less) and those outside the cone" (p. 172).

Mayers found that when the teacher acted as a role model for the class, that is, responded to the television instructor, "pupils inside the cone-shaped area directly in front of the screen performed significantly better than those outside that area" (p. 176). The same finding did not hold true for classes in which the teacher's role was that of observer. Thus, Mayers's findings supported the hypothesis that "social psychological factors account for part or all of the relationship under certain conditions" (p. 178). That is, the active presence of the teacher during television or motion picture instruction can enhance learning by increasing students' responsiveness.

McVey (1970) synthesized research findings from different areas (e.g., audiovisual technology and ophthalmology) "into a working statement concerning the nature of viewer-display relationships as they apply principally to television" (p. 278). McVey recommended that, for optimal viewing, accuracy, and comfort, seats should be located in the space he called "audience volume," which

> has an ellipsoidal shape and its configuration is determined by . . . the physical properties of the TV image, its size, shape and brightness, and human factors such as visual acuity, image distortion resulting from angular viewing, eye fixation patterns, and visual comfort. (p. 278)

The minimum viewing location, when interpreted in terms of image widths, was found to be

> two times the image width (2W) and represents the minimum viewing distance for most displays including high-resolution television and film. This distance . . . cannot be recommended as a suitable minimum viewing distance for the typical classroom monitor with its generally poor image resolution for it is found that at this distance the image is seen more as a crude scanning line than as a discrete picture. (p. 279)

Identification of the optimum viewing distance was based on the "reflexive search pattern of the eye." That is, "a closer viewer-distance results in the concentration of eye fixations at the center" of the screen, whereas greater distance forces "concentration of eye fixations on the outside borders" (p. 280).

Thus, by providing a proper seating arrangement in relation to the television set, instructors and educational technologists can avoid and/or reduce students' visual fatigue, which is an important element to consider in a televised instructional course. McVey concluded,

> The establishment of any set of viewer-display recommendations is the product of a number of "trade-offs" or compromises, within established tolerable viewing limitations. . . . It will be up to the individual user to set his own priorities. (p. 289)

Allen (1955) reviewed and summarized seven studies that investigated the effects of class preparation for the showing of an instructional film on students' learning. The preparatory and/or introductory activities used in these studies were

> descriptions of the content of the film, . . . stress upon the importance of learning the material, . . . lists of difficult words to be encountered in the film, . . . [and] announcement that a test will be given after the film showing. (p. 183)

Because its approach to preparatory activities for showing an instructional film was similar to that of the present study, in which cues/no cues were given to the students before showing an instructional film, the Allison and Ash study was selected for further discussion from among the seven studies reviewed by Allen. Allison and Ash investigated how well 480 college students enrolled in an introductory psychology course could learn from films under the following conditions:

> instructions designed to _decrease_ motivation to learn by lowering their anxiety about learning from the film; . . . instructions designed to have a _neutral_ effect; and . . . motivational instructions designed to _increase_ anxiety about learning. (p. 186)

The investigators found that increasing the amount of anxiety resulted in significantly more learning. They concluded, "Anxiety produced by the use of suitably worded instructions can have a beneficial effect on the learning of complex materials from films" (in Allen, 1955, p. 186).

Based on his analysis of research concerning the effects of class preparation for showing an instructional film on students' learning, Allen concluded, "Teacher introductions and class preparation for film showings result in significantly more factual material learned than merely showing the film without an introduction" (p. 186).

This chapter contained a review of literature and research with emphases on controlling of students' seating in the classroom for viewing an instructional film versus television. Despite a careful search of the available writings, the only studies located were concerned with instructional television rather than film. However, the similarity between film and instructional television justified the inclusion of such research in this review.

Among many important issues discussed concerning the projection of instructional materials in the classroom were rules guiding seating distance from the screen, based on screen width as a unit of measurement. Another factor to consider when projecting visual material is the limitations of the projecting equipment (e.g., television and film showing have different screen-viewing and viewing-angle characteristics). As McVey concluded, "It will be up to an individual user to set his own priorities" when designing and planning for the projection of instructional media in the classroom setting.

Based on the findings of studies reviewed in this chapter, it would appear that students' seating-position distance and angle from the screen's central focus should not be ignored. In addition, findings of the reviewed research demonstrated that class preparation for film showings has a significant positive effect on students' learning.

The methods and procedures used to carry out this experimental study are explained in Chapter III.

CHAPTER III

METHODS AND PROCEDURES

Introduction

This experimental study was conducted to investigate the effects of seating position on college students' performance in perceiving information, in terms of visual-discrimination learning and listening comprehension (VDL/LC), when viewing an instructional film in the classroom. The following key points were investigated:

1. students' seating distance from the screen's central focus (SCF) in front of the classroom;

2. students' seating angle, to the left or to the right side from SCF in a horizontal plane in front of the classroom;

3. the possible effects of cues, given _before_ showing the instructional film, on students' performance in perceiving information (VDL/LC) from their assigned seating position in the environmental setting; and

4. the effects of students' seating position on their perceived information (VDL/LC).

Identification of these factors should help those dealing with instructional films, or other front-of-room visually projected materials, to improve the optimal viewing area in a common classroom situation. The optimal viewing area is related to:

1. the screen's surface (material) and width, which are used as indicators for calculating the seating distance from SCF (Erickson, 1965; Heinich et al., 1982; Kodak Projection Calculator, n.d.); and

2. the seats' distance at an angle from SCF, in a horizontal plane of a straight-row classroom arrangement.

The methods and procedures used in carrying out this study are explained in the following sections: Experimental Methodology, Pilot Study, Experimental Group, the Subjects, Experimental Settings, Instrumentation, and Statistical Treatment of the Data.

Experimental Methodology

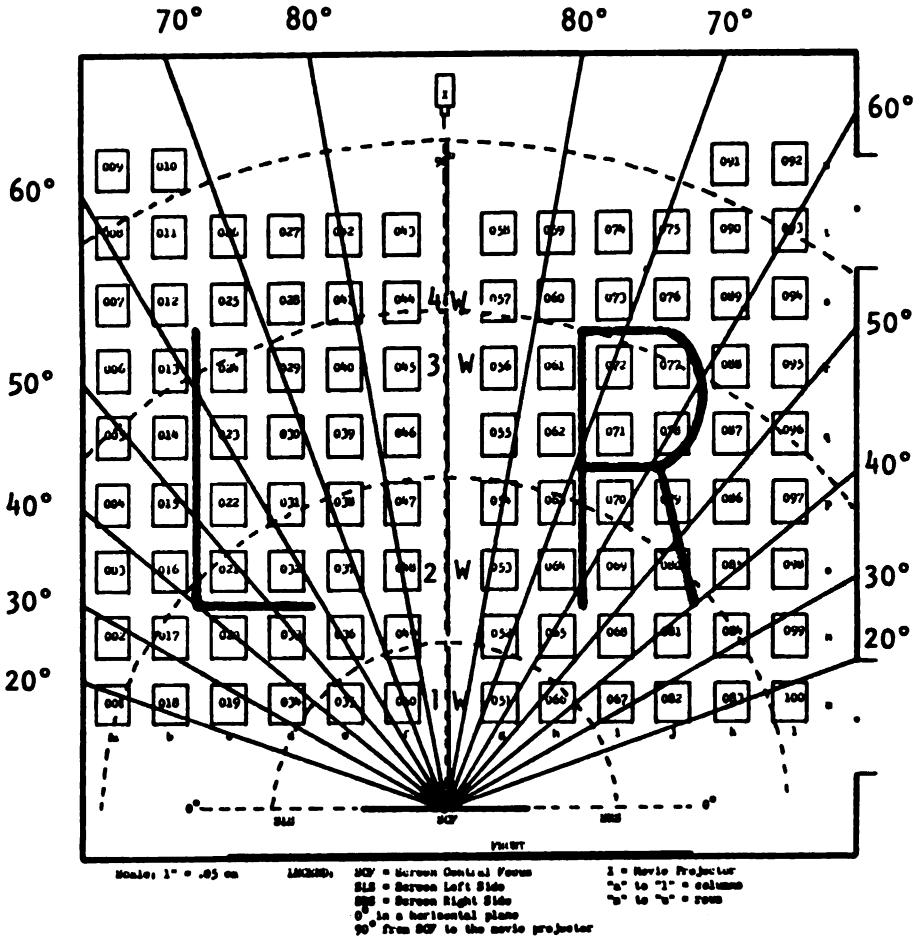
The University Committee on Research Involving Human Subjects at Michigan State University granted the researcher permission to use a student sample in this experimental study (Appendix E). The pilot and experimental groups comprised undergraduate and graduate students enrolled in different colleges at Michigan State.

Both instruments used in the experimental study were administered to the subjects in sealed envelopes that were numbered according to the seat numbers in straight-row classroom settings. The Inventory Test was given to the subjects before and the Performance Test after the showing of an instructional film.

Seat numbers were randomly assigned (Figure 4) according to

1. the seats' distance from SCF, measured in screen widths to the left or right side of the SCF in front of the room; and

2. the seats' angle, measured in degrees to the left or right side of the SCF in a horizontal plane in front of the room.



W = screen width

Figure 4.--Diagram illustrating the seats randomly assigned in Experimental Setting One.

The treatment (given cues/given no cues) was designed so that

1. students in seats with even numbers (2, 4, ..., 130) were assigned to Treatment One: Given Cues; and

2. students in seats with odd numbers (1, 3, ..., 129) were assigned to Treatment Two: Given No Cues.

All of the subjects were randomly assigned to seats in two experimental settings, as discussed in the following pages.

Procedures in Experimental Setting One

1. Seat numbers were randomly assigned in a systematic numerical order from 001 to 100 (Appendix A, Table A-1).

2. Numbered envelopes containing the two instruments were organized according to the systematic numerical order shown in Table A-1.

3. Before entering the room, the subjects were given the envelope containing both instruments and a pencil. They were shown the seating-location map at the entrance to the room, as depicted in Figure 4. The number of each seat was written in blue marker on a 3" x 5" white card placed on the seat.

Subjects participated in the experiment on a voluntary basis. Therefore, it was difficult to anticipate the number and nature of students who would participate.

Procedures in Experimental
Setting Two

In Setting Two, the experiment was conducted during a Family Child Ecology class period and between two other classes scheduled to use the same room. This experimental group comprised 124 students from the College of Nursing at Michigan State. All of the subjects were randomly assigned to seats as follows:

1. Each seat number was written on a 2" x 3" piece of white paper, which was folded twice and placed in a plastic bag. The subjects picked a seat number before entering the room.

2. The number of each seat in the room was written in blue marker on an 8-1/2" x 11" piece of white paper placed on the seat, as shown in Figure 5.

3. A numbered envelope containing the test instruments was placed on the correspondingly numbered seat.

Once the subjects were seated, the researcher turned on a tape-recorder, which was on a table at the front of the room. During the musical "overture," the researcher checked to see that all of the numbered envelopes matched the seat numbers. The experimental activities were timed and the pace determined by the musical background. The prerecorded verbal instructions (Appendix B, Script B-1) and musical background were designed to hold constant the time and pace of each part of the study, when replicated in the pilot and experimental groups.

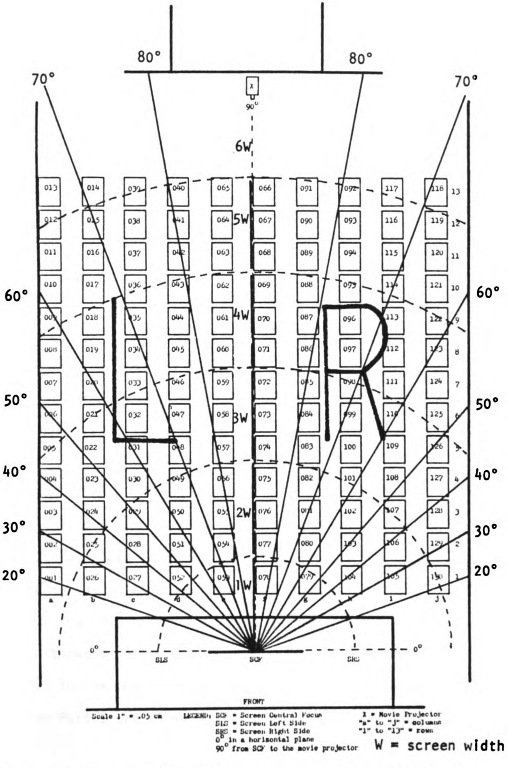


Figure 5.--Diagram illustrating seat-number distribution in Experimental Setting Two.

The Pilot Study

Pilot Study One

A pilot study was carried out to test and validate the Inventory Test and the Performance Test, the two instruments designed to collect the necessary data for this research. The pilot-study group comprised a small number of subjects (undergraduate and graduate students) drawn from the experimental population. These subjects were enrolled in various colleges at Michigan State during Spring Term 1984.

Two experimental sessions composed of four subjects and 14 subjects, respectively, were carried out on May 30 and May 31, 1984, in Experimental Setting One. Each test was completed in two hours. Based on the subjects' attitudes toward the test and findings on both instruments, the researcher revised the tests as follows:

The Inventory Test (used also as pretest)

1. The reading time for directions was reduced from three minutes to one minute.

2. The period for completing the test was reduced from 30 to 15 minutes.

3. Instructions were added on page 1 concerning the time necessary to complete the test.

The Performance Test (used also as posttest)

1. The reading time for directions was reduced from five minutes to three minutes.

2. The period for completing the test was divided into 15 minutes for Part I and 20 minutes for Part II of the test. This change

was necessary because some of the subjects forgot to complete Part II of this test, and it was necessary to reduce the total time of the experiment to guarantee student availability.

3. The directions were revised. For example, written instructions were added on page 8 to alert the students to wait for prerecorded instructions before starting Part II of the test.

4. Items in Part II were revised and the language clarified.

5. An item was added on evaluation of the seat's physical position in relating to the SCF.

6. The answer sheet was eliminated, and subjects were asked to write their responses in the test booklet.

Prerecorded Instructions

The content of the prerecorded instructions was revised, and musical background was used for timing and pacing each part of the experiment. (See Appendix B, Script B-1.)

Pilot Study Two

All of the procedures carried out in Experimental Setting One were used as a pilot study to retest and validate the revised instruments and prerecorded instructions. The pilot-study group comprised undergraduate and graduate students enrolled at Michigan State during Summer and Fall Terms 1984. The pilot-study participants were divided into two groups, henceforth identified as groups A and B.

The pilot study was replicated four times to increase the number of subjects. As shown in Table 1, the sample sizes for groups A and B were small (A = 14, B = 34). The two Group B sections (B_1 and B_2) were tested in different hours.

Table 1.--Pilot-study schedule distribution.

Variable	Group A	Group B	
Term	Summer 1984	Summer 1984	Fall 1984
Subgroup	A_1	B_1	B_2
Date	July 3 & 24	July 2	October 1
Hour	10:20-11:50 a.m.	10:20-11:50 a.m.	8:00-9:30 p.m.
Sample size	8 + 6	21	13
Total N	14	34	
Room	Experimental Setting One		
Duration	One hour and 30 minutes		

The Sample

The sample comprised 124 undergraduate students from the College of Nursing at Michigan State University. All of them were enrolled in a Family Child Ecology course during Fall Term 1984. This experimental session was held on October 2, 1984, in Experimental Setting Two.

The Subjects

Descriptions of the subjects are based on data collected through the Inventory Test (Appendix C, Instrument C-1), administered before showing the film. The Inventory Test data provided an overall description of the pilot study (groups A and B) and of the sample in terms of (1) demographic data, (2) physical condition, (3) college educational level, and (4) background in human biology. Information on specific subgroups in the pilot study can be found in Table A-2 in Appendix A.

Demographic Data

The overall demographic data on both the pilot and experimental study groups are shown in Table 2.

Table 2.--Demographic data on subjects in pilot and experimental study groups.

	Pilot Study		Sample
	Group A	Group B	
Sample size	14	34	124
Age			
Range	19-43	25-49	18-43
Mean	25.36	33.50	21.32
Sex			
Female	11	14	122
Male	3	20	2
Ethnic Group			
Caucasian	13	17	108
Black	0	1	7
Spanish	0	9	4
Indian (American)	1	0	0
Oriental	0	3	4
Other (Middle Eastern)	0	4	0
No information	0	0	1

The heterogeneity of the pilot-study groups is demonstrated by the characteristics of the subjects in the experiment. Of the 34 subjects in Group B, there were 25 foreign students, whose first language was other than English. The sample group was characterized by its homogeneity. With few exceptions, the group comprised female Caucasians whose ages ranged from 18 to 43, with a mean age of 21.32 years.

Physical Condition

The overall physical-condition data on subjects in both the pilot study and sample groups are shown in Table 3.

Table 3.--Physical condition of subjects in pilot study and sample groups.

Variable	Pilot Study Group		Sample
	A	B	
Sample size		34	124
Vision			
Normal	5	18	68
Corrected	9	16	56
Hearing			
Normal	13	34	124
Corrected	1	0	0
Writing			
Left-handed	0	3	13
Right-handed	14	31	111

The number of subjects with corrected vision in relation to the number of subjects in the groups was higher in group A (9 subjects) than in the sample (56 subjects). On the other hand, the numbers of left-handed subjects in the sample and group B were low (3 and 13, respectively). Only one person had corrected hearing; the rest reported normal hearing capabilities.

College Educational Level

The subjects in both the pilot study and sample groups were enrolled at Michigan State for Summer or Fall Term 1984, as shown in Table 4. The groups A and the sample were composed solely of undergraduate students, whereas group B included 9 master's and 17 doctoral degree candidates.

Table 4.--College educational level of study participants.

Variable	Pilot Study Group		Sample
	A	B	
Sample size	14	34	124
Sophomore	0	0	57
Junior	1	0	50
Senior	11	2	12
MS/MA candidate	0	9	0
Ph.D. candidate	0	17	0
No information	2	6	5

Background in Human Biology

The subjects' background in human biology, in terms of courses taken and knowledge of terms, is shown in Table 5. Background in human biology was used as the pretest in this experiment to measure the subjects' knowledge of human biology before they viewed the instructional film.

Table 5.--Subjects' background in human biology.

Variable	Pilot Study Group A N	A %	B N	B %	Sample N	Sample %
Sample size	14	100.00	34	100.00	124	100.00
Number of courses in HB						
Didn't take any course	7	50.00	19	55.90	6	4.84
One course	2	14.29	4	11.76	31	25.00
Two courses	3	21.42	4	11.76	31	25.00
Three courses	2	14.29	3	8.82	17	13.70
Four or more courses	0	0.00	4	11.76	38	30.65
No information	0	0.00	0	0.00	1	0.81
Knowledge of HB terms						
# of correct responses possible per subject	11	11	11			
Total # of correct responses possible (N = 11)	154	100.00	374	100.00	1,364	100.00
Correct responses	72	46.75	175	46.79	1,033	75.73
Incorrect responses	82	53.25	144	38.50	331	24.27
Missing all resp.	0	0.00	55	14.71	0	0.00
Mean score correct responses	5.14		5.14		8.3	

Except for seven subjects in group A, all of the study participants had taken at least one course in human biology. The figures demonstrate a balanced situation for group A; that is, seven subjects had not taken any course in human biology. In group B, 15 subjects had taken one to more than four courses, while in the sample group, 38 subjects had taken four or more courses in this field.

In terms of knowing some human biology terms, in relation to the sample sizes (see Table 5), group A had the highest number of incorrect responses (53.25%), and the sample group had the highest number of correct responses (75.73%). In other words, group A had 82 incorrect responses out of 154 total possible correct responses; the sample group had 1,033 correct responses out of a total of 1,364 possible correct responses. The data also demonstrated that 55 responses were missing, all in group B. That is, five subjects (14.71%) did not respond to the questions.

Experimental Settings

The experimental study was designed to be carried out in a classroom designated Experimental Setting One. During Summer Term 1984, it was possible to have all of the study groups in this setting at the same time (10:20-11:50 a.m.). When the experimental study was replicated in Fall 1984, Experimental Setting One was available only in the evening. Therefore, one of the two experimental sessions was carried out from 8:00-9:30 p.m. The other took place from 10:20-11:50 a.m. in a classroom designated Experimental Setting Two.

Each of the classroom settings used in this experimental study is described in the following sections.

Experimental Setting One

The classroom designated Experimental Setting One was about 40 feet by 42 feet. The two windows, about 10 feet wide by 8 feet high, were located on the right side of the room and had cloth curtains used to darken the classroom. Two exit doors (about 6 feet wide) were located on the left side of the room. A ceiling fan was located between each of the 12 pairs of lights, making a total of six fans.

The room's seating capacity, in a straight-row arrangement, was 162 seats, which were placed in nine rows of 18 seats each, divided by a center aisle (i.e., nine seats on each side of the aisle). For this study, the room was reorganized by using only 100 seats placed in a straight-row spatial arrangement, as shown in Figure 6.

Two pieces of cardboard were prepared for use as measuring units for placing each seat in a row and column. The seats' row distance (16 inches) was determined by placing one cardboard on the floor between the front legs of side-by-side seats. The seats' column distance (19 inches) was determined by placing the second cardboard on the floor between a front leg of the seat in the back row and a back leg of the seat in the front row, as shown in Figure 7.

The setting included nine rows, m through u, and 12 columns, a through l. Row u at the rear of the room had only four seats, located in columns a, b, k, and l. The seats in column a, on the right side of the room, were placed against the wall, by the windows. The seats in column l, by the exit doors on the left side of the room, were placed 30 inches from the wall.

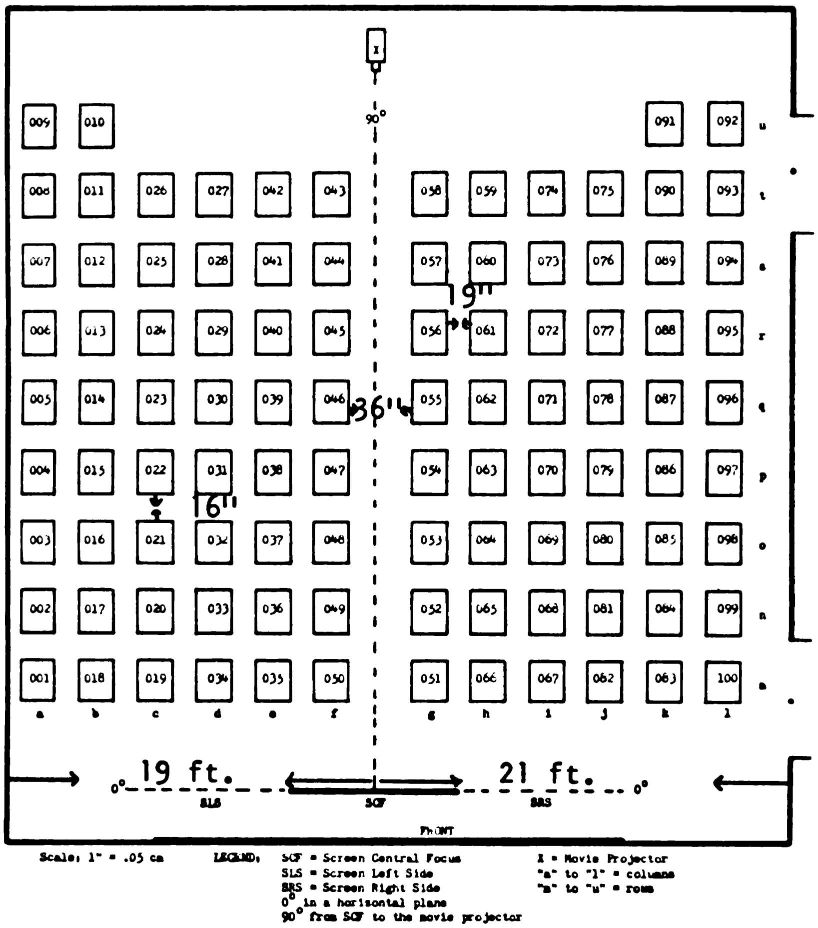


Figure 6.--Straight-row classroom spatial arrangement in Experimental Setting One.

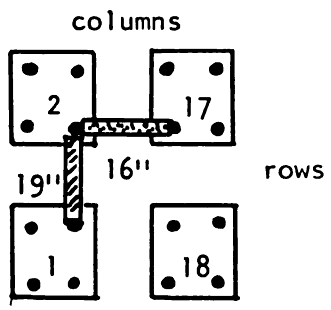


Figure 7.--Measuring distance between row and column of seats.

To determine the center aisle in front of the screen's central focus (SCF), a 36-inch piece of cardboard was placed between the legs of seats in columns f and g. The seats in the first row (row m) were placed about seven feet from the front wall and about five feet from the fixed screen in front of the room.

The matte-white (8 feet square) screen was pulled down from a roller device fixed, 29 inches from the wall, in the ceiling in front of the room. The SCF was not located at the center point of the front wall; rather, it was about 19 feet from the left side wall and about 21 feet from the right side wall, as shown in Figure 6.

The movie projector, which had a projection zoom lens, was placed at the rear of the room. The projection lens was perpendicularly aligned to the SCF (i.e., at a 90-degree angle to the screen) in front of the room.

Experimental Setting Two

The room used for Experimental Setting Two was 37 feet by 55 feet. There were no windows in this room, and both exit doors were located at the rear of the room. The room's seating capacity, in a straight-row arrangement, was 154 seats, placed in six columns of 15 seats each and four columns of 16 seats.

For this experiment, 24 seats were removed from the rear of the room, leaving a total of 30 seats in the room, placed in 10 columns (a through j) and 13 rows (01 through 13). The distance between rows was about 20 inches. The seats in the first row were measured with a scale, and other seats were arranged after them. About four inches were maintained between seats in each column, as shown in Figure 8.

The seats in column a were placed against the wall on the right side of the room. The arrangement had no center aisle because this room had a projection booth, as well as ceiling loud-speakers. Two screens were affixed to the ceiling in front of the room, with a mechanical device for lowering and raising them. These screens were not used because they were out of central-classroom vision.

A portable matte-white screen (eight feet square) was placed about five feet from the front wall, in the center of the room. The bottom of the screen was pulled up about four feet above floor level; its top was about 11 feet above floor level.

The movie projector, which had a projection zoom lens, was first tested from the projection booth. When the projection system was being tested, it presented a feedback effect that was audible in the

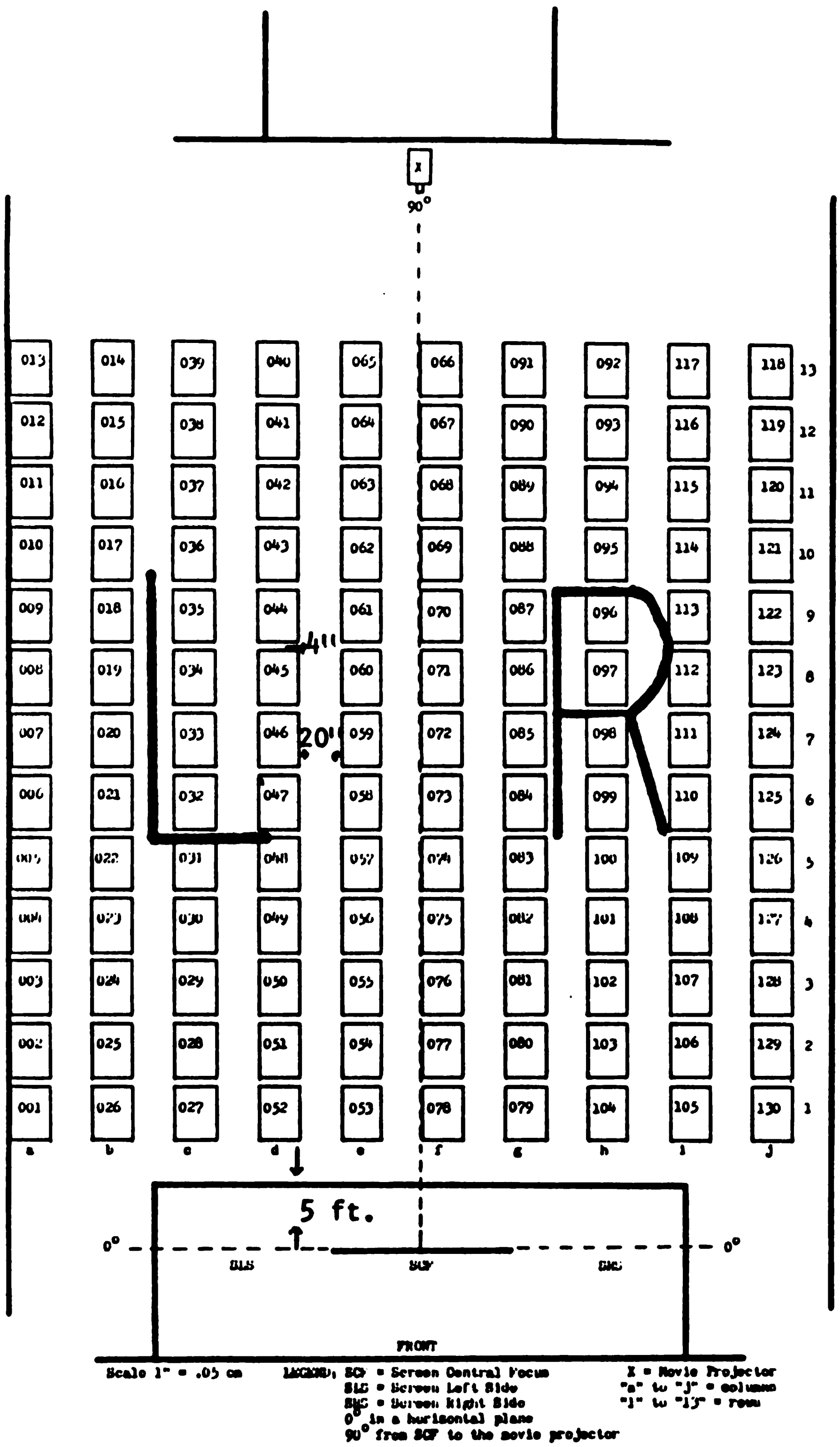


Figure 8.--Diagram of assigned seats in Experimental Setting Two.

classroom. Thus, the projection booth was not used, and the movie projector was placed at the rear of the room on a small table. The projection lens was aligned perpendicularly to the SCF (i.e., at a 90-degree angle to the screen) in a horizontal plane, in front of the room.

Instrumentation

The primary purpose of this study was to determine the effects of college students' seating position when viewing an instructional film in a straight-row classroom arrangement on their performance in perceiving information. Two data-collection instruments were designed to collect specific information pertinent to the research. The instruments (the Inventory Test and the Performance Test) were analyzed and evaluated in terms of validity by a Michigan State University professor who is knowledgeable about the design of evaluation instruments. These instruments were tested as part of the pilot studies described earlier in this chapter.

Each instrument, individually sealed, was placed in an envelope sealed with blue tape. Then, each envelope was given a number that corresponded with a seat number in the classroom. Test instruments were distributed to the subjects as explained in the Experimental Methodology section.

The Inventory Test

The Inventory Test was printed on colored paper and was sealed with yellow tape. This instrument (Appendix C) was designed to elicit certain demographic data for the experiment and was also used as a pretest to measure students' knowledge of human-biology concepts. The subjects were required to complete the Inventory Test before the instructional film was shown. In essence, the Inventory Test elicited four types of data: demographic data, physical condition, college educational level, and background in human biology.

Demographic data. Demographic data were collected to provide information on subjects' personal characteristics that might have affected their performance on the posttest. The subjects' ethnic group, interpreted in terms of their nationality, was an important factor that could affect their perception. For example, the sample included 25 foreign students whose first language was other than English. It was assumed that these subjects would have some problem perceiving the oral narration in the film because the rate was rapid, demanding high concentration and aural acuity.

Physical condition. The experiment was designed to be conducted in an ordinary classroom situation. Thus, questions on subjects' physical condition were intended to provide information on participants' physical condition and possible effects on their performance in perceiving information from the instructional film. The variables were (1) vision (normal or corrected), (2) hearing (normal or corrected), and (3) writing (left/right-handed or ambidextrous).

The subjects' perception of information (VDL/LC) was assumed to be affected by their seat-position distance and angle from the SCF.

College-educational level. Information on subjects' college educational level was sought because of its possible effect on their posttest performance after viewing the instructional film. The subjects' perception of information (VDL/LC) was assumed to be affected by their college educational level.

Background in human biology. Information on the subjects' background in human biology was sought because the instructional film they were shown concerned human muscles. The students' experience in human biology was a relevant factor. Hence, it was assumed that the treatment (given cues/given no cues) might have an effect on their performance on the posttest. The human-biology variables were as follows: (1) number of courses taken in human biology and (2) knowledge of selected human-biology terms.

Reasons for classroom seating preference for viewing an instructional film. Information was sought on the subjects' personal seating preferences for viewing an instructional film in the classroom and the possible effects of the randomly assigned seating on subjects' posttest performance. (See Appendix A, Table A-4.) The statements of reasons designed for this experiment were based on studies of students' seat location in the classroom and on other related research (Appendix D).

The Performance Test

The Performance Test was printed on white paper and sealed with red tape. This instrument was designed to elicit information concerning treatment (given cues/given no cues) effects on subjects' performance in perceiving information (VDL/LC). Subjects completed this test after viewing the instructional film from their randomly assigned seats in a straight-row classroom arrangement (Appendix C).

The variables included in the Performance Test were as follows: (1) treatment (given cues/given no cues), (2) the Performance Test (Part I: test on film content; Part II: open questions), and seat location (seat distance, seat angle, and seat side from SCF). These variables are discussed in the following paragraphs.

Treatment. Data on treatment variables (given cues/given no cues) were designed to provide important information on subjects' previous experience with the subject matter of the instructional film Muscle, which was to be shown to them, and the possible effects of such experience on their posttest performance. It was assumed that this treatment (given cues/given no cues) might affect subjects' posttest performance. The independent variables were (1) given cues and (2) given no cues.

1. Given cues. Subjects assigned to even-numbered seats (2, 4, ... 100, ... 130) were given cues (Treatment I) on some of the main topics to which they should pay attention when viewing the film, Muscle. They were not permitted to take notes on the cues. Data on this variable were intended to provide relevant information on subjects' perception of information (VDL/LC) and possible effects on their posttest performance. It was assumed that Treatment I (given cues) might affect the subjects' performance on the posttest, unlike the effect experienced by subjects who were not given cues.

2. Given no cues. Students assigned to odd-numbered seats (1, 3, ... 99, ... 129) received Treatment II (no cues given). Thus, these subjects were given no information at all on the film to be shown. Data on this variable were intended to provide information on subjects' perceived information (VDL/LC) and possible effects on their posttest performance. It was assumed that Treatment II (no cues given) might affect subjects' performance on the posttest, unlike the effects experienced by subjects who were given cues.

Performance Test. Performance Test items were designed to provide relevant information on subjects' perception of information (VDL/LC) and possible effects of seat distance and angle on their test performance. The subjects' perception of information (VDL/LC) was assumed to be affected by the treatment (cues given/no cues given). The independent variables were scores on (1) Part I--test on film content and (2) Part II--open questions.

1. Part I--Test on film content. The multiple-choice test was designed after previewing the film and reading the CRM/MCGraw-Hill script for the film, Muscle (see Appendix B, Script B-2). Data from the test on film content were designed to provide data on the subjects' performance in perceiving information (VDL/LC). These findings were used to answer the research questions and hypotheses posed in the study.

The subjects' perception of information (VDL/LC) was assumed to be affected by the treatment (cues given/no cues given). That is, students who received cues were expected to perform better on the posttest than those who did not receive such information.

The dependent variable was then divided into visual discrimination learning (VDL) and listening comprehension (LC). Each of the items was coded in terms of the variables VDL and LC. These questions were used to measure the subjects' performance in perceiving information as follows:

a. VDL-FVL (VDL-foveal): Items 54, 56, 57, 58, 61, 69, 76, 87, and 88.

b. VDL-PRPHRL (VDL peripheral): Items 44, 48, 52, 62, 63, 70, 84, and 86.

c. VDL was the combination of VDL-FVL and VDL-PRPHRL items.

d. The other items were classified as LC.

2. Part II--Open-ended questions. The open-ended questions were constructed after the writer previewed sections of the film and the script for the film, Muscle. The film was selected for its effective use of animation, graphs, and titling, among other techniques. The oral film narration rate was somewhat compressed to cover up the extensive number of visuals presented. Animated graphics (drawing) and the written labels shown too rapidly would make it difficult for subjects to perceive them through their foveal and peripheral vision from their seating position in the classroom.

As in the multiple-choice test, data on open-ended questions were intended to provide relevant information on subjects' performance in perceiving information (VDL/LC). The subjects' perception of information was assumed to be affected by the treatment (cues given/no cues given). Hence, being given cues possibly would have affected subjects' performance on the posttest, unlike the effects experienced by the subjects who received no cues.

Seat Location

Seat numbers were distributed in a straight-row classroom arrangement. Figure 9 represents Experimental Setting Two, in scale (one inch = .05 cm). The independent variable of seat location was divided into (1) seat distance from SCF, (2) seat angle from SCF, and (3) seat angle side from SCF.

Seat distance from SCF. The distance of each seat from SCF was measured as shown in Figure 10, in which the rectangles represent seats in the classroom. The center of each rectangle (seat) was found by tracing diagonal lines linking opposite corners, as shown in Figure 10. The distance of each seat from SCF was determined by measuring from the screen's central focus to the seat's center (Figure 10). The distance measured was recorded in feet.

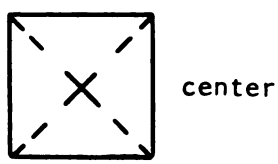


Figure 10.--Locating the center of the rectangle.

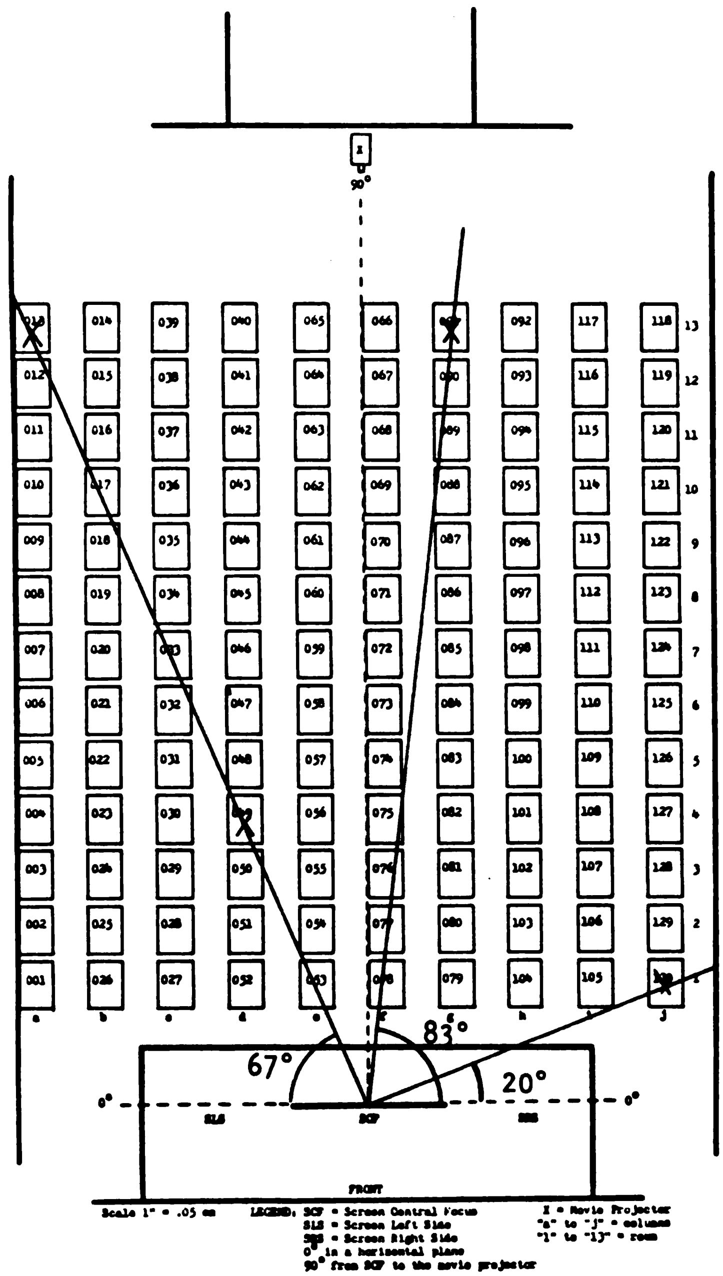


Figure 9.--Measuring distance and angle from SCF to seat's center in Experimental Setting Two.

Seat angle from SCF. Seat angles were determined as depicted in Figure 9. The angle of each seat was measured by superimposing the basic horizontal line of the protractor (0-180 degrees) over the line representing the screen's width in front of the room. The 90-degree mark was placed over the perpendicular line from the projecting line of the movie projector. Each angle was read following the same technique used to measure distance--that is, tracing a straight line from the SCF to the center of the seat. The angle measured was read and registered in degrees.

Seat angle side from SCF. Based on the SCF in front of the room, a seat's angle was identified as being at the left or the right side of the SCF. The techniques used for measuring seat distance and angle from the SCF were employed to determine subjects' personal seating preference in Experimental Setting Two but rearranged with 150 seats, and subjects' randomly assigned seats in Experimental Setting One for the pilot studies (Figure 11). All measurements were taken from the SCF to the center of each seat in both Experimental Setting One and Two.

Statistical Analysis

At the beginning of this chapter, the key points concerning students' seating position for viewing an instructional film in a straight-row classroom arrangement were presented. Three hypotheses were formulated to guide the analysis of data in this study. The statistical method used to test each hypothesis is explained after the particular hypothesis is stated.

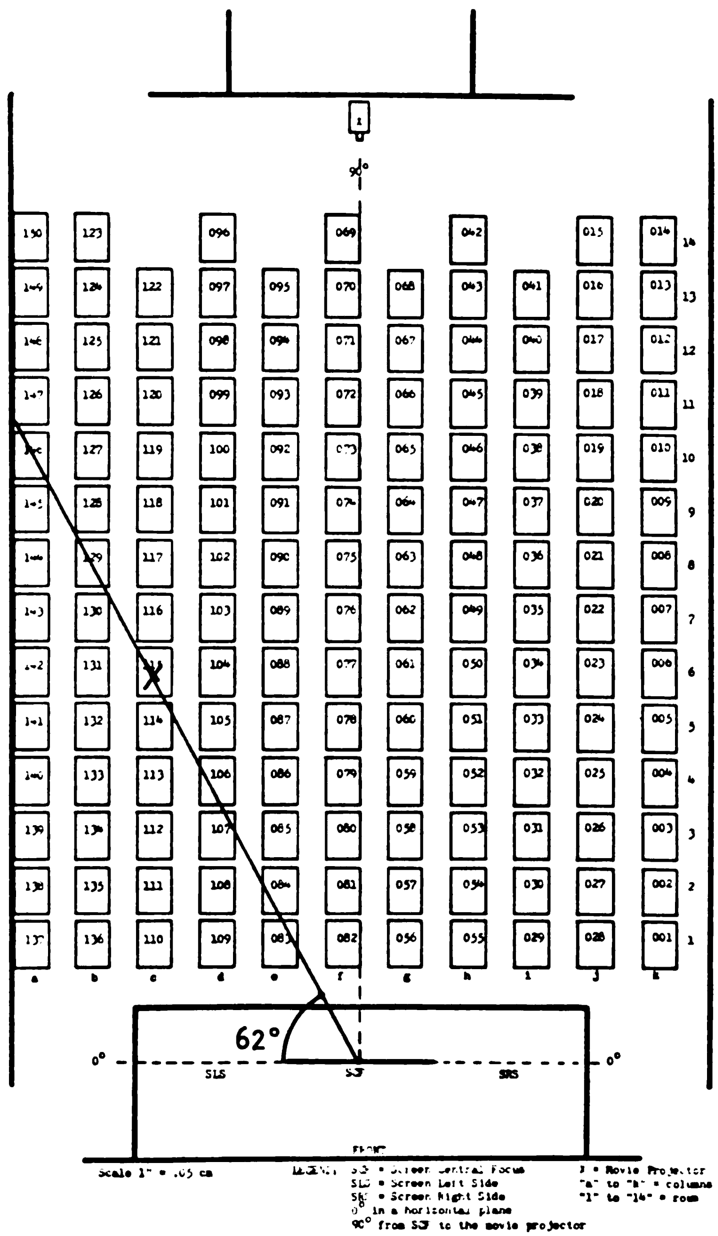


Figure 11.--Experimental Setting Two arranged for students' personal seating preference for viewing an instructional film.

> Hypothesis 1: Holding constant the student's angle of vision and other key independent variables, the farther the student is from the screen's central focus, the more information he/she will perceive.

Hypothesis 1 was tested by applying the multiple-regression technique, which permitted analysis of the linear relationship between the continuous independent variable (distance) and perceived information, holding constant other key independent variables. The hypothesis was tested separately for visual discrimination learning and listening comprehension, the continuous dependent variables. Multiple-regression analysis revealed no evidence of a linear effect of distance on the outcomes. Moreover, examination of scatterplots displaying the relationship between distance and each outcome revealed no apparent nonlinear effect.

> Hypothesis 2: Holding constant the student's seat distance from the screen's central focus, the smaller the seat's angle on the left or the right side of the screen's central focus in a horizontal plane in front of the room, the less information the student will perceive.

Hypothesis 2 was tested by applying the multiple-regression procedure, which permitted an analysis of the linear relationship between the continuous independent variable (angle degree) and perceived information, holding constant other key independent variables. The hypothesis was tested separately for visual discrimination learning and listening comprehension. From this linear combination, it was not possible to "estimate" the effect of angle of students' seating position on their learning processes. Multiple-regression analysis revealed no evidence of a linear effect of angle on the outcomes.

Moreover, examination of scatterplots displaying the relationship between angle and each outcome revealed no apparent nonlinear effect.

> Hypothesis 3: Students who receive cues before a film is shown will perceive more information than those who receive no cues.

The one-way ANOVA technique was used to test this hypothesis, making it possible to "estimate" the effects of the treatment (cues given/no cues given), a categorical independent variable, on the students' perceived information, a continuous dependent variable. The treatment was assumed to be related to the amount of students' perceived information (VDL/LC). It was also assumed that cues possibly would have some effect on students' performance in perceiving information, unlike the effects experienced by subjects who were given no cues.

Summary

This chapter dealt with methods and procedures used in investigating the possible effects of (1) students' seating-position distance and angle from the SCF on their performance in perceiving information (VDL/LC) when viewing an instructional film and (2) students' being given cues or no cues before seeing the instructional film.

The experimental design of the study was described in this chapter. The criteria for assigning students to seats in Experimental Settings One and Two were described in the Experimental Methodology section.

Both test instruments were evaluated for validity and reliability through three pilot studies. The Inventory Test data provided an overall description of the subjects; they completed this test before viewing the film. The Performance Test was designed to elicit relevant data on treatment (cues/no cues) and possible effects on students' performance in perceiving information. This test was completed after subjects viewed the film.

Multiple-regression and one-way ANOVA were used to test the data for possible effects of seating distance, seating angle, and use of cues on student performance in perceiving information. Results of the statistical analyses performed for this study, as well as a discussion of the findings, are found in Chapter IV.

CHAPTER IV

STATISTICAL ANALYSIS OF RESULTS AND DISCUSSION

Analysis of Data

The purpose of this chapter is to present and analyze the statistical findings of the experimental study. Hypotheses 1 and 2 were analyzed by applying the multiple-regression technique, which permitted analysis of the linear relationship between the dependent variables and a set of independent variables pertinent to these hypotheses. The hypotheses were also tested separately for visual discrimination learning (VDL) and listening comprehension (LC), as well as for TOTAL (VDL+LC) scores, the continuous dependent variables. That is, the results of the multiple-regression analysis are shown separately for the continuous dependent variables as follows: (a) results for the TOTAL (VDL+LC) scores on perception of information, (b) results for listening comprehension (LC), and (c) results for visual discrimination learning (VDL).

The following theoretical multiple-regression model was used to test Hypotheses 1 and 2:

$$Y = \alpha + B_1X_1 + B_2X_2 + \ldots + B_8X_8 + B_9X_9 + e_{ij}$$

where B_i represents how mean TOTAL (VDL+LC) scores or VDL scores or LC scores (Y_i) changed in relation to one unit of X_{i1} when the remainder of the variables were held constant.

The independent variables used as predictors for testing all of the hypotheses are shown in Table 6.

Table 6.--Independent variables used as predictors in the multiple-regression analysis.

Description of Independent Variable	Code-Label	Type[a]
Experimental Variables		
Seat ANGLE from screen's central focus	ANGLE	C
CUES given/NO CUES given	CUES	D
Seat DISTANCE from screen's central focus	DISTANCE	C
Covariables		
PRE-TEST in human biology	PRE-TEST	C
Self-score on seat's ANGLE (from 0 to 4 = bad to good)	SELF-LOCATION	D
Vision (NORMAL/corrected)	NORMAL VISION	D
Seat at screen's SIDE (left/right side)	LEFTSIDE	D
COURSES TAKEN in human biology (from 0 to more than 4)	COURSES TAKEN	D
Self-score on seat's DISTANCE (from 0 to 4 = bad to good)	SELF-DISTANCE	D

[a]C = continuous D = discrete

The third hypothesis was analyzed by applying the one-way analysis of variance (ANOVA) technique breakdown by the categorical independent variables of CUES given and NO CUES given, by regions, as shown in Figure 12. In other words, the experimental setting was divided into three regions: (a) Front Region I was the area between angles of 19 degrees and 50 degrees and distance about 8 to 10 feet to the left and to the right side of the screen's central focus in front of the room; (b) Action Region II, mentioned by Totusek and Staton-Spicer (1982), was the area between angles of 50 degrees and 90 degrees, and distance about 13 to 35 feet, to the left and to the right side of the screen's central focus in front of the room; (c) and Rear Region III was the area occupied by the last two rows (12 and 13) and columns a and j, starting at a 50-degree angle to the left and to the right side of the screen's central focus in front of the room (see Figure 12). Thus, Hypothesis 3 was tested by region, separately for perception of information--TOTAL (VDL+LC) scores, for listening comprehension (LC) scores, and for visual discrimination learning (VDL) scores, the dependent variables.

An alpha level of .05 was used to decide whether each hypothesis was supported or not. In the following pages, each hypothesis is restated, followed by the results of statistical analysis of that hypothesis.

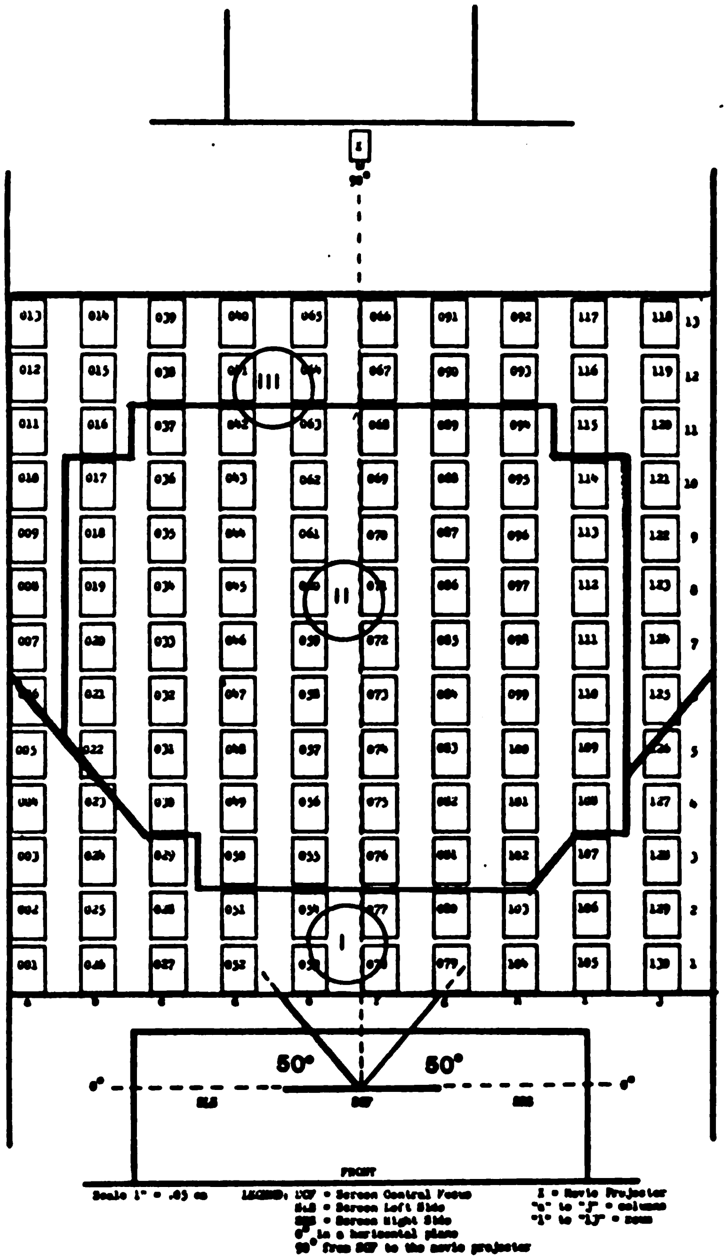


Figure 12.--Experimental setting identified by regions: Front Region I, Action Region II, and Rear Region III.

Hypothesis 1

> Hypothesis 1: Holding constant the student's angle of vision and other key independent variables, the farther the student is from the screen's central focus, the more information he/she will perceive.

A separate test was applied for each available score: for perception of information--TOTAL (VDL+LC) scores, for listening comprehension (LC) scores, and for visual discrimination learning (VDL) scores, the continuous dependent variables.

Results of multiple-regression analysis for TOTAL (VDL+LC) scores.

> Hypothesis 1a: Holding constant the student's angle of vision and other key independent variables, the farther the student is from the screen's central focus, the more information he/she will perceive--TOTAL (VDL+LC) scores.

Hypothesis 1a was not supported. There was no association between TOTAL (VDL+LC) scores and DISTANCE. The unstandardized beta (b) for DISTANCE was .0154 when all other independent variables were held constant. This value was not significant at the alpha = .05 level.

The simple-correlation coefficient between DISTANCE and TOTAL (VDL+LC) scores (r = -.0084) indicated a correlation near zero, which was not statistically significant at alpha = .05 (p = .463). The multiple-correlation coefficient between the independent and dependent variables was .3977, which was significant at the alpha = .05 level. The squared multiple-correlation coefficient (R^2 = .1581) indicated that 15.8% of the variation in the TOTAL (VDL+LC) scores was explained by the combined independent variables, which were included in the regression equation (see Table 6).

Table 7 shows selected statistics obtained for the multiple correlation of the TOTAL (VDL+LC) scores with all of the mentioned predictors included in the regression equation.

Table 7.--Analysis of variance for the multiple correlation between the independent variables and the TOTAL (VDL+LC) scores.

Source	SS^2	df	MS	F	Significance
Regression (explained)	569.216	9	63.246	2.379	.017
Residual (unexplained)	3030.558	114	26.584		
SS Total	3599.774	123			

Multiple R = .39765
R^2 = .15813
Standard deviation = 5.15595
Critical value F ≃ 1.95

Table 8 is a summary of the multiple-regression analysis for TOTAL (VDL+LC) scores with the independent variables.

Table 8.--Summary of multiple-regression data for TOTAL (VDL+LC) scores.

Variables	Unstandardized b	Std. Error b	F	Signif.
Angle	-.0223	.032	.475	.492
Cues	.999	.940	1.129	.290
Pre-test	.517	.193	7.178	.008
Self-location	.716	1.277	.314	.576
Normal vision	-.161	.954	.028	.866
Leftside	1.569	.967	2.635	.107
Courses taken	2.136	.978	4.771	.031
Distance	.0154	.057	.074	.786
Self-distance	.509	1.313	.150	.699
(Constant)	29.532	2.955	99.857	.000

Graph 1 illustrates the expected change in Y_i for changes in X_8 = DISTANCE, by using its two extreme values (5 feet and 43 feet), while holding other variables (X's) constant at zero. The prediction equation was

$$Y'_i = a + b_1X_1 + . . . + b_8X_8 + b_9X_9 =$$

where: a = 29.532 (intercept) = constant

b = .0154 (slope)

X_i = estimators (see Table 6) X_1 . . . X_7 and X_9 = 0

X_8 = DISTANCE = 1

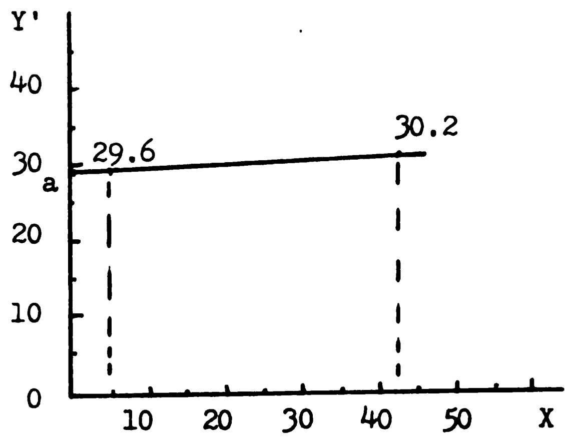
X_{81} = 5 feet

X_{82} = 43 feet

then,

$$Y'_{81} = 29.532 + (.0154)(0) + . . . + (.0154)(5) + (.0154)(0) = 29.6$$

$$Y'_{82} = 29.532 + (.0154)(0) + . . . + (.0154)(43) + (.0154)(0) = 30.2$$



Graph 1. Predicting TOTAL (VDL+LC) scores when DISTANCE = 1.

It was concluded that the effect of DISTANCE on TOTAL (VDL+LC) scores was not significant at the .05 level. That is, the student's perception of information (TOTAL [VDL+LC] scores) was not significantly affected by his/her seat's DISTANCE from the screen's central focus. However, when all of the predictors (Table 6) were included in the regression, the results demonstrated an overall significant (.017) effect on the student's amount of perceived information explained by those independent variables at the .05 level (see Table 7).

According to Pedhazur (1982), using the regression equation to predict the changes in TOTAL (VDL+LC) scores on the basis of given DISTANCE error associated with this equation, as well as random errors of the dependent variables, would affect the accuracy of the prediction. The computed standard error B for distance was .057. Then, it may be said that the actual TOTAL (VDL+LC) scores of approximately 68% of the subjects would fall within the range Y' ± .057. By using the results from the prediction equation, the intervals for both DISTANCE predictors were as follows: for 5 feet = (29.6 - .057) < Y < (29.6 + .057); for 43 feet = (30.2 - .057) < Y < (30.2 + .057). Pedhazur noted,

> A confidence interval provides more information than the information provided by a statement about the rejection of (or the failure to reject) a null hypothesis, which is almost false anyway. . . . The narrower the confidence interval, the smaller the range of possible null hypotheses, and hence the greater the confidence in one's findings. (p. 29)

A 95% confidence interval was computed for unstandardized beta (b) by using alpha = .05 and t-ratio. Table 9 shows the selected statistics obtained for the 95% confidence interval for TOTAL (VDL+LC) scores.

Table 9.--Confidence interval for TOTAL (VDL+LC) scores.

Variables	Unstandardized b	Std. Error b	T	95% Confidence Interval
Cues	.999	.940	1.063	-.8631, 2.8611
Pre-test	.517	.193	2.679	.1348, .8998
Left side	1.569	.967	1.623	-.3460, 3.485
Courses taken	2.136	.978	2.184	.1990, 4.073
(CONSTANT)	29.532	2.955	9.992	-23.6770, 35.386

The DISTANCE confidence interval for TOTAL (VDL+LC) scores was found to be -.969, .128. Therefore, it may be stated with 95% confidence that the parameter lay within this range; that is, $-.969 \leq \beta \leq$

.128. Thus, b was not significantly different from zero at the .05 level (Pedhazur, 1982).

Results of multiple-regression analysis for LC scores.

> Hypothesis 1b: Holding constant the student's angle of vision and other key independent variables, the farther the student is from the screen's central focus, the more information he/she will perceive--LC scores.

Hypothesis 1b was not supported. There was no statistically significant difference in LC scores for DISTANCE. The unstandardized beta for DISTANCE was -.0057 when all other independent variables were held constant. This value was not significant at the alpha = .05 level.

The simple-correlation coefficient between DISTANCE and LC scores (r = -.0527) indicated a low and negative correlation in the sample, which was not significant at the alpha = .05 level (p = .280). The multiple-correlation coefficient between the independent and dependent variables was .40933, which was significant at the alpha = .05 level. The squared multiple-correlation coefficient (R^2 = .1676) indicated that 16.8% of the variation in LC scores was explained by the combined independent variables, which were included in the regression equation (see Table 6).

Table 10 shows selected statistics obtained for the multiple correlation of the LC scores with all of the mentioned predictors included in the regression equation.

Table 10.--Analysis of variance for the multiple correlation between the independent variables and LC scores.

Source	SS^2	df	MS	F	Significance
Regression (explained)	301.537	9	33.504	2.54954	.010
Residual (unexplained)	1498.099	114	13.141		
SS Total	1799.636	123			

Multiple R = .40933
R^2 = .16755
Standard deviation = 3.62508
Critical value F ≃ 1.95

Table 11 is a summary of the multiple-regression data for LC scores with the independent variables.

Table 11.--Summary of multiple-regression data for LC scores.

Variables	Unstandardized b	Std. Error b	F	Signif.
Cues	.9729	.6609	2.167	.144
Pre-test	.3708	.1358	7.459	.007
Left side	.7826	.679	1.325	.252
Courses taken	1.584	.688	5.309	.023
(CONSTANT)	19.743	2.078	90.287	.000

Graph 2 illustrates the expected change in Y_1 for changes in X_8 = DISTANCE, by using its two extreme values (5 feet and 43 feet), while holding other variables (X's) constant at zero. The prediction equation was

$$Y_i' = a + b_1X_1 + \ldots + b_8X_8 + b_9X_9 =$$

where: $a = 19.743$ (intercept) = constant

$b = -.0057$ (slope)

X_i = estimators (see Table 6)) = $X_1 \ldots X_7$ and $X_9 = 0$

X_8 = DISTANCE = 1

$X_{81} = 5$ feet

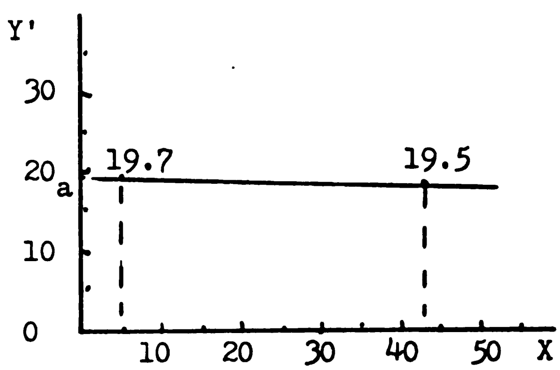
$X_{82} = 43$ feet

then

$$Y_i' = a + b_1X_1 + \ldots + b_8X_8 + b_9X_9 =$$

$$Y_{81}' = 19.743 + (-.0057)(0) + \ldots \_ (-.0057)(5) + (-.0057)(0) = 19.7$$

$$Y_{82}' = 19.743 + (-.0057)(0) + \ldots + (-.0057)(43) + (-.0057)(0) = 19.5$$



Graph 2. Predicting LC scores when DISTANCE = 1.

It was concluded that the effect of DISTANCE on LC scores was not statistically significant at the .05 level. That is, the student's perception of information in terms of listening comprehension was not significantly affected by his/her seat's DISTANCE from the screen's central focus.

The computed standard error b for DISTANCE was .039. Then, it may be said that the actual LC scores of approximately 68% of the subjects would fall within the range $Y_i \pm .039$. By using the results from the prediction equation, the intervals for both DISTANCE predictors were as follows: for 5 feet = $(19.7 - .039) < Y < (19.7 + .039)$; for 43 feet = $(19.5 - .039) < Y < (19.5 + .039)$.

A 95% confidence interval was computed for unstandardized beta, by using the alpha = .05 level and t-ratio. Table 12 shows the selected statistics obtained for the 95% confidence interval for LC scores.

Table 12.--Confidence interval for LC scores.

Variables	Unstandardized b	Std. Error b	T	95% Confidence Interval
Cues	.9729	.6609	1.472	-.336, 2.282
Pre-test	.3708	.1358	2.731	.102, .639
Left side	.7826	.679	1.151	-.564, 2.129
Courses taken	1.5842	.688	2.304	.222, 2.946
(CONSTANT)	19.743	2.078	9.502	-15.627, 23.859

The DISTANCE confidence interval for LC scores was computed as -.085, .073. Therefore, it may be stated with 95% confidence that the parameter lay within this range; that is, $-.085 \leq \beta \leq .073$. Thus, b was not significantly different from zero at the .05 level (Pedhazur, 1982).

Results of multiple-regression analysis for VDL scores.

> Hypothesis 1c: Holding constant the student's angle of vision and other key independent variables, the farther the student is from the screen's central focus, the more information he/she will perceive--VDL scores.

Hypothesis 1c was not supported. There was no statistically significant difference in VDL scores for DISTANCE. The unstandardized beta for DISTANCE was .0211 when all other independent variables were held constant. This value was not significant at the alpha = .05 level.

The simple-correlation coefficient between DISTANCE and VDL scores (r = .0685) indicated a low and positive correlation in the sample, which was not significant at the alpha = .05 level (p = .225). The multiple-correlation coefficient between the independent and dependent variables was .30218, which was not significant at the alpha = .05 level. The squared multiple-correlation coefficient (R^2 = .0913) indicated that 9.13% of the variation in VDL scores was explained by the combined independent variables included in the regression equation (see Table 6).

Table 13 shows selected statistics obtained for the multiple correlation of the VDL scores with all of the mentioned predictors included in the regression equation.

Table 13.--Analysis of variance for the multiple correlation between the independent variables and the VDL scores.

Source	SS^2	df	MS	F	Significance
Regression (explained)	58.31291	9	6.47921	1.27286	.259
Residual (unexplained)	580.29193	114	5.09028		
SS Total	638.60484	123			

Multiple R = .30218
R^2 = .09131
Standard deviation = 2.25616
Critical value F ≃ 1.95

Table 14 is a summary of the multiple-regression data for VDL scores with the independent variables.

Table 14.--Summary of multiple-regression data for VDL scores.

Variables	Unstandardized b	Std. Error b	F	Signif.
Angle	-.0014	.0141	.0104	.919
Cues	.026	.4113	.0039	.950
Pre-test	.1466	.0845	3.008	.086
Self-location	.4034	.559	.521	.472
Normal vision	.1089	.4173	.068	.795
Left side	.7871	.4231	3.461	.065
Courses taken	.5516	.4279	1.662	.200
Distance	.0211	.0248	.723	.397
Self-distance	.2295	.5747	.159	.690
(CONSTANT)	9.7883	1.2932	57.292	.000

Graph 3 illustrates the expected change in Y_i for changes in X_8 = DISTANCE, by using its two extreme values (5 feet and 43 feet), while holding other variables (X's) constant at zero. The prediction equation was

$$Y'_i = a + b_1X_1 + . . . b_8X_8 + b_9X_9 =$$

where: a = 9.788 (intercept) = constant

b = .0211 (slope)

X_i = estimators (see Table 6) = $X_1 . . . X_7$ and $X_9 = 0$

X_8 = DISTANCE = 1

X_{81} = 5 feet

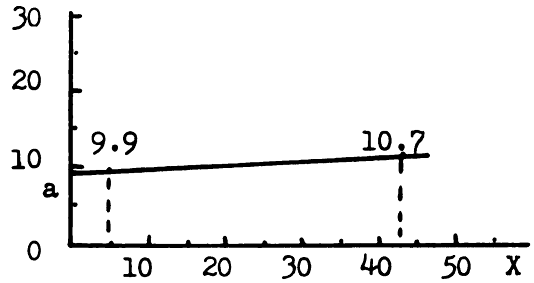
X_{82} = 43 feet

then,

$$Y'_i = a + b_1X_1 + . . . + b_8X_8 + b_9X_9 =$$

$$Y'_{81} = 9.788 + (.0211)(0) + . . . + (.0211)(5) + (.0211)(0) = 9.9$$

$$Y'_{82} = 9.788 + (.0211)(0) + . . . + (.0211)(43) + (.0211)(0) = 10.7$$



Graph 3. Predicting VDL scores when DISTANCE = 1.

It was concluded that the effect of DISTANCE on VDL scores was not statistically significant at the alpha = .05 level. That is, the student's perception of information in terms of visual discrimination learning was not significantly affected by his/her seat's DISTANCE from the screen's central focus.

The computed error b for DISTANCE was .0248. Then, it may be said that the actual VDL scores of approximately 68% of the subjects would fall within the range $Y_i \pm .0248$. By using the results from the prediction equation, the intervals for both DISTANCE predictors were as follows: for 5 feet = $(9.9 - .0248) < Y < (9.9 + .0248)$; for 43 feet = $(10.7 - .0248) < Y < (10.7 + .0248)$.

A 95% confidence interval was computed for unstandardized beta, by using the alpha = .05 level and t-ratio. Table 15 shows the selected statistics obtained for the 95% confidence interval for VDL scores.

Table 15.--Confidence interval for VDL scores.

Variables	Unstandardized b	Std. Error b	T	95% Confidence Interval
Cues	.0260	.4113	.6322	-.7888, .8408
Pre-test	.1466	.0845	1.734	-.0208, .3139
Left side	.787	.4231	1.860	-.0510, 1.625
Courses taken	.552	.4279	1.289	-.2960, 1.399
(CONSTANT)	9.7883	1.293	7.5692	-7.2260, 12.350

The DISTANCE confidence interval for VDL scores was found to be -.0281, .0703. Therefore, it may be stated with 95% confidence that the parameter lay within this range; that is, $-.0281 \leq \beta \leq .0703$. Thus, beta was not significantly different from zero at the alpha = .05 level (Pedhazur, 1982).

Hypothesis 2

> Hypothesis 2: Holding constant the student's seat distance from the screen's central focus and other key independent variables, the smaller the seat's ANGLE on the left or the right side of the screen's central focus in a horizontal plane in front of the room, the less information the student will perceive.

A separate test was applied for each available score: for perception of information--TOTAL (VDL+LC) scores, for listening comprehension (LC) scores, and for visual discrimination learning (VDL) scores, the continuous dependent variables.

Results of multiple-regression analysis for TOTAL (VDL+LC) scores.

> Hypothesis 2a: Holding constant the student's seat distance from the screen's central focus and other key independent variables, the smaller the seat's ANGLE on the left or the right side of the screen's central focus in a horizontal plane in front of the room, the less information the student will perceive--TOTAL (VDL+LC) scores.

Hypothesis 2a was not supported. There was no statistically significant difference in TOTAL (VDL+LC) scores for ANGLE. The unstandardized beta for ANGLE was -.0223 when all other independent variables were held constant. This value was not significant at the alpha = .05 level.

The simple-correlation coefficient between ANGLE and TOTAL (VDL+LC) scores (r = -.0865) indicated a low and negative correlation in the sample, which was not significant at the alpha = .05 level (p = .170). The multiple-correlation coefficient between the independent and dependent variables was .3977, which was significant at the alpha = .05 level. The squared multiple-correlation coefficient (R = .1581) indicated that 15.8% of the variation in the TOTAL (VDL+LC) scores was explained by the combined independent variables included in the regression equation (see Table 6).

Table 7 shows selected statistics obtained for the multiple correlation of the TOTAL(VDL+LC) scores with all of the mentioned predictors included in the regression equation.

Table 8 is a summary of the multiple-regression analysis for TOTAL (VDL+LC) scores with the independent variables.

Graph 4 illustrates the expected change in Y_i for changes in X_1 = ANGLE, by using its two extreme values (19 degrees and 89 degrees), while holding other variables (X's) constant at zero. The prediction equation was

$$Y_i' = a + b_1X_1 + \ . \ . \ . + b_9X_9 =$$

where: a = 29.532 (intercept) = constant

b = -.0223 (slope)

X_1 = estimators (see Table 6) = X_2 . . . X_9 = 0

X_1 = ANGLE = 1

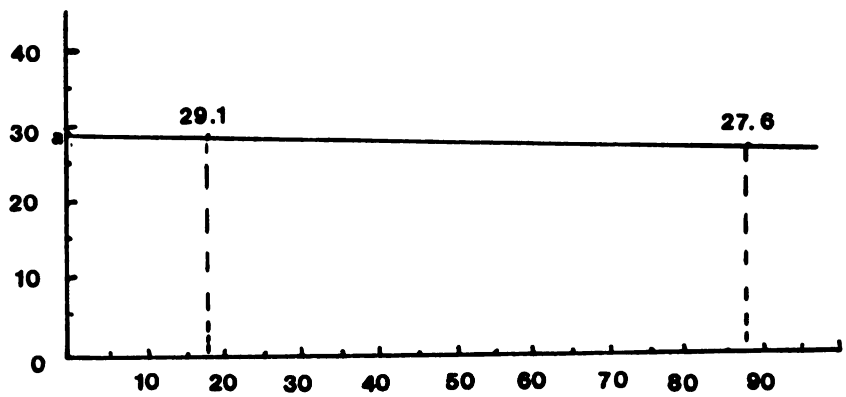
X_{11} = 19 degrees

X_{12} = 89 degrees

then,

$$Y_{11}' = 29.532 + (-.0223)(19) + \ . \ . \ . + (-.0223)(0) = 29.1$$

$$Y_{12}' = 29.532 = (-.0223)(89) + \ . \ . \ . + (-.0223)(0) = 27.6$$



Graph 4. Predicting TOTAL (VDL+LC) scores when ANGLE = 1.

It was concluded that the effect of ANGLE on TOTAL (VDL+LC) scores was not significant at the alpha = .05 level. That is, the student's perception of information (TOTAL [VDL+LC] scores) was not significantly affected by his/her seat's ANGLE from the screen's central focus. However, when all of the predictors (Table 6) were included in the regression equation, the results demonstrated an overall significant (.017) effect on the student's perceived information explained by those estimators, at the alpha = .05 level (see Table 7).

According to Pedhazur (1982), using a regression equation to predict the changes in TOTAL (VDL+LC) scores on the basis of a given ANGLE, errors associated with this equation, as well as random errors of the dependent variables, would affect the accuracy of the prediction.

The computed standard error beta for ANGLE was .0323. It may be said, then, that the actual TOTAL (VDL+LC) scores of approximately 68% of the subjects would fall within the range $Y' \pm .0323$. By using the results from the prediction equation, the intervals for both ANGLE predictors were as follows: for 19 degrees = $(29.1 - .0323) < Y < (29.1 + .0323)$; for 89 degrees = $(27.6 - .0323) < Y < (27.6 + .0323)$.

A 95% confidence interval was computed for unstandardized beta, by using alpha = .05 and t-ratio. Table 9 shows the selected statistics obtained for the 95% confidence interval for TOTAL (VDL+LC) scores. The ANGLE confidence interval for TOTAL (VDL+LC) scores was -.0863, .0417. Therefore, it may be stated with 95% confidence that the parameter lay within this range; that is, $-.0863 \leq \beta \leq .0417$. Thus, beta was not significantly different from zero at the alpha = .05 level (Pedhazur, 1982).

Results of multiple-regression analysis for LC scores.

> Hypothesis 2b: Holding constant the student's seat distance from the screen's central focus and other key independent variables, the smaller the seat's ANGLE on the left or the right side of the screen's central focus in a horizontal plane in front of the room, the less information the student will perceive--LC scores.

Hypothesis 2b was not supported. There was no statistically significant difference in LC scores for ANGLE. The unstandardized beta for ANGLE was -.0208 when all other independent variables were held constant. This value was not significant at the alpha = .05 level.

The simple-correlation coefficient between ANGLE and LC scores (r = -.1171) indicated a low and negative correlation in the sample, which was not significant at the alpha = .05 level (p = .098). The multiple-correlation coefficient between the independent variables was .40933, which was significant at the alpha = .05 level. The squared multiple-correlation coefficient (R^2 = .1676) indicated that 16.8% of the variation in LC scores was explained by the combined independent variables included in the regression equation (see Table 6).

Selected statistics obtained for the multiple correlation of the LC scores with all of the mentioned predictors included in the regression equation are shown in Table 10. The summary of the multiple-regression analysis for LC scores with all of the independent variables is shown in Table 11.

Graph 5 illustrates the expected change in Y_1 for changes in X_1 = ANGLE, by using its two extreme values (19 degrees and 89 degrees), while holding other variables (X's) constant at zero. The prediction equation was

$$Y'_1 = a = b_1X_1 + . . . + b_9X_9 =$$

where: a = 19.743 (intercept) = constant

b = -.0208 (slope)

X_1 = estimators (see Table 6) = X_2 . . . X_9 = 0

X_1 = ANGLE = 1

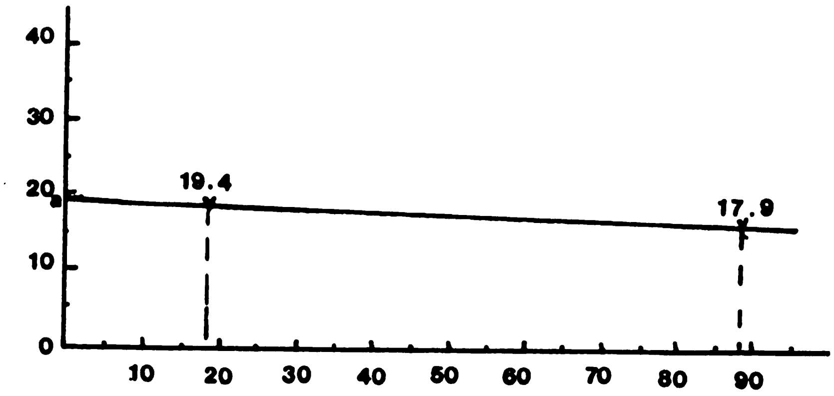
X_{11} = 19 degrees

X_{12} = 89 degrees

then,

$$Y'_{11} = 19.743 + (-.0208)(19) + . . . + (-.0208)(0) = 19.4$$

$$Y'_{12} = 19.743 + (-.0208)(89) + . . . + (-.0208)(0) = 17.9$$



Graph 5. Predicting LC scores when ANGLE = 1.

It was concluded that the effect of ANGLE on LC scores was not statistically significant at the alpha = .05 level. That is, the student's perception of information in terms of listening comprehension was not significantly affected by his/her seat's ANGLE from the screen's central focus.

The computed standard error beta for ANGLE was .0227. Then, it may be said that the actual LC scores of approximately 68% of the subjects would fall within the range $Y_i \pm .0227$. By using the results of the prediction equation, the intervals for both ANGLE predictors were as follows: for 19 degrees = $(19.4 - .0227) < Y < (19.4 + .0227)$; for 89 degrees = $(17.9 - .0227) < Y < (17.9 + .0227)$.

A 95% confidence interval was computed for unstandardized beta, by using the alpha = .05 level and t-ratio. The selected statistics obtained for the 95% confidence interval for LC scores and other independent variables are shown in Table 7. The ANGLE confidence interval for LC scores was found to be -.0658, .0242. Therefore, it may be stated with 95% confidence that the parameter lay within this range; that is, $-.0658 \leq \beta \leq .0242$. Thus, beta was not significantly different from zero at the alpha = .05 level (Pedhazur, 1982).

Results of multiple-regression analysis for VDL scores.

> Hypothesis 2c: Holding constant the student's seat distance from the screen's central focus and other key independent variables, the smaller the seat's ANGLE on the left or the right side of the screen's central focus in a horizontal plane in front of the room, the less information the student will perceive--VDL scores.

Hypothesis 2c was not supported. There was no statistically significant difference in VDL scores for ANGLE. The unstandardized beta for ANGLE was -.0014 when all other independent variables were held constant. This value was not significant at the alpha = .05 level.

The simple-correlation coefficient between Angle and VDL scores (r = -.0088) indicated a near-zero correlation in the sample, which was not significant at the alpha = .05 level (p = .461). The multiple-correlation coefficient between the independent and dependent variables was .30218, which was not significant at the alpha = .05 level. The squared multiple-correlation coefficient (R^2 = .0913) indicated that 9.13% of the variation in VDL scores was explained by the combined independent variables included in the regression equation (see Table 6).

The selected statistics obtained for the multiple correlation of the VDL scores with all of the mentioned predictors included in the regression equation are shown in Table 13. The summary of the multiple-regression analysis for VDL scores with the independent variables is shown in Table 14.

Graph 6 illustrates the expected change in Y_i for changes in X_1 = ANGLE, by using its two extreme values (19 degrees and 89 degrees), while holding other variables (X's) constant at zero. The prediction equation was

$$Y_i' = a + b_1X_1 + . . . + b_9X_9 =$$

where: a = 9.788 (intercept) = constant

b = -.0014 (slope)

X_i = estimators (see Table 6) = $X_2 . . . X_9 = 0$

X_1 = ANGLE = 1

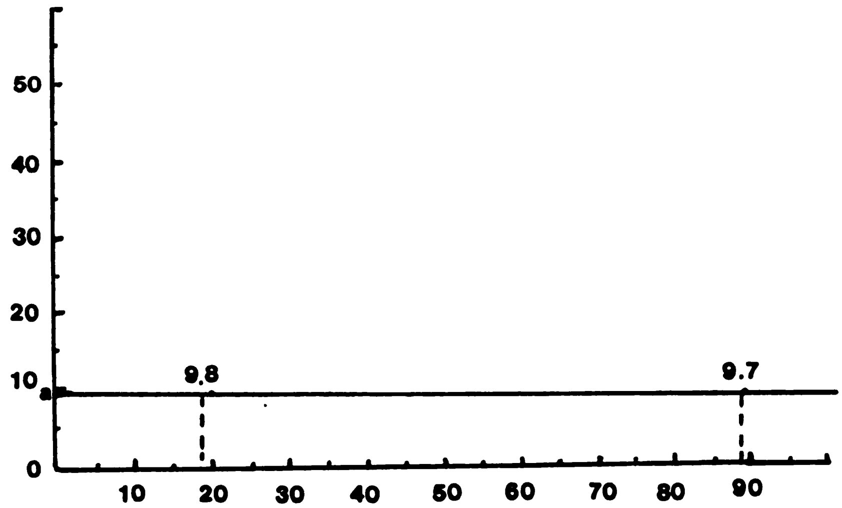
X_{11} = 19 degrees

X_{12} = 89 degrees

then,

$$Y'_{11} = 9.788 + (-.0014)(19) + \ldots + (-.0014)(0) = 9.8$$

$$Y'_{12} = 9.788 + (-.0014)(89) + \ldots + (-.0014)(0) = 9.7$$



Graph 6. Predicting VDL scores when ANGLE = 1.

It was concluded that the effect of ANGLE on VDL scores was not statistically significant at the alpha = .05 level. That is, the student's perception of information in terms of visual discrimination learning was not affected by his/her seat's ANGLE from the screen's central focus.

The computed standard error beta for ANGLE was .0141. It may be said that the actual VDL scores of approximately 68% of the subjects would fall within the range $Y' \pm .0141$. By using the results of the prediction equation, the intervals for both ANGLE predictors were as follows: for 19 degrees = $(9.8 - .0141) < Y < (9.8 + .0141)$; for 43 degrees $(9.7 - .0141) < Y < (9.7 + .014)$.

A 95% confidence interval was computed for unstandardized beta, by using the alpha = .05 level and t-ratio. Selected statistics obtained for the 95% confidence interval for VDL scores are shown in Table 15. The ANGLE confidence interval for the VDL scores was found to be -.0294, .0266. Therefore, it may be stated with 95% confidence that the parameter lay within this range; that is, $-.0294 \leq \beta \leq .0266$. Thus beta was not significantly different from zero at the alpha = .05 level (Pedhazur, 1982).

Hypothesis 3

> Hypothesis 3: Students who receive CUES before a film is shown will perceive more information than those who receive no CUES.

Hypothesis 3 was first tested by classroom region. Separate analyses were conducted for perception of information--TOTAL (VDL+LC) scores, for listening comprehension (LC) scores, and for visual discrimination learning (VDL) scores, the dependent variables.

The theoretical model appropriate for this analysis was based on Pedhazur (1982), in which

$$"Y_{ij} = \mu + \beta_j + \varepsilon_{ij}$$

where Y_{ij} = score of individual 'i' in group or treatment 'j'; μ = the population mean; β_j = the effect of treatment 'j'; ε_{ij} = error associated with the score of the individual 'i' in group or treatment 'j.' . . ." (p. 291).

Hypothesis 3 was tested by using analysis of variance with an alpha = .05 level as the significance level for acceptance. The strength of the effects of giving CUES on perception of information (TOTAL [VDL+LC])--that is, the degree of variability in the whole group (124) subjects) and, in particular, the variability within giving CUES and giving NO CUES--was measured by the descriptive statistic eta^2.

> The value of eta^2 will be 1.0 if and only if there is no variability within each category of [CUES/NO CUES] and there is some variability between categories. The index will be zero (0) if and only if there is no difference among the means of [CUES and NO CUES]. Therefore, $eta^2 = 0$ indicates that there is no effect of [CUES/NO CUES]. . . . (Nie et al., 1975, p. 401)

FRONT REGION I

The critical value for Front Region I with 1, 29 degrees of freedom was F = 4.21.

Results of ANOVA for TOTAL (VDL+LC) scores.

> Hypothesis 3.Ia: Students who receive CUES before a film is shown will perceive more information than those who receive NO CUES--TOTAL (VDL+LC) scores.

Hypothesis 3.Ia was not supported. There was no statistically significant difference in TOTAL (VDL+LC) scores between the CUES and NO CUES groups in Front Region I, at the alpha = .05 level (.1660). It may be inferred that, for Front Region I, being given CUES before showing a film did not have a significant effect on students' perception of information at the alpha = .05 level. However, eta^2 = .0698 indicated some CUES effects on perception of information (TOTAL [VDL+LC]); hence eta^2 was different from zero (Nie et al., 1975).

The simple-correlation coefficient between CUES and TOTAL (VDL+LC) scores (r = .1058) indicated a low and positive correlation in the sample, which was not significant at the alpha = .05 level (p = .121). Table 16 shows the main statistical characteristics of the subjects in the group.

Table 16.--Summary statistics for TOTAL (VDL+LC) scores: Hypothesis 3.Ia.

Variable	N	Sum	Mean	Variance	Std. Dev.	SS^2
No cues	15	570	38.0000	18.4286	4.2929	258.0000
Cues	14	490	35.0000	46.9231	6.8500	610.0000
SS total	29	1,060	36.5517	33.3276	5.7730	933.1724

Table 17 shows the selected statistics obtained from the analysis of variance for TOTAL (VDL+LC) scores.

Table 17.--ANOVA results for TOTAL (VDL+LC) scores: Hypothesis 3.Ia.

Source	SS^2	df	MS	F	Signif.	eta^2
Between groups	65.1724	1	65.1724	2.0273	.166	.0698
Within groups	868.0000	27	32.1481			
SS total	933.1724	28				

Results of ANOVA for LC scores.

Hypothesis 3.Ib: Students who receive CUES before a film is shown will perceive more information than those who receive NO CUES--LC scores.

Hypothesis 3.Ib was not supported. There was no statistically significant difference in LC scores between the CUES and NO CUES groups in Front Region I, at the alpha = .05 level. It may be inferred that, for Front Region I, being given CUES before showing a film did not have a significant effect on students' listening comprehension at the alpha = .05 level. However, $eta^2 = .0522$ indicated some CUES effects on LC scores; hence eta was different from zero (Nie et al., 1975).

The simple-correlation coefficient between CUES and LC scores (r = .1386) indicated a low and positive correlation in the sample, which was not significant at the .05 level (p = .062). Table 18 contains the main statistical characteristics of the subjects in the group.

Table 18.--Summary statistics for LC scores: Hypothesis 3.Ib.

Variable	N	Sum	Mean	Variance	Std. Dev.	SS^2
No cues	15	376	25.0667	7.0667	2.6583	98.9333
Cues	14	327	23.3571	21.9396	4.6840	285.2143
SS total	29	703	24.2414	14.4754	3.8047	405.3103

Table 19 shows the selected statistics obtained from the analysis of variance for LC scores.

Table 19.--ANOVA results for LC scores: Hypothesis 3.Ib.

Source	SS^2	df	MS	F	Signif.	eta^2
Between groups	21.1627	1	21.1627	1.4874	.233	.0522
Within groups	384.1476	27	14.2277			
SS total	405.2103	28				

Results of ANOVA-for VDL scores.

Hypothesis 3.Ic: Students who receive CUES before a film is shown will perceive more information than those who receive NO CUES--VDL scores.

Hypothesis 3.Ic was not supported. There was no difference in VDL scores between the CUES and NO CUES groups in Front Region I at the .05 level. It may be inferred that, for Front Region I, being given CUES before showing a film did not have a significant effect on students' visual discrimination learning at the .05 level. However, $eta^2 = .0641$ indicated some CUES effects on visual discrimination learning; hence eta was different from zero (Nie et al., 1975).

The simple-correlation coefficient between CUES and VDL scores ($r = .0186$) indicated a low and positive correlation in the sample, which was not significant at the alpha = .05 level ($p = .419$). Table 20 shows the main statistical characteristics of the subjects in this group.

Table 20.--Summary statistics for VDL scores: Hypothesis 3.Ic.

Variable	N	Sum	Mean	Variance	Std. Dev.	SS^2
No cues	15	194	12.9333	6.2095	2.4919	86.9333
Cues	14	163	11.6429	6.8626	2.6197	89.2143
SS total	29	357	12.3103	6.7217	2.5926	188.2069

Table 21 shows the selected statistics obtained from the analysis of variance for VDL scores.

Table 21.--ANOVA results for VDL scores: Hypothesis 3.Ic.

Source	SS^2	df	MS	F	Signif.	eta^2
Between groups	12.0593	1	12.0593	1.8485	.1852	.0641
Within groups	176.1476	27	6.5240			
SS total	188.2069	28				

ACTION REGION II

The critical value for Action Region II with 1, 63 degrees of freedom was $F \simeq 3.99$.

Results of ANOVA for TOTAL (VDL+LC) scores.

Hypothesis 3.IIa: Students who receive CUES before a film is shown will perceive more information than those who receive NO CUES--TOTAL (VDL+LC) scores.

Hypothesis 3.IIa was supported. There was a statistically significant difference in TOTAL (VDL+LC) scores between the CUES and NO CUES groups in Action Region II (.0033) at the alpha = .05 level. It may be inferred that, for Action Region II, being given CUES before showing a film did have a significant effect on students' perception of information at the .05 level. Eta^2 = .1292 indicated a strong effect of being given cues before showing a film on students' perception of information (TOTAL [VDL+LC] scores); eta^2 was different from zero (Nie et al., 1975).

The simple-correlation coefficient between CUES and TOTAL (VDL+LC) scores (r = .1058) indicated a low and positive correlation in the sample, which was not statistically significant at the alpha = .05 level (p = .121). Table 22 contains the main statistical characteristics of the subjects in this group.

Table 22.--Summary statistics for TOTAL (VDL+LC) scores: Hypothesis 3.IIa.

Variable	N	Sum	Mean	Variance	Std. Dev.	SS^2
No cues	32	1,057	33.0313	33.8377	5.8170	1048.9688
Cues	33	1,216	36.8485	17.0701	4.1216	546.2424
SS total	65	2,273	34.9692	28.6240	5.3501	1831.9385

Table 23 shows the selected statistics obtained from the analysis of variance for TOTAL (VDL+LC) scores.

Table 23.--ANOVA results for TOTAL (VDL+LC) scores: Hypothesis 3.IIa.

Source	SS^2	df	MS	F	Signif.	eta^2
Between groups	236.7273	1	236.7273	9.3491	.0033	.1292
Within groups	1595.2112	63	25.3208			
SS total	1831.93 85	64				

Results of ANOVA for LC scores.

Hypothesis 3.IIb: Students who receive CUES before a film is shown will perceive more information than those who receive NO CUES--LC scores.

Hypothesis 3.IIb was supported. There was a statistically significant difference in LC scores between the CUES and NO CUES groups in Action Region II at the alpha = .05 level (.0065). It may be inferred that, for Action Region II, being given CUES before showing a film did have a significant effect on students' listening comprehension at the .05 level. Hence eta^2 = .1118, which indicated a strong CUES effect on LC scores; eta^2, then, was different from zero (Nie et al., 1975).

The simple-correlation coefficient between CUES and listening comprehension (LC) scores (r = .1386) indicated a low and positive correlation in the sample, which was not statistically significant at the alpha = .05 level (p = .062). Table 24 shows the main statistical characteristics of the subjects in this group.

Table 24.--Summary statistics for LC scores: Hypothesis 3.IIb.

Variable	N	Sum	Mean	Variance	Std. Dev.	SS^2
No cues	32	679	21.2188	19.9183	4.4630	617.4688
Cues	33	786	23.8182	7.9659	2.8224	254.9091
SS total	65	1,465	22.5385	15.3462	3.9174	982.1538

Table 25 shows the selected statistics obtained from the analysis of variance for LC scores.

Table 25.--ANOVA results for LC scores: Hypothesis 3.IIb.

Source	SS^2	df	MS	F	Signif.	eta^2
Between groups	109.7760	1	109.7760	7.9276	.0065	.1118
Within groups	872.3778	63	13.8473			
SS total	982.1538	64				

Results of ANOVA for VDL scores.

> Hypothesis 3.IIc: Students who receive CUES before a film is shown will perceive more information than those who receive NO CUES--VDL scores.

Hypothesis 3.IIc was supported. There was a statistically significant difference in VDL scores between the CUES and NO CUES groups in Action Region II at the alpha = .05 level (.0186). It may be inferred that, for Action Region II, being given CUES before showing a film did have a significant effect on students' visual discrimination learning (VDL) at the .05 level. Therefore, eta^2 = .0849 indicated some CUES effects on visual discrimination learning; hence eta^2 was different from zero (Nie et al., 1975).

The simple-correlation coefficient between CUES and visual discrimination learning (VDL) scores ($r = .0186$) indicated a low and positive correlation in the sample, which was not significant at the alpha = .05 level ($p = .419$). Table 26 contains the main statistical characteristics of the subjects in this group.

Table 26.--Summary statistics for VDL scores: Hypothesis 3.IIc.

Variable	N	Sum	Mean	Variance	Std. Dev.	SS^2
No cues	32	378	11.8125	4.6089	2.1468	142.8750
Cues	33	430	13.0303	3.6553	1.9119	116.9697
SS total	65	808	12.4308	4.4365	2.1063	283.9385

Table 27 shows the selected statistics obtained from the analysis of variance for VDL scores.

Table 27.--ANOVA results for VDL scores: Hypothesis 3.IIc.

Source	SS^2	df	MS	F	Signif.	eta^2
Between groups	23.0938	1	23.0938	5.8416	.0186	.0849
Within groups	259.8447	63	4.1245			
SS total	283.9385	64				

REAR REGION III

The critical value for Rear Region III with 1, 28 degrees of freedom was F = 4.20

Results of ANOVA for TOTAL (VDL+LC) scores.

> Hypothesis 3.IIIa: Students who receive CUES before a film is shown will perceive more information than those who receive NO CUES--TOTAL (VDL+LC) scores.

Hypothesis 3.IIIa was not supported. There was no statistically significant difference in TOTAL (VDL+LC) scores between the CUES and NO CUES groups in Rear Region III, at the alpha = .05 level (.839). It may be inferred that, for Rear Region III, being given CUES before showing a film did not have a significant effect on students' perception of information at the alpha = .05 level. However, eta^2 = .0015 indicated a very poor CUES effect on TOTAL (VDL+LC) scores; hence eta^2 was different from zero (Nie et al., 1975).

The simple-correlation coefficient between CUES and TOTAL (VDL+LC) scores (r = .1058) indicated a low and positive correlation in the sample, which was not significant at the alpha = .05 level (p = .121). Table 28 shows the main statistical characteristics of the subjects of this group.

Table 28.--Summary statistics for TOTAL (VDL+LC) scores: Hypothesis 3.IIIa.

Variable	N	Sum	Mean	Variance	Std. Dev.	SS^2
No cues	17	620	36.4706	21.6397	4.6518	346.2353
Cues	13	469	36.0769	35.0769	5.9226	420.9231
SS total	30	1,089	36.3000	26.4931	5.1471	768.3000

Table 29 shows selected statistics obtained from the analysis of variance for TOTAL (VDL+LC) scores.

Table 29.--ANOVA results for TOTAL (VDL+LC) scores: Hypothesis 3.IIIa.

Source	SS^2	df	MS	F	Signif.	eta^2
Between groups	1.1416	1	1.416	.0417	.8397	.0015
Within groups	767.1584	28	27.3985			
SS total	768.3000	29				

<u>Results of ANOVA for LC scores</u>.

Hypothesis 3.IIIb: Students who receive CUES before a film is shown will perceive more information than those who receive NO CUES--LC scores.

Hypothesis 3.IIIb was not supported. There was no statistically significant difference in listening comprehension (LC) scores between the CUES and NO CUES groups in Rear Region III at the alpha = .05 level (.683). It may be inferred that, for Rear Region III, being given CUES before showing a film did not have a significant effect on students' LC scores at the .05 level. However, eta^2 = .006 indicated a very poor CUES effect on listening comprehension; hence eta^2 was different from zero (Nie et al., 1975).

The simple-correlation coefficient between CUES and listening comprehension (LC) scores (r = .1386) indicated a low and positive correlation in the sample, which was not significant at the alpha = .05

level (p = .062). Table 30 contains the main statistical characteristics of the subjects in this group.

Table 30.--Summary statistics for LC scores: Hypothesis 3.IIIb.

Variable	N	Sum	Mean	Variance	Std. Dev.	SS^2
No cues	17	391	23.0000	12.3750	3.5178	198.0000
Cues	13	306	23.5385	12.7692	3.5734	153.2308
SS total	30	697	23.2333	12.1851	3.4907	353.3667

Table 31 shows selected statistics obtained from the analysis of variance for LC scores.

Table 31.--ANOVA results for LC scores: Hypothesis 3.IIIb.

Source	SS^2	df	MS	F	Signif.	eta^2
Between groups	2.1359	1	2.1359	.1703	.683	.006
Within groups	351.2308	28	12.5440			
SS total	353.3667	29				

Results of ANOVA for VDL scores.

Hypothesis 3.IIIc: Students who receive CUES before a film is shown will perceive more information than those who receive NO CUES--VDL scores.

Hypothesis 3.IIIc was not supported. There was no statistically significant difference in VDL scores between the CUES and NO CUES groups in Rear Region III at the alpha = .05 level. It may be inferred that, for Rear Region III, being given CUES before showing a film did not have a significant effect on students' visual discrimination learning (VDL) at the alpha = .05 level. However, eta^2 = .0411 indicated some CUES effects on visual discrimination learning scores; hence eta^2 was different from zero (Nie et al., 1975).

The simple-correlation coefficient between CUES and VDL scores (r = .0186) indicated a low and positive correlation in this sample, which was not significant at alpha = .05 (p = .419). Table 32 shows the main characteristics of the subjects in this group.

Table 32.--Summary statistics for VDL scores: Hypothesis 3.IIIc.

Variable	N	Sum	Mean	Variance	Std. Dev.	SS^2
No cues	17	229	13.4706	3.2647	1.8068	52.2353
Cues	13	163	12.5385	8.1026	2.8465	97.2308
SS total	30	392	13.0667	5.3747	2.3183	155.8667

Table 33 shows selected statistics obtained from the analysis of variance for VDL scores.

Table 33.--ANOVA results for VDL scores: Hypothesis 3.IIIc.

Source	SS^2	df	MS	F	Signif.	eta^2
Between groups	6.4006	1	6.4006	1.199	.2828	.0411
Within groups	149.4661	28	5.3381			
SS total	155.8667	29				

Hypothesis 3: Students who receive CUES before a film is shown will perceive more information than those who receive NO CUES.

The critical value for the sample with 2, 121 degrees of freedom was F ≃ 3.07.

Results of ANOVA for TOTAL (VDL+LC) scores. Hypothesis 3 was not supported in terms of TOTAL (VDL+LC) scores. There was no statistically significant difference in TOTAL (VDL+LC) scores between the CUES and NO CUES groups in the sample as a whole, at the alpha = .05 level. It may be inferred that, for the total sample, being given CUES before showing a film did not have a significant effect (alpha = .05 level) on students' perception of information, in terms of visual discrimination learning and listening comprehension (F = 1.136; F prob. = .3244).

The simple-correlation coefficient between CUES and TOTAL (VDL+LC) scores (r = .1058) indicated a low and positive correlation in the sample, which was not significant at the alpha = .05 level (p = .121). Table 34 shows the main characteristics of the subjects in this group.

Table 34.--Summary statistics for TOTAL (VDL+LC) scores: Hypothesis 3.

Group	N	Mean	Std. Dev.	Std. Error
Region I	29	36.5517	5.7730	1.0720
Region II	65	34.9692	5.3501	.6636
Region III	30	36.3000	5.1471	.9397
Total	124	35.6613		

Table 35 shows selected statistics obtained from the analysis of variance for TOTAL (VDL+LC) scores.

Table 35.--ANOVA results for TOTAL (VDL+LC) scores: Hypothesis 3.

Source	²SS	df	MS	F	F Prob.
Between groups	66.3633	2	33.1817	1.136	.3244
Within groups	3533.4109	121	29.2017		
Total	3599.7742	123			

<u>Results of ANOVA for LC scores</u>. Hypothesis 3 was not supported in terms of LC scores. There was no statistically significant difference in LC scores between the CUES and NO CUES groups in the sample as a whole at the alpha = .05 level. It may be inferred that, for the entire sample, being given CUES before showing a film did not have a significant effect on students' listening comprehension at the .05 level (F = 2.044; F Prob. = .1340).

The simple-correlation coefficient between CUES and LC scores (r = .1386) indicated a low and positive correlation in the sample, which was not significant at the alpha = .05 level (p = .062). Table 36 shows the main characteristics of the subjects in this group.

Table 37 shows selected statistics obtained from the analysis of variance for LC scores.

Table 36.--Summary statistics for LC scores: Hypothesis 3.

Group	N	Mean	Std. Dev.	Std. Error
Region I	29	24.2414	3.8047	.7065
Region II	65	22.5385	3.9174	.4859
Region III	30	23.2333	3.4907	.6373
Total	124	23.1048		

Table 37.--ANOVA results for LC scores: Hypothesis 3.

Source	SS^2	df	MS	F	F Prob.
Between groups	58.8062	2	29.4031	2.044	.1340
Within groups	1740.8309	121	14.3870		
Total	1799.6371	123			

<u>Results of ANOVA for VDL scores</u>. Hypothesis 3 was not supported in terms of VDL scores. There was no statistically significant difference in VDL scores between the CUES and NO CUES groups in the sample as a whole, at the alpha = .05 level. It may be inferred that, for this sample, being given CUES before showing a film did not have a significant effect on students' visual discrimination learning at the .05 level (F = 1.020; F Prob. = .3635).

The simple-correlation coefficient between CUES and VDL scores (r = .0186) indicated a low and positive correlation in this sample, which was not significant at the alpha = .05 level (p = .419). Table 38 shows the main characteristics of the subjects in this group.

Table 38.--Summary statistics for VDL scores: Hypothesis 3.

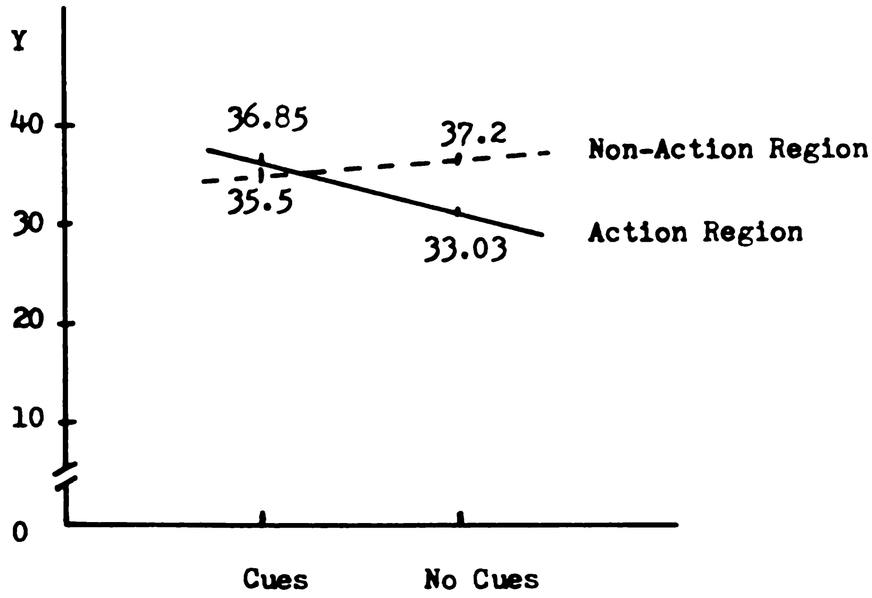
Group	N	Mean	Std. Dev.	Std. Error
Region I	29	12.3103	2.5926	.4814
Region II	65	12.4308	2.1063	.2613
Region III	30	13.0667	2.3183	.4233
Total	124	12.5565		

Table 39 shows selected statistics obtained from the analysis of variance for VDL scores.

Table 39.--ANOVA results for VDL scores: Hypothesis 3.

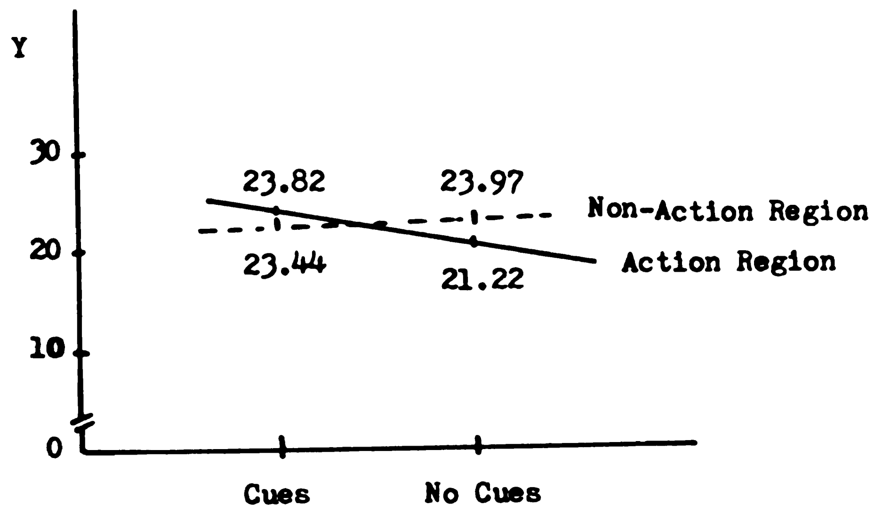
Source	SS	df	MS	F	F Prob.
Between groups	10.5928	2	5.2964	1.020	.3635
Within groups	628.0120	121	5.1902		
Total	638.6048	124			

To analyze the interaction effects of cues, pre-test, and courses taken in the human biology field by region, it was necessary to combine the Front I and Rear III Regions into the Nonaction Region; Action Region II was maintained in the analysis of variance. There was a statistically significant interaction for TOTAL (VDL+LC) scores between region and cues given to students before viewing a film, at the alpha = .05 level (.025). (See Graph 7.)



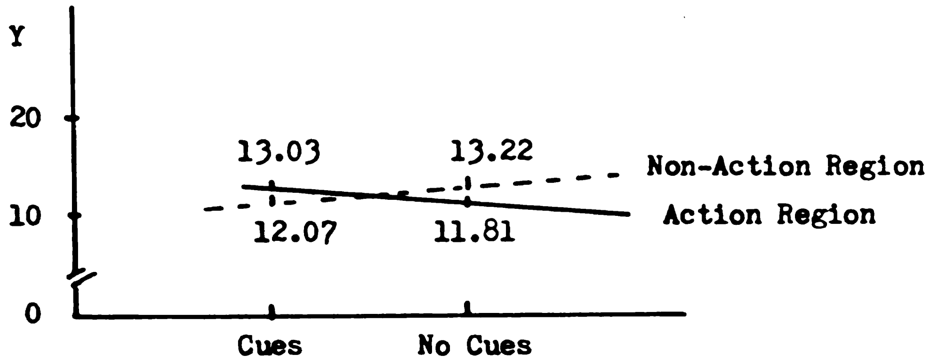
Graph 7.--TOTAL (VDL+LC) mean scores by CUES/region.

There was no significant interaction for LC scores between region and cues given to students before viewing a film, at the alpha = .05 level (.099). (See Graph 8.)



Graph 8. LC mean scores by CUES/region.

There was a statistically significant interaction for VDL scores between region and cues given to students before viewing a film, at the alpha = .05 level (.014). (See Graph 9.)



Graph 9.--VDL mean scores by CUES/region.

Discussion

Before discussing the results of the study, it is important to review some information on the physical format of Experimental Setting Two, in which the research was conducted. The room was about 37 feet by 55 feet, and it was considered to be a narrow classroom environment.

Hypothesis 1 predicted that students seated farther from the screen's central focus would perceive more information in terms of visual discrimination learning and listening comprehension than those who were seated close to the screen. From the results, it was concluded that seating DISTANCE from the screen's central focus did not have a statistically significant effect on students' perception of information for TOTAL (VDL+LC) scores, for LC scores, or for VDL scores at the .05 level of significance.

The graphs illustrating the linear regression equations suggested a positive correlation near zero for TOTAL (VDL+LC) scores and VDL scores and a negative correlation, also near zero, for LC scores.

The simple-correlation coefficient between DISTANCE and subjects' evaluation of seat distance (SELF-DISTANCE) ($r = .3442$) from the screen's central focus indicated a low and positive correlation, which was significant at the alpha = .05 level ($p = .001$). This finding seemed to indicate that students preferred seats farther from the screen's central focus in this narrow environment.

Hypothesis 2 predicted that students seated at a smaller angle from the screen's central focus would perceive less information in terms of visual discrimination learning and listening comprehension than would those whose seats were placed at a larger angle from the screen's central focus. From the results, it was concluded that seating ANGLE from the screen's central focus did not have a statistically significant effect on students' perceived information at the alpha = .05 level.

The graphs illustrating the linear regression equations suggested a tendency for a negative correlation for TOTAL (VDL+LC) and LC scores and a negative correlation near zero for the VDL scores.

The simple-correlation coefficient between ANGLE and CUES ($r = .0063$; $p = .475$) and subjects' evaluation of seat angle (SELF-LOCATION) ($r = .0339$; $p = .354$) indicated a low and positive correlation, which was not significant at the alpha = .05 level. This coefficient also seemed to indicate that the seat's angle (smaller or larger) from the screen's central focus did not affect students' perception of information, in terms of visual discrimination learning or listening comprehension, when viewing an instructional film in this narrow classroom environment.

The simple-correlation coefficient between ANGLE and SELF-DISTANCE ($r = -.0941$; $p = .149$), PRE-TEST ($r = -.0085$; $p = .463$), COURSES TAKEN ($r = -.0423$; $p = .321$), and LEFTSIDE ($r = -.1357$; $p = .066$) indicated a low and negative correlation, which was not significant at the alpha = .05 level.

Hypothesis 3 predicted that students who received cues before viewing an instructional film would perceive more information than those who received no cues. The results demonstrated that the hypothesis was supported only for Action Region II. In other words, cues did have a statistically significant effect on students' perception of information for TOTAL (VDL+LC), LC, and VDL scores, at the .05 level, as follows: .00330, .0186, and .0065, respectively. It was concluded that, for students in both front and rear regions, being given cues did not have a statistically significant effect on their perception of information--TOTAL (VDL+LC), LC, or VDL scores--at the .05 level of significance.

However, when Hypothesis 3 was tested for CUES and NO CUES for the whole group, it was found that the effect of cues on students' post-test performance was not significant at the alpha = .05 level. From the results, it was concluded that giving cues did not have a significant effect on students' total perceived information, visual discrimination learning, or listening comprehension.

The interaction effect was analyzed between region (Nonaction and Action) and cues given to students before they viewed a film in class. The results revealed that, for TOTAL (VDL+LC) and VDL scores, there was a significant interaction effect at the alpha = .05 level; no such interaction effect existed for LC scores.

Because of students' previous experience in human biology courses (See Table A-3, Appendix A), it seems that the treatment--being given CUES before viewing a film--did not have the expected effect on students' total perceived information--TOTAL (VDL+LC), visual discrimination learning (VDL), or listening comprehension (LC) on the performance test.

Summary

In this chapter the statistical findings of the study were presented and analyzed. Multiple-regression and analysis of variance techniques were used to analyze the data collected in the study. The .05 level of significance was established as the basis on which to accept or reject the hypotheses. The hypotheses were tested separately for TOTAL (VDL+LC) perception of information, for listening comprehension (LC), and for visual discrimination learning (VDL).

The results demonstrated that distance and angle predictors did not have a statistically significant effect on the dependent variables. However, for Action Region II in Hypothesis 3, giving cues before showing a film did have a statistically significant effect in each of the subhypotheses--that is, concerning TOTAL (VDL+LC), LC, and VDL scores. The inclusion of the predictors (see Table 6) in Hypotheses 1 and 2 did have a statistically significant effect for TOTAL (VDL+LC) and LC scores, but not for VDL scores.

A summary of the study, findings, conclusions, and recommendations are found in Chapter V.

CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The study was an investigation of the effects of seating distance and angle degree from the screen's central focus, and of cues given before showing an instructional film. The three dependent variables--perception of information (VDL+LC), listening comprehension (LC), and visual discrimination learning (VDL) were considered important factors in using a sound-motion instructional film in the classroom. No previous study attempting to relate distance, angle, and cues to students' perception of information presented by a film has been conducted in a classroom setting. Few studies on distance and angle have been done by using instructional television or on cues given by using instructional film. For this reason, the present researcher attempted to analyze the effects of students' seating distance, angle, and being given cues before viewing a film. It was postulated that some measurable effects of distance and angle from the screen's central focus might affect students' perception of information in terms of visual discrimination learning and listening comprehension.

The subjects were 124 college students enrolled in a family child ecology class at Michigan State University. All subjects responded to both instruments during a predetermined time for each test. The subjects were assured by the researcher that the information obtained would be strictly confidential. The Inventory Test was administered before showing the film; it was also used as a pretest. The Performance Test was divided into two parts (a multiple-choice test and open questions) and was administered after students viewed the film.

After the data were collected and tabulated, the results were analyzed by multiple regression and analysis of variance (ANOVA). The statistical analyses of the data revealed the following:

Hypothesis 1 was not supported. There were no statistically significant effects on perception of information, in terms of visual discrimination learning and listening comprehension, accounted for by distance, as indicated by the F-test.

Hypothesis 2 was not supported. There were no statistically significant effects on perception of information, in terms of visual discrimination learning and listening comprehension, accounted for by angle, as indicated by the F-test.

Hypothesis 3 was not supported for Front Region I or for Rear Region III. There were no statistically significant effects on perception of information, in terms of visual discrimination learning and listening comprehension, accounted for by cues given, as indicated by the F-test in ANOVA.

Hypothesis 3 was supported for Action Region II. There were statistically significant effects on perception of information, in terms of visual discrimination learning and listening comprehension, accounted for by cues given before viewing a film, as indicated by the F-test in ANOVA.

Hypothesis 3 was not supported for the whole group. There were no statistically significant effects on perception of information, in terms of visual discrimination learning and listening comprehension, accounted for by cues given before viewing a film, as indicated by the F-test in ANOVA.

Findings

1. College students' perception of information, in terms of visual discrimination learning and listening comprehension, was not significantly affected by their seating distance from the screen's central focus in front of the room.

2. College students' listening comprehension was not significantly affected by their seating distance from the screen's central focus in front of the room.

3. College students' visual discrimination learning was not significantly affected by their seating distance from the screen's central focus in front of the room.

4. College students' perception of information, in terms of visual discrimination learning and listening comprehension, was not significantly affected by their seat's angle from the screen's central focus in front of the room.

5. College students' listening comprehension was not significantly affected by their seat's angle from the screen's central focus in front of the room.

6. College students' visual discrimination learning was not significantly affected by their seat's angle from the screen's central focus in front of the room.

7. Front Region I and Rear Region III college students' perception of information, in terms of visual discrimination learning and listening comprehension, was not significantly affected by receiving cues before viewing a film.

8. Front Region I and Rear Region III college students' listening comprehension was not significantly affected by receiving cues before viewing a film.

9. Front Region I and Rear Region III college students' visual discrimination learning was not significantly affected by receiving cues before viewing a film.

10. Action Region II college students' perception of information, in terms of visual discrimination learning and listening comprehension, was significantly affected by receiving cues before viewing a film.

11. Action Region II college students' listening comprehension was significantly affected by receiving cues before viewing a film.

12. Action Region II college students' visual discrimination learning was significantly affected by receiving cues before viewing a film.

13. College students' perception of information, in terms of visual discrimination learning and listening comprehension, was not significantly affected by receiving cues before viewing a film.

14. Classroom region did matter when students received cues before viewing a film in the classroom.

Conclusions

Based on the findings of this study, the following conclusions were drawn:

1. Seating distance and seat's angle from the screen's central focus in front of a straight-row classroom arrangement in a narrow room did not produce statistically significant effects on students' perception, in terms of visual discrimination learning and listening comprehension.

2. Giving cues before viewing a film in a narrow classroom did produce statistically significant effects on Action Region II students' perception of information, in terms of visual discrimination learning and listening comprehension.

3. Giving cues before viewing a film in a narrow classroom setting did not produce statistically significant effects on Front Region I or Rear Region III students' perception of information, in terms of visual discrimination learning and listening comprehension.

4. Giving cues before viewing a film in a narrow classroom setting did not produce statistically significant effects on college students' perception of information, in terms of visual discrimination learning and listening comprehension.

Recommendations

In view of the findings of the present investigation, the following recommendations are made for future research:

1. In an effort to measure the effects of distance and angle of seats for viewing an instructional film and other types of audio-visual resources in a classroom, it is recommended that more concrete variables be used as indices of students' perception of information, in terms of visual discrimination learning and listening comprehension.

2. For maximum effect of distance and angle of seats in a straight-row classroom arrangement, it is recommended that wider and more square environmental settings be used, instead of narrow rooms.

3. For maximum effect in a straight-row classroom arrangement, identified by regions, it is recommended that more concrete variables be used as indices of students' perception of information, in terms of visual discrimination learning and listening comprehension.

4. For maximum effect of cues in a straight-row classroom arrangement, as a whole and/or identified by regions, it is recommended that more concrete variables be used as indices of students' perception of information, in terms of visual discrimination learning and listening comprehension.

5. Further research on perception of information should be undertaken in terms of visual discrimination learning and listening comprehension (which is affected by seat's distance and angle) and being given cues when using different audiovisual instructional resources in the classroom.

6. It is recommended that more sophisticated and better scales be developed to investigate distance, angle, and cue effects on students' perception of information, primarily in terms of visual discrimination learning in a classroom situation.

7. Further research should be conducted on students' evaluation of seating distance and seat's angle from the screen's central focus in front of the room, for viewing projected visuals.

APPENDICES

APPENDIX A

TABLES

Table A-1.--Systematic numerical order of the numbered seats randomly assigned previously.

Order #	Seat #	Order #	Seat #	Order #	Seat #	Order #	Seat #
001	001	026	056	051	028	076	086
002	100	027	039	052	073	077	038
003	018	028	062	053	005	078	063
004	083	029	027	054	096	079	012
005	019	030	074	055	029	080	089
006	082	031	016	056	072	081	048
007	034	032	085	057	022	082	053
008	067	033	047	058	079	083	006
009	035	034	054	059	010	084	095
010	066	035	007	060	091	085	033
011	050	036	094	061	037	086	068
012	051	037	025	062	064	087	026
013	002	038	076	063	023	088	075
014	099	039	013	064	078	089	014
015	049	040	088	065	041	090	087
016	052	041	031	066	060	091	021
017	003	042	070	067	036	092	080
018	098	043	046	068	065	093	024
019	017	044	055	069	004	094	077
020	084	045	008	070	097	095	042
021	009	046	093	071	030	096	059
022	092	047	032	072	071	097	040
023	043	048	069	073	011	098	061
024	058	049	020	074	090	099	044
025	045	050	081	075	015	100	057

Table A-2.--Demographic data frequency.

Variable	Pilot Study A	Pilot Study B_1	Pilot Study B_2	Experimental Exp.
Sample size	14	21	13	124
College Educational Level				
Mean score	3.357	4.286	5.000	2.573
Standard deviation	1.447	2.513	1.633	.894
Standard error	.387	.548	.453	.080
Frequencies				
Sophomore	...	....	....	57
Junior	1	...	...	50
Senior	11	1	1	12
MS/MA candidate	...	4	5	...
Ph.D. candidate	...	11	6	...
No information	2	5	1	4
Sex				
Mean score	1.214	1.571	1.615	1.016
Standard deviation	.426	.507	.506	.126
Standard error	.114	.111	.140	.011
Frequencies				
Female	11	9	5	122
Male	3	12	8	2
Ethnic Group				
Mean score	1.214	1.762	3.692	1.242
Standard deviation	.802	1.179	2.057	.810
Standard error	.214	.257	.570	.073
Frequencies				
Caucasian	13	14	3	108
Black	...	...	1	7
Spanish	...	6	3	4
Indian (native USA)	1	...	...	...
Oriental	...	1	2	4
Other (Middle East)	...	...	4	...
No information	...	...	...	1
Age				
Mean score	25.357	34.429	32.538	21.323
Standard deviation	6.640	6.547	5.125	5.092
Standard error	1.775	1.429	1.422	.457

Table A-2.--Continued.

Variable	Pilot Study A	Pilot Study B_1	Pilot Study B_2	Experimental Exp.
Age (cont'd.)				
Frequencies				
18-20	2	...	...	94
21-23	7	...	...	12
24-26	...	1	1	6
27-29	2	3	3	...
30-32	1	8	2	5
33-35	1	2	4	...
36-38	...	1	2	4
39-41	...	3	...	2
42-44	1	1	1	1
45-47	...	1	...	...
48-50	...	1	...	...
Physical Condition				
Vision				
Mean score	1.643	1.476	1.462	1.452
Standard deviation	.497	.512	.519	.500
Standard error	.133	.112	.144	.045
Frequencies				
Normal vision	5	11	7	68
Corrected vision	9	10	6	56
Hearing				
Mean score	1.071	1.000	1.000	1.000
Standard deviation	.267	0	0	0
Standard error	.071	0	0	0
Frequencies				
Normal hearing	13	21	13	124
Corrected hearing	1	...	...	...
Writing				
Mean score	2.000	1.905	1.923	1.895
Standard deviation	0	.301	.277	.308
Standard error	0	.066	.077	.028
Frequencies				
Left-handed	...	2	1	13
Right-handed	14	19	12	111

Table A-3.--Score distribution on pretest.

Variable	Pilot Study			Experimental
	A	B_1	B_2	Exp.
Sample size	14	21	13	124
Background in Human Biology				
Courses taken in H.B.				
Mean score	1.000	1.381	.615	2.427
Standard deviation	1.177	1.564	1.193	1.308
Standard error	.314	.341	.331	.117
Frequencies				
Didn't take any course	7	10	9	6
One course	2	2	2	31
Two courses	3	3	1	31
Three courses	2	3	...	17
Four or more courses	...	3	1	38
Human biology terminology				
Mean score	5.143	5.857	4.000	8.331
Standard deviation	2.316	2.651	3.697	2.556
Standard error	.619	.579	1.025	.230
Frequencies				
One	...	1	1	...
Two	2	...	...	1
Three	...	2	1	3
Four	5	2	2	13
Five	2	1	...	7
Six	2	5	1	6
Seven	1	4	1	12
Eight	...	2	1	9
Nine	1	1	1	21
Ten	1	2	1	18
Eleven	...	...	...	34

Table A-4.--Students' reasons for personal seating preferences.

Variable	Pilot Study												Scores of Experimental Group			
	Scores of Group A				Scores of Group B_1				Scores of Group B_2							
	0	1	2	Mean	0	1	2	Mean	0	1	2	Mean	0	1	2	Mean
Academic Reasons																
Have no interest in the content	10	3	1	.357	20	0	1	.095	10	1	2	.385	101	19	4	.219
Have interest in subject matter	2	5	7	1.357	8	4	9	1.048	3	4	6	1.231	21	22	81	1.484
Like to participate in classroom	3	5	6	1.214	6	8	7	1.048	3	7	3	1.000	39	61	24	.879
Don't like to speak in class	8	6	0	.429	13	5	3	.524	5	6	2	.769	64	45	15	.605
Physical Condition																
Auditory defects	11	1	2	.357	14	5	2	.429	8	3	2	.538	97	16	11	.306
Visual problems	9			.643	17	2	2	.286	8	2	3	.615	73	32	19	.565
Can see and hear better	2	3	9	1.500	6	1	14	1.381	1	4	8	1.538	14	20	90	1.613
Seat Location in the Room																
Like to be by the door	9	5	0	.357	18	1	2	.238	8	5	0	.385	88	30	6	.339
Like to be by the window	7	5	2	.643	17	4	0	.190	11	2	0	.154	78	33	13	.463
No special reason; just like that seat	8	3	3	.643	10	6	5	.762	7	5	1	.538	53	38	33	.839
Like that seat's position in class	3	1	10	1.500	8	7	6	.905	4	6	3	.923	28	24	72	1.355
Personal Space																
Eye contact with instructor	3	2	9	1.429	8	7	6	.905	6	3	4	.846	42	21	61	1.153
To receive professor's attention	4	5	5	1.071	10	8	3	.667	7	4	2	.615	51	40	33	.855
Like to be alone	12	2	0	.143	17	4	0	.190	11	2	0	.154	88	28	8	.355
To interact with others	2	6	6	1.286	12	6	3	.571	5	4	4	.923	38	53	33	.960
Feel anxiety in middle of the room	10	4	0	.286	18	2	1	.190	10	2	1	.308	97	18	9	.290
Afraid of being called by instructor	8	6	0	.429	18	2	1	.190	12	0	1	.154	88	33	3	.315
Avoiding noisy and inattentive person	3	7	4	1.071	9	7	5	.810	8	3	2	.538	72	38	14	.532
Keeping distance from instructor	7	5	2	.643	14	3	4	.524	8	3	2	.538	72	38	14	.532
Sample size	14				21				13				124			

Table A-5.--Means and standard deviations of variables used in this study.

Variable	Mean	S.D.
TOTAL (VDL + LC)[a]	35.6613	5.4098
VDL[b]	12.5565	2.2786
LC[c]	23.1048	3.8251
Angle	66.2097	16.4071
Cues (No Cues)	.4839	.5018
Pretest	8.3306	2.5558
Self-location	.5806	.4955
Normal Vision	.5484	.4997
Left Side	.5161	.5018
Right Side	.4839	.5018
Courses Taken	.4435	.4988
Distance	25.2661	9.9332
Self-distance	.6613	.4752

[a]Perception of information (VDL + LC).

[b]Visual discrimination learning.

[c]Listening comprehension.

Table A-6.--Frequency distribution of seating distance from the screen's central focus.

Code	Absolute Frequency	Relative Frequency (%)	Adjusted Frequency (%)	Cumulative Frequency (%)
5	1	.8	.8	.8
7	2	1.6	1.6	2.4
8	3	2.4	2.4	4.8
10	3	2.4	2.4	7.3
12	5	4.0	4.0	11.3
13	4	3.2	3.2	14.5
15	5	4.0	4.0	18.5
17	9	7.3	7.3	25.8
18	7	5.6	5.6	31.5
20	9	7.3	7.3	38.7
22	4	3.2	3.2	41.9
23	8	6.5	6.5	48.4
25	6	4.8	4.8	53.2
27	5	4.0	4.0	57.3
28	6	4.8	4.8	62.1
30	6	4.8	4.8	66.9
32	7	5.6	5.6	72.6
33	3	2.4	2.4	75.0
35	8	6.5	6.5	81.5
37	6	4.8	4.8	86.3
38	5	4.0	4.0	90.3
40	6	4.8	4.8	95.2
42	4	3.2	3.2	98.4
43	2	1.6	1.6	100.0
Total	124	100.0	100.0	

Table A-7.--Frequency distribution of seat's angle from the screen's central focus in the experimental setting.

Code	Absolute Frequency	Relative Frequency (%)	Adjusted Frequency (%)	Cumulative Frequency (%)
19	1	.8	.8	.8
22	1	.8	.8	1.6
27	1	.8	.8	2.4
30	1	.8	.8	3.2
32	1	.8	.8	4.0
33	1	.8	.8	4.8
34	1	.8	.8	5.6
37	3	2.4	2.4	8.1
40	1	.8	.8	8.9
41	1	.8	.8	9.7
42	1	.8	.8	10.5
43	1	.8	.8	11.3
44	1	.8	.8	12.1
45	3	2.4	2.4	14.5
47	1	.8	.8	15.3
49	1	.8	.8	16.1
50	1	.8	.8	16.9
51	2	1.6	1.6	18.5
52	1	.8	.8	19.4
53	2	1.6	1.6	21.0
54	1	.8	.8	21.8
55	4	3.2	3.2	25.0
56	2	1.6	1.6	26.6
59	3	2.4	2.4	29.0
60	2	1.6	1.6	30.6
61	3	2.4	2.4	33.1
62	2	1.6	1.6	34.7
63	2	1.6	1.6	36.3

Table A-7.--Continued.

Code	Absolute Frequency	Relative Frequency (%)	Adjusted Frequency (%)	Cumulative Frequency (%)
64	3	2.4	2.4	38.7
65	3	2.4	2.4	41.1
66	3	2.4	2.4	43.5
67	5	4.0	4.0	47.6
68	2	1.6	1.6	49.2
69	2	1.6	1.6	50.8
70	4	3.2	3.2	54.0
71	4	3.2	3.2	57.3
72	1	.8	.8	58.1
73	5	4.0	4.0	62.1
74	3	2.4	2.4	64.5
75	3	2.4	2.4	66.9
76	2	1.6	1.6	68.5
77	3	2.4	2.4	71.0
78	2	1.6	1.6	72.6
79	4	3.2	3.2	75.8
80	3	2.4	2.4	78.2
81	3	2.4	2.4	80.6
82	2	1.6	1.6	82.3
83	4	3.2	3.2	85.5
84	3	2.4	2.4	87.9
85	2	1.6	1.6	89.5
86	5	4.0	4.0	93.5
87	1	.8	.8	94.4
88	3	2.4	2.4	96.8
89	4	3.2	3.2	100.0
Total	124	100.0	100.0	

APPENDIX B

SCRIPTS

Script B-2: MUSCLE

Narrator

We take the simple process of writing pretty much for granted. In fact, it's not simple at all. This very precise action requires the intricate coordination of thousands upon thousands of separate muscular movements involving some dozens of muscles, millions of the specialized cells that compose them, and billions of the molecules that function within and around the cells. The unique processes of muscular movement have intrigued man for centuries.

With our advancing technology, we are beginning to understand and simulate man's muscle systems in the laboratory.

Technician

The remote manipulator is an electro-mechanical device used to simulate the human hand, wrist, and arm without an elbow joint. The speed of the remote manipulator is limited in various ways, primarily in that you can make one motion at a time and that very deliberately, whereas the human hand does many motions at one time and does them mechanically. You first have to realize that we are only simulating the thumb and forefinger and that primary limitation in the remote manipulator is that it does not have any sense of feeling. You lose that sense and you have to compensate by using your vision.

It's a remarkable machine--it will do remarkable things, but the wonderful complication of the human arm is something we just can't replace.

Narrator

Man, like other animals, lacks the ability to manufacture his own food. He must depend upon the environment to get his nourishment. Man not only moves through the environment for his food, he also controls his muscles to move objects and to shape the environment to fit his needs. The primary tissues of the body that are responsible for movement are muscles. Muscles are groupings of specialized cells that act in response to a stimulus. Muscular movement is always generated by a contraction, a shortening and thickening. No one type of muscle can by itself supply the movement we need to function adequately. The variety is made possible by the over 600 different muscles in our bodies in combination. In the human body, as well as other vertebrates, there are three different types of muscles: the first is striated muscle which gives us the movement whereby we protect ourselves, reproduce and move through the environment to gather food. The second type is smooth muscle. While it also plays a role in reproduction, the greater part of its activity is involved with the mechanics of digesting food. Cardiac muscle, the third type, found only in the heart, pumps blood to all parts of the body. In so doing, it supplies the other two muscular systems, the rest of the body, and itself with the oxygen needed for the production of energy and the removal of waste substances.

Smooth muscle makes up most of the digestive tract, the swallowing mechanism, the esophagus, the stomach, intestines, the bladder, arteries, veins, and the uterus in women. Smooth muscles are involuntary, meaning that we normally don't consciously control them. It is fortunate that they are involuntary. If they weren't, for instance, digesting our food would probably require our full and undivided attention.

The smooth muscles are controlled by the autonomic nervous system. Nerve impulses originate in the control centers of the brain or spinal cord, travel down the motor nerve cells to end where the impulses stimulate or enervate muscle. The smooth muscles receive two different kinds of impulses, one that stimulates the muscles to contract and a second that relaxes them. Smooth muscles characteristically contract slowly.

Cardiac muscle combines characteristics of both smooth and striated muscles. Outwardly the cells of cardiac muscle look much like striated muscle cells but as with smooth muscle, their contraction is involuntary. The cardiac muscle has a unique characteristic. Unlike either smooth or striated muscle, it does not need to be externally innervated by the nervous system to act. It has a self-contained or myogenic origin of contraction. The nerves that innervate the heart do not initiate contraction, they only modify it.

The beat of the heart originates in a specialized area of muscle cells called the pacemaker. Its pace is transmitted by electrical couplings to adjacent cells causing them to contract.

Cardiac cells contract rhythmically. If a single cell is isolated, it will beat or contact by itself. The contact of the two cardiac cells together gives rise to a coupling, with the fastest cell governing the rate of both.

From the first contraction of the heart in the human embryo, it steadily and automatically contracts more than once per second or over one hundred thousand times a day, every day throughout life.

The rate of the heartbeat correlates directly with the activity of the body. The blood vessels in the active muscles of the area expending the energy dilate during activity. In some way, the activity of the muscles causes the heart to contract more rapidly and pump more blood carrying oxygen through the enlarged blood vessels, as well as to the rest of the system.

Unlike striated muscles, cardiac muscles don't fatigue with prolonged high rates of contraction. There is enough time between contractions to allow the cells to eliminate wastes and be resupplied with oxygen.

The different muscle systems are highly coordinated. For example, if you run immediately after eating, the nervous system will divert the bulk of the oxygen-carrying blood from the smooth muscles of the digestive system to the higher priority demands of the striated muscles to supply oxygen for fast action. This re-directing of our energies leaves the food undigested in the stomach causing painful cramps.

Most muscles in the body are fast-acting striated muscles. These are also referred to as skeletal because they are the muscles that move the skeleton.

Tendons attach both ends of the striated muscles to the skeleton. One end of the muscle may be attached at two points--these muscles are bi-headed.

Many muscles must act together to perform seemingly simple movements. When the biceps contract, the elbow tends to flex, the triceps relax, the forearm rotates into a palm upward position and the upper arm rises away from the side of the chest. When the triceps contract and the biceps relax, the arm moves down.

It is the nervous system's high degree of control of a single muscle's contraction coordinated with its control of other muscles that allows us our great variety of movement.

The biceps and the triceps in the arm act in opposition. When the biceps contract, the triceps relax and vice versa. This arrangement is antagonistic. Most striated muscles are arranged in antagonistic pairs like this.

Muscle only produces force by shortening during contraction. As different muscles contract, their combined individual shortening or pulling movements cause the limbs to move. Muscles only pull in their movement, but can combine their contractions to allow a pushing force.

There are two kinds of pulling actions. In isometric contraction, muscles develop tension and exert a force without changing their overall length. In isotonic contractions, muscles do change their length, shorten, and exert a constant force. A person who develops his muscles by exercising does not increase the number of his muscle cells, he only enlarges the size of existing cells.

Striated muscles act in highly coordinated ways as when the jaw, tongue, larynx and lips combine their movements to produce sound in the form of speech.

Some striated muscles like those of our eyes do not move bone. The muscles of our eyelids facilitate the spreading of lubricants across the surface of the eye to keep it from drying out.

These movements are voluntary, but the same muscles also move involuntarily, such as when they protect the eye from foreign objects.

The muscles surrounding the ear are apparently vestigial. Once they were more than likely used for directing the ear towards sound, much like the ear muscles of the present-day dog or horse.

Our facial muscles allow us a great repertoire of movement. We use the many tiny striated muscles in our face to express emotion. Think of us without this ability. It would be difficult to communicate feelings and express ourselves. We wouldn't be able to do simple things like smile.

The striated muscles of the arm are made up of millions upon millions of individual muscle cells. The contraction of the muscle represents the contraction of each of its component cells. It begins when a nerve impulse from the spinal cord or brain, travelling at one hundred to three hundred feet per second, moves down the nerve fiber to the threshold of the cell. There it initiates a complex sequence of changes in the chemical and molecular properties of the cell.

The nerve fiber ending is separated from the muscle cell by a small space known as the neuro-muscular junction. Though what happens here is not completely understood, it appears that the nerve impulse reaches the end of the fiber and brings about the release of a chemical called transmitter substance. This transmitter substance travels across the junction to receiving areas on the membrane of the cell called receptor sites.

The interaction of the transmitter substance on the receptor sites brings about changes in the membrane's selective permeability.

The membrane, which up until now has kept some ions out and allowed others through and into the cell, changes--allowing sodium ions, that have been kept out, to enter.

Before the sodium passes through the membrane, the cell is negatively charged on the inside in relation to the outside. This relative difference is the cell's membrane potential. The sodium, which is positively charged, changes the membrane potential as it flows into the cell, thus increasing the positive charge inside the cell.

Positively charged potassium, which has been kept in the cell, starts to flow out, beginning to restore the cell's original potential, but cannot do so as so much sodium is flowing in. A mechanism not yet understood stops the sodium from flowing in and the outflowing potassium restores most of the cell's original potential. But some sodium remains in the cell. This is removed by a mechanism known as the sodium pump, which activates and pumps the sodium back out of the cell, finally restoring the cell's original membrane potential.

The momentary change in the cell's potential communicates the impulse from the neuro-muscular junction, along the membrane, down the tubules, to the sarcomplasmic reticulum inside the cell where calcium is stored.

At this point calcium is released. When released, calcium is thought to inhibit the actions of two proteins in the cell, tropomyosin and troponin. This inhibiting effect allows two protein chains, or myofilaments, actin and myosin, to interact. The interaction, or sliding movement, of the actin and myosin molecules past each other is the contractile mechanism of the striated muscle cell. It is here at the molecular level that the actual movement of contraction begins. Research to date indicates that myosin has lateral projections, or cross bridges, which attach to receptor sites on the actin. It is the calcium's inhibition of tropomyosin and troponin which frees the receptor sites to interact.

When the myosin attaches to the actin, a high energy molecule, ATP, is broken down, or split, and energy is released. It is speculated that the energy released by the splitting of the ATP molecule produces the force that lengthens the myosin cross bridges that move the actin.

Energy is used in lesser amounts when the actin/myosin bond is broken. The myosin molecules then shorten and reattach themselves to a new receptor site and repeat the process.

The muscle relaxes when the membrane's original potential is restored and calcium is re-absorbed.

The whole process, from the nerve impulse's arrival at the neuromuscular junction to the sliding of the filaments takes approximately 1/40th of a second. A single movement of one of the cross-bridges has a relatively insignificant effect on the movement of the whole muscle.

But each impulse from the nervous system produces a number of movements of the cross-bridges. And when you consider further that there are about 500 myosin and 900 actin myofilaments in a sarcomere, and 5,000 sarcomeres in a myofibril, and that in a muscle cell or fiber one centimeter long and ten thousandth of a centimeter in diameter there are 8,000 myofibrils, that means that in a single muscle cell there is a total of 56 billion myofilaments.

The single unit of contraction is called a motor unit. It is made up of the motor nerve and the muscle fibers it innervates. It is the number of motor units activated that determines the strength of movement.

It is only when we realize that all of these molecular interactions within one cell make up a single contraction that we can understand how remarkable the contraction process really is. As man has increased the body of knowledge concerning the workings of muscles, it has become possible to introduce sophisticated methods of analysis and treatment of diseases involving the muscle systems. Research is currently underway at the University of Colorado which demonstrates that people can be trained to control muscles to relieve such disorders as muscle tension headaches.

<u>Doctor #1</u>

Tension headaches, also known as muscle contraction headaches, are perhaps the commonest, or psychosomatic or stress related disorder. We expect there are probably several million people around with tension headaches. Its cause, at least its immediate cause, is rather clear, rather straightforward. It's caused by sustained contraction of the muscles in the head and neck. Our objective was to take people suffering from tension headache and train them to relax the muscles involved. The way we did this was to use the EMG, or electrode miographic feedback.

Doctor #2

The EMG is the electro myogram and it is the electrical signal generated by muscle tissues, specifically the bio potentials which are generated by the cell membranes as they depolarize when energized by the motor neuron. And, of course, as the motor neuron energizes the muscle thousands of cell membranes depolarize simultaneously and these bio-electric signals are more or less summated and can be picked up on the surface of the skin by surface electrodes. And we amplify these tiny bio-electric signals on the surface.

Doctor #1

The patient would come into the laboratory, he would lie down on the cot, we would fasten electrodes to his forehead, then he would receive feedback of what his forehead, or frontels muscle was doing.

Doctor #2

There are two types of auditory displays and we use one type of visual display. We can use them in combination or separately. As far as the electrode displays are concerned, there is a tone which varies in frequency. When the person's attention level is high, the tone is at a high pitch. As he begins to lower his attention, the tone tracks it down, it lowers its pitch, or frequency. The other type of auditory feedback is kind of a geiger counter sound, a click type sound, the higher the muscle tension, the faster the click rate is. As people relax the click rate becomes slower and slower.

Doctor #1

We also have a visual feedback display and in this case the subject sees a panel in front of him and when the subject is rather tense and the particular muscle he will see a red spot of light on that visual indicator, when he is beginning to relax he will see an amber color, and as he becomes quite relaxed he will see green on the visual indicator.

Narrator

Muscle feedback therapy involves the electronic detection and translation into audio-visual signals of great numbers of momentary changes in the effective muscle cells' membrane potentials. The microsecond of depolarization represents one in an intricate series of almost simultaneous biochemical steps whereby a nerve impulse from the central nervous system ultimately initiates the sliding past each other of billions of the active myofilaments actin and myocin within each cell, drawing its perimeters inward. The resulting shortening and thickening of the cell is in the aggregate the seemingly simple act of muscular contraction.

Script B-1: SCRIPT FOR THE PRE-RECORDED INSTRUCTIONS

Time	Description
4 min 35 sec	Overture music--"Warsaw Concerto"--The Best of the Classics--Liberace. (The experimenter will check the subject's envelope to white-card seat's number, according to the floor plan.)
1 min 40 sec	You have received the sealed envelope which contains the two instruments to be used in this experiment. Both instruments are also sealed. The Inventory Test is printed on colored paper and its seal is yellow. The Performance Test is on white paper, and its seal is red. The Inventory Test was designed to elicit a limited amount of demographic data important to the experiment. The personal information being asked will be kept confidential, but do not sign your name on the test. While you are completing the Inventory Test, you will hear very soft music. When the period of 15 minutes is over, you will hear instructions to stop writing the Inventory Test and to put it back in the envelope. Then, you will receive instructions concerning the second instrument, the Performance Test. Please do not talk to each other or ask questions during the entire period of the experiment. Now you can break the blue seal to open the envelope and to pick only, I repeat, only the colored test. Keep the envelope in your lap. You will have one minute to read the instructions on the Inventory Test. I will tell you when to break the yellow seal of this test.
1 min	(Let tape run for one minute--no music background.)
8 sec	You will have 15 minutes to complete this test. Now you can break the yellow seal of the Inventory Test.
15 sec	Music background--Miniatures for Guitar (Side One)--Liona Boyd. <u>Spanish Romance</u> (traditional). <u>Adelita</u> (Francisco Tarrega). <u>Cajita de Jusica</u> (Francisco

Tarrega). Lagrima (Gramcisco Tarrega). Andantino (Mateo Carcassi). Andante (Fernando Sor)--Estudio #2 (Fernando Sor). Pavana (Francisco Tarrega).

2 min The time is over. Put the colored test back in the envelope and pick the white test. First, you will see the film. Then, I will tell you when to break the red seal of this test.

The Performance Test is divided into two parts. You are expected to complete the first part in 15 minutes, and the second one in 20 minutes. I will tell you when the time for each part is over. Once you have finished both parts of the test, please put it back in the envelope.

Give the envelope to the experimenter, who will be at the desk at the "exit" of this room. She will check both instruments inside the envelope. Because of this, you are expected to approach the desk one by one.

You will have three minutes to read the instructions on the Performance Test. Do not take any notes.

3 min Music background: Miniature for Guitar--Lyona Boyd. Greensleeves (Traditional).

(Turn off the lights of the room and project the film MUSCLE.)

30 min (Projection of the film MUSCLE.)

(Turn on the lights of the room.)

8 sec Now you can break the red seal of the Performance Test. You will have 15 minutes to complete the first part of the test. I will tell you when the time is over.

15 min Music background: Miniature for Guitar (Side Two)--Liona Boyd. Little Suite (a) Balletto, (b) Policenello, (c) Minuetto, (d) Sarabanda, (e) Gavoette (A. Logy). Gavotte (L. Roncalli). Pavana (L. Milan). Prelude and Gigue (Robert de Visee). Estudio #17 (D. Aguado). Estudio in E (Francisco Tarrega).

8 sec The time is over. You are expected to complete the second part of this test in 20 minutes. I will tell you when the time is over.

20 min	Music background: Miniature for Guitar (Side One)--Liona Boyd. Spanish Romance (traditional). Adelita (Francisco Tarrega). Cajita de Musica (Francisco Tarrega). Lagrima (Grancisco Tarrega). Andantino (Mateo Carcassi). Andante (Fernando Sor). Estudio #2 (Fernando Sor). Pavana (Francisco Tarrega). Andante (Francisco Tarrega). Lento (Francisco Tarrega). El Noy de la Mare. Greensleeves (Traditional).
10 sec	The time is over. Put the Performance Test back in the envelope. You are expected to approach the desk one by one. The envelope must be checked by the experimenter to see if both instruments are inside of it. Please return also the pencil. Then you may leave the room. Thank you for participating in this experiment.
4 min 18 sec	Closure music--"Tchaikovsky Piano Concerto #1"--The Best of the Classics--Liberace.

NOTE: The real time of the experiment is one hour, 37 minutes and 7 seconds (about one hour and 30 minutes).

APPENDIX C

RESEARCH INSTRUMENTS

SEAT__________ROW________

THE INVENTORY TEST

Directions: You will have one minute to read the following instructions. You will also be told when to break the seal of this instrument.

This test was designed to elicit a limited amount of demographic data important to the experiment. The personal information being asked will be kept confidential.

While you are completing this TEST, you will hear soft music. When the period of FIFTEEN minutes to complete this INVENTORY TEST is over, you will HEAR INSTRUCTIONS to stop writing and to put this Test back into the envelope. Then you will receive instructions concerning the second instrument.

Please DO NOT TALK to each other or ask questions during the entire period of the experiment.

I. V. de Camargo
Ph.D. Candidate
Summer '84 MSU

PLEASE AWAIT INSTRUCTOR'S PRE-RECORDED DIRECTIONS
BEFORE BREAKING THE YELLOW SEAL OF THIS INSTRUMENT.

THE INVENTORY TEST

Dear Participant in this Experiment,

We assure you that all the personal information given in this instrument will be kept confidential.

Irfe V. de Camargo
Experimenter
Summer '84 MSU

DIRECTIONS: Read carefully the items below and fill out the information required which best describes your present situation. You will have FIFTEEN minutes to complete it.

01. Write an X in front of the term that describes your college educational level by the end of this Summer term.

( ) a. Freshman
( ) b. Sophomore
( ) c. Junior
( ) d. Senior
( ) e. MS candidate
( ) f. PhD candidate
( ) g. Ed Specialist
(X) h. PhD candidate*

*Example

01-A. Term first enrolled at MSU________ (term) of 19____.

01-B. Including Summer '84, I have completed _____ (number of) terms.

01-C. My graduation is estimated for the _____ (term) of 19___.

02. I am ________ years old.

03. Sex:

( ) a. female
( ) b. male

04. Race and/or ethnic origin:

( ) a. Caucasian
( ) b. Black
( ) c. Spanish
( ) d. Indian (native)
( ) e. Oriental
( ) f. Other (specify) ____________________________

04-A. Nationality (country name) __________________________

05. I am _______ feet tall.

06. I have

( ) a. normal vision of:

( ) 1. 20x20
( ) 2. 20x40
( ) 3. 20x60
( ) 4. 20x80
( ) 5. I don't know (don't use glasses or contact lenses)

( ) b. corrected vision (using glasses and/or contact lenses)

07. I have

( ) a. normal hearing
( ) b. corrected hearing (using hearing devices)

08. I write

( ) a. left-handed
( ) b. right-handed
( ) c. with both hands

09. Have you ever taken any Human Biology course(s)?

( ) a. yes
( ) b. no

10. Write the letter X and complete the required information in front of the topics that identify the courses, programs, or units you have already taken in Human Biology. Mark as many topics as apply.

( ) a. Human Physiology term_____ 19___
( ) b. Skeleton term_____ 19___
( ) c. Vertebrate muscles term_____ 19___
( ) d. Human blood circulatory system term_____ 19___
( ) e. Respiratory system term_____ 19___
( ) f. Anatomy term_____ 19___
( ) g. Other (specify) ____________________ term_____ 19___
( ) h. ____________________________________ term_____ 19___

11. In Column I at the left, you read some technical terms related to the Human Biology area of study, which are to be matched to the terms of Column II, at the right. Then, in the space between parentheses, in front of the terms in Column II, write the letter correspondent of Column I.

COLUMN I	COLUMN II
(a) muscle*	(a) smooth*
(b) hand	( ) tibia
(c) arm	( ) carpus
(d) clavicle	( ) phalanges
(e) leg	( ) radius
(f) foot	( ) carpus
	( ) triceps
	( ) femur
	( ) metatarsus
	( ) trapezius
	( ) humerus
	( ) tarsus

*Example

12. Complete the table below with the number and titles of the course(s) you are taking this Spring '84. In the proper column, WRITE the number of the seat you USUALLY PREFER TO SIT IN, in that particular course, in a classroom arrangement as shown in the graph, Item 13 below.

COURSE NUMBER	COURSE TITLE	CREDIT	SEAT NUMBER
ADV-323*	Consumer Behavior*	4	29*
EAC-430*	Motorcycle Safety*	4	132*
______	______________________	___	___
______	______________________	___	___
______	______________________	___	___
______	______________________	___	___
______	______________________	___	___

*Example

13. Examine carefully the graph below, showing a traditional straight-row seating of a spatial classroom arrangement, numbered from 1 to 150. Then read each question that follows, answering as required.

13-A. Draw a circle around the seat number you USUALLY PREFER TO SIT IN when being exposed to a sound motion instructional film.

(front of the room)

1	28	29	55	56	82	83	109	122	136	137
2	27	30	54	57	81	84	108	121	135	138
3	26	31	53	58	80	85	107	120	134	139
4	25	32	52	59	79	86	106	119	133	140
5	24	33	51	60	78	87	105	118	132	141
6	23	34	50	61	77	88	104	117	131	142
7	22	35	49	62	76	89	103	116	130	143
8	21	36	48	63	75	90	102	115	129	144
9	20	37	47	64	74	91	101	114	128	145
10	19	38	46	65	73	92	100	113	127	146
11	18	39	45	66	72	93	99	112	126	147
12	17	40	44	67	71	94	98	111	125	148
13	16	41	43	68	70	95	97	110	124	149
14	15		42		69		96		123	150

(back of the room)

---

14. Based on Questions 12, 13, and 13-A, write the letter X under the value of the value scale, and in front of the statement that best describes your reason(s) for choosing that seat number, that is, the seat you USUALLY PREFER TO SIT IN, in the traditional straight-row (Item 13) classroom arrangement, to attend the courses mentioned above (Item 12).

The values of the scale-value are: 0 = no reason
1 = low reason
2 = strong reason

(Mark as many reasons as you want to justify your seat preference.)

Reasons for Seat Preference	SCALE VALUES 0	1	2
a. allergic to chalk dust*			x*
b. eye-contact with instructor.			
c. keeping distance from instructor			
d. like to be alone			
e. to interact with others			
f. like to be by the door			
g. auditory defects			
h. visual problems			
i. can see and hear better			
j. feel anxiety in middle of the room			
k. like to be by the window			
l. avoiding noisy and inattentive persons			
m. afraid of being called by the instructor			
n. like to participate in classroom			
o. to receive professor's attention			
p. have no interest in the content			
q. have interest in the subject matter			
r. do not like to speak in classroom			
s. no special reason; just like that seat			
t. like that seat's position in the classroom			
u. other (specify)			
v.			
w.			
x.			
y.			
z.			

*Example

SEAT ___________

15. As I have assured you, all the information given will be kept confidential. Will you authorize me to ask the Registrar's Office for your scores on the GRE or Miller Test or other, and GPA?

Scores:

(a) GRE ______________________________
(b) Miller Test ____________________
(c) Other (specify) ________________
(d) GPA ______________________________

In order for the Registrar's Office to release the above scores, your signature is required, as well as your student number. To protect your anonymity, you are asked to sign your name below, where it can be removed physically before returning this page with your seat number and scores.

Thank you,

Irfe V. de Camargo
Experimenter
Spring '84

Student Number ________________________

Signature _____________________________

THE PERFORMANCE TEST

Directions I

You will have three minutes to read CAREFULLY the information below. Then, the lights of the room will be turned off, and the film MUSCLES will be shown. YOU DO NOT HAVE TO TAKE ANY NOTES.

The following facts and ideas are the major categories you are to pay attention to. These are given to help you to improve your ability of SEEING and HEARING specific information presented through the sound motion colored instructional film. These are some of the main topics:

a. Remote manipulator vs. human being
b. Type of muscles in the human body
c. Functions of muscles
d. Muscle movements
e. Muscle contraction and relaxation
f. Chemical functions and direction of their effects on muscle movements
g. Use of color in training muscle contraction-relaxing
h. Proteins: myosin, troponin, tropomyosin
i. Function of nerve on muscle movements
j. Use of this knowledge by the medical doctors
k. Muscle movements interpreted in drawings shown on the film

After seeing the film, you will hear instructions to BREAK THE RED SEAL of this instrument. While writing this test, you will hear very soft music. You will have 35 minutes to complete both parts of the test. You are expected to answer Part I in 15 minutes, when you will HEAR instructions to stop writing it and to start completing Part II. You will have 20 minutes to answer Part II.

Once you have completed the test, place it back in the envelope. Wait to return the envelope and pencil to the person at the desk at the EXIT of the room, one by one, when it will be checked.

Be sure to have both instruments in the envelope (Inventory and Performance Tests) and the pencil when returning them.

BE SURE ALSO TO ANSWER BOTH PARTS OF THIS TEST.

Thank you,

Irfe V. de Camargo
Experimenter
ESD-CEP
College of Education
Summer '84 MSU

THE PERFORMANCE TEST

Directions II

You will have three minutes to read CAREFULLY the information below. Then, the lights of the room will be turned off, and a sound motion instructional film will be shown. YOU DO NOT HAVE TO TAKE ANY NOTES.

The following facts and ideas are to be helpful to you:

a. Learn the right knowledge because it is a necessary tool for your entire life.
b. Use the accumulated knowledge of the past.
c. Move forward in spite of uncertainty.
d. Recognize new alternatives.
e. Apply harmony and creativity as a unit.
f. Interact between and among things, you and other persons.
g. Harmony is a part of the flow of life.
h. Creativity.
i. Harmony.
j. Color and movement.
k. Light and shades.

After seeing the film, you will hear instructions to BREAK THE RED SEAL of this instrument. While writing this test, you will hear very soft music. You will have 35 minutes to complete both parts of the test. You are expected to answer Part I in 15 minutes, when you will HEAR instructions to stop writing it and to start completing Part II. You will have 20 minutes to answer Part II.

Once you have completed the test, place it back in the envelope. Wait to return the envelope and pencil to the person at the desk at the EXIT of the room, one by one, when it will be checked.

Be sure to have both instruments in the envelope (Inventory and Performance Tests) and the pencil when returning them.

BE SURE ALSO TO ANSWER BOTH PARTS OF THIS TEST.

Thank you,

Irfe V. de Camargo
Experimenter
ESD-CEP
College of Education
Summer '84 MSU

THE PERFORMANCE TEST

Part I

DIRECTIONS: Read each item carefully, but do not spend too much time on any one item. Write the letter X in front of the correct response that best completes the statement.

You will have FIFTEEN minutes to complete it.

Example* - 00 - Smooth muscles are
(X) a. involuntary
( ) b. voluntary
( ) c. "a" and b"

01. The writing process requires coordination of

( ) a. less than twelve muscles
( ) b. twelve muscles
( ) c. more than twelve muscles

02. The remote manipulator is an electro-mechanical device used to stimulate the human

( ) a. hand, and arm without an elbow joint
( ) b. hand, wrist, and arm without an elbow joint
( ) c. hand, wrist, and arm with an elbow joint

03. The primary limitation in the remote manipulator is that

( ) a. it can make one deliberate motion each time
( ) b. it has no feeling sense
( ) c. "a" and "b"

04. The primary tissues of the human body that are responsible for movement are

( ) a. the bone tissues
( ) b. the muscle tissues
( ) c. the nerve tissues

05. The number of types of muscles is

( ) a. four
( ) b. three
( ) c. two

06. Muscular movement is

( ) a. always generated by a contraction, a shortening and thickening
( ) b. sometimes generated by a contraction, a shortening and thickening
( ) c. not generated by a contraction, a shortening and thickening

07. Which is not representative of the smooth muscle type?

( ) a. the esophagus, intestines, arteries, veins, and bladder
( ) b. the esophagus, intestines, arteries, veins, and heart
( ) c. the esophagus, intestines, arteries, veins, and stomach

08. The unique characteristic of the cardiac muscle is

( ) a. that the nerves that innervate the heart do not initiate contraction
( ) b. that it has a self-contained or myogenic origin of contraction
( ) c. "a" and "b"

09. The striated muscles are attached to the skeleton by

( ) a. the nerves that innervate the muscles
( ) b. tendons
( ) c. "a" and "b"

10. The term "antagonistic pair" means

( ) a. that some muscles act in opposition to each other
( ) b. that most striated muscles are arranged in antagonistic pairs
( ) c. "a" and "b"

11. A person who develops his/her muscles by exercising

( ) a. increases the number of his/her muscle cells
( ) b. enlarges the size of the existing cells
( ) c. "a" and "b"

12. Muscles only produce force by

( ) a. combining flexing movements
( ) b. combining pulling movements
( ) c. shortening during contraction

13. In isotonic contractions,

( ) a. muscles develop tension and exert force without changing their overall length
( ) b. muscles do change their length, shorten, and exert a constant force
( ) c. "a" and "b"

14. The production of sound in the form of speech results from the high coordination of movements of the jaw, tongue, larynx and lips. These muscles are classified as:

( ) a. smooth
( ) b. striated
( ) c. "a" and "b"

15. The muscles of our eyelids facilitate the spreading of lubricants across the surface of the eye to keep it from drying out. These muscles are of type

( ) a. smooth muscles
( ) b. striated muscles
( ) c. "a" and "b"

16. The facial muscles are used to express emotion. These muscles are called

( ) a. smooth muscles
( ) b. striated muscles
( ) c. "a" and "b"

17. The contraction of the striated muscles of the arm represents the contraction

( ) a. of each of its component cells
( ) b. of the forearm and hand
( ) c. of the arm and hand

18. A nerve impulse, from the spinal cord or brain, to move down the nerve fiber to the threshold of the cell, travels at the speed of

( ) a. 300 feet/second
( ) b. 100-300 feet/second
( ) c. 200-300 feet/second

19. Neuro-muscular junction is

( ) a. the nerve fiber ending
( ) b. the innervation of the striated muscles
( ) c. the space that separates the nerve film ending from the muscle cell

20. When the nerve impulse reaches the end of the fiber, it brings about the release of a chemical called

( ) a. sodium ions
( ) b. calcium ions
( ) c. transmitter substance

21. The changes brought about in the membrane's selective permeability result from the interaction of the transmitter substance on the receptor sites. The membrane changes are that of

( ) a. allowing sodium ions to enter the cell
( ) b. allowing sodium ions to be kept out of the cell
( ) c. not allowing other ions into the cell

22. The potential of the cell's membrane is that

( ) a. the cell is positively charged on the inside in relation to the outside
( ) b. the cell is negatively charged on the inside in relation to the outside
( ) c. the cell is not charged, positively or negatively, on the inside in relation to the outside

23. The sodium <u>changes</u> the membrane potential as it flows into the cell. Thus, the sodium is

( ) a. negatively charged
( ) b. positively charged
( ) c. not charged, positively or negatively

24. The original potential of the cell <u>begins</u> to be restored by the

( ) a. sodium positively charged
( ) b. calcium positively charged
( ) c. potassium positively charged

25. Which chemical element has to be <u>backed out</u> of the cell in order to restore the cell's original membrane potential?

( ) a. potassium
( ) b. sodium
( ) c. calcium

26. The <u>back out</u> of the cell mechanism is known as

( ) a. the potassium pump
( ) b. the sodium pump
( ) c. the calcium pump

27. Calcium is stored inside the cell

( ) a. in the neuro-muscular junction
( ) b. in the sarcomplasmic reticulum
( ) c. in the tubules

28. Tropomyosin and troponin are classified as two types of

( ) a. cell's mechanisms
( ) b. proteins
( ) c. glucose

29. The actions of tropomyosin and troponin are thought to be inhibited when

( ) a. sodium is released
( ) b. calcium is released
( ) c. potassium is released

30. The contractile mechanism of the striated muscle cell occurs when there is interaction of

( ) a. the actin and myosin molecules past each other
( ) b. the tropomyosin and troponin molecules past each other
( ) c. sodium and calcium molecules past each other

31. The actual movement of contraction begins

( ) a. when changes of the membrane potential are completed
( ) b. at the molecular level
( ) c. when sodium is released

32. Which one of the proteins has lateral projections or cross-bridges which attach to receptor sites on the actin?

( ) a. troponin
( ) b. tropomyosin
( ) c. myosin

33. ATP (adenosine triphosphate) is a high-energy molecule, which is broken down, or split, and energy is released when

( ) a. the myosin attaches to the troponin
( ) b. the myosin attaches to the actin
( ) c. the myosin attaches to the tropomyosin

34. ATP produces the force

( ) a. that lengthens the myosin cross-bridges that move the actin
( ) b. that shortens the myosin cross-bridges that move the actin
( ) c. neither "a" nor "b"

35. When the actin/myosin bond is broken, which molecules are shortened and reattached to a new receptor site?

( ) a. actin
( ) b. myosin
( ) c. "a" and "b"

36. The muscle relaxes when

( ) a. the membrane's original potential is restored and calcium is reabsorbed
( ) b. the membrane's original potential is changed and calcium is released
( ) c. the membrane's original potential is maintained and calcium is absorbed

37. The whole process, from the nerve impulse's arrival at the neuromuscular junction to the sliding of the filaments, takes approximately

( ) a. 1/30th of a second
( ) b. 1/40th of a second
( ) c. 1/50th of a second

38. In a single muscle cell there is a total of

( ) a. 8,000 myofilaments
( ) b. 56 billion myofilaments
( ) c. 5,000 myofilaments

39. The single unit of contraction is called (a)

( ) a. sodium pump
( ) b. cross-bridges
( ) c. motor unit

40. The strength of movement is determined by

( ) a. the amount of sodium pumped out of the cell
( ) b. the number of movements of the cross-bridges
( ) c. the number of motor units activated

41. The contraction process, then, is the result of

( ) a. the molecular interactions within one cell
( ) b. the molecular interactions outside the cell
( ) c. the molecular interaction within-outside the cell

42. In which University is research being developed in training people to control muscles to relieve such disorders as muscle-tension headaches?

( ) a. University of Dayton
( ) b. University of Colorado
( ) c. University of California

43. Tension headaches are caused by

( ) a. sustained contraction of the muscles in the neck
( ) b. sustained contraction of the muscles in the head and shoulders
( ) c. sustained contraction of the muscles in the head and neck

44. The EMG (electro myogram) is a machine used to

( ) a. measure tension headache
( ) b. train people to relax the muscles involved in the tension headache
( ) c. energize the muscle cell

45. A type of EMG (electro myogram) machine generates a series of colored lights giving information on muscle state in patients.

45A. The color the patient will see when he/she begins to relax is

( ) a. green
( ) b. amber
( ) c. red

45B. The color the patient will see when he/she becomes tense is

( ) a. green
( ) b. amber
( ) c. red

46. Muscle feedback therapy involves the electronic detection and translation into audio-visual signals of

( ) a. small numbers of momentary changes in the effective muscle cell's membrane potentials
( ) b. average numbers of momentary changes in the effective muscle cell's membrane potentials
( ) c. great numbers of momentary changes in the effective muscle cell's membrane potentials

47. The simple act of muscular contraction is the result of

( ) a. enlarging and slighting of the cell
( ) b. shortening and thickening of the cell
( ) c. controlling by the autonomic nervous system

PLEASE AWAIT INSTRUCTOR'S PRE-RECORDED DIRECTIONS
BEFORE STARTING TO WORK ON PART II OF THIS INSTRUMENT

Part II

<u>DIRECTIONS</u>: Read each item-question <u>carefully</u> and <u>write</u> the required information in the blank space corresponding to the item. You will have TWENTY minutes to complete PART II of this test.

48. On a scale from 0 to 4, give a grade to your ability to learn the facts and ideas you SAW and HEARD during the presentation of this film.

    My personal score is as checked below:

    ( ) a. zero
    ( ) b. 1
    ( ) c. 2
    ( ) d. 3
    ( ) e. 4
    (X) f. zero*

    *Example

0	1	2	3	4
low		average		high

49. Did the drawings in the film help you to increase your ability to learn the facts and ideas you SAW during the presentation of this film?

    ( ) a. yes
    ( ) b. no

    49A. If YES, explain how and how much the drawings in the film helped you to increase your ability to learn the facts and ideas you saw. (Write one to three sentences.)

49B. If NO, explain and justify your reason(s). (Write one to three sentences.)

49C. On a scale from 0 to 4, grade your ability to learn the facts and ideas presented through the drawings you SAW in the film.

My personal score is as checked below:

0	1	2	3	4
low				high

( ) a. zero
( ) b. 1
( ) c. 2
( ) d. 3
( ) e. 4
(X) f. zero*

*Example

50. Did the narration in the film help you to increase your ability to learn the facts and ideas you HEARD during the presentation of the film?

( ) a. yes
( ) b. no

50A. If YES, explain how and how much the narration on the film helped you in increasing your ability to learn the facts and ideas you HEARD during the film. (Write one to three sentences.)

50B. If NO, explain and justify your reason(s). (Write one to three sentences.)

50C. On a scale from 0 to 4, grade your ability to learn <u>just</u> from ONLY listening to the narration in the film.

My personal grade is as checked below:

0	1	2	3	4
low				high

( ) a. zero
( ) b. 1
( ) c. 2
( ) d. 3
( ) e. 4
(X) f. zero*

*Example

51. Write the number of the seat you were assigned to for this experiment. My seat number was ___________________.

52. On a scale from 0 to 4, rate how well you SAW the images on the film projected on the screen from the seat you were assigned to.

0	1	2	3	4
Hardly saw				Saw very well

( ) a. zero
( ) b. 1
( ) c. 2
( ) d. 3
( ) e. 4
(X) f. zero*

*Example

53. On a scale from 0 to 4, rate how well you SAW EVERYTHING on the screen from the seat you were assigned to.

0	1	2	3	4
Hardly Saw				Saw very well

( ) a. zero
( ) b. 1
( ) c. 2
( ) d. 3
( ) e. 4
(X) f. zero*

*Example

54. On a scale from 0 to 4, rate how far away your seat was from the screen for you (think in terms of angle-degree of the seat position).

0	1	2	3	4
Bad angle		Good angle but too close to the screen		Good angle

( ) a. zero
( ) b. 1
( ) c. 2
( ) d. 3
( ) e. 4
(X) f. zero*

*Example

55. On a scale from 0 to 4, rate how well you READ the labels written on the drawings shown in the film.

0	1	2	3	4
Couldn't read them		Hard to read them		Read them very well

( ) a. zero
( ) b. 1
( ) c. 2
( ) d. 3
( ) e. 4
(X) f. zero* *Example

56. Do you recall some of the labels written on the drawings shown in the film?

( ) a. yes
( ) b. no

56A. If YES, write the labels that you recall, without going back to the item-questions.

(1) ______________________________
(2) ______________________________
(3) ______________________________
(4) ______________________________
(5) ______________________________

56B. If NO, explain the reasons why you could not recall the written labels shown on the drawings in the film. (Write one to three sentences.)

57. Where were located on the screen the written labels on the drawings shown in the film you were able to see? Select as many of the below as apply:

( ) a. top center of the screen
( ) b. center of the screen
( ) c. bottom center of the screen
( ) d. upper left of the screen-center
( ) e. upper right of the screen-center
( ) f. bottom left of the screen-center
( ) g. bottom right of the screen-center

58. On a scale from 0 to 4, rate how well you could see details on the drawings shown in the film. (For example, "The contractile mechanism of the striated muscle cell occurs when there are interactions of the actin and myosin molecules past each other.")

0	1	2	3	4
Didn't see details		Hardly saw details		Saw details very well

( ) a. zero
( ) b. 1
( ) c. 2
( ) d. 3
( ) e. 4
(X) f. zero* *Example

59. "Arrows" are details that were used to show the reactions of the chemical elements as sodium and calcium on the muscular contraction. On a scale from 0 to 4, how well did you see them from the seat you were assigned?

0	1	2	3	4
Didn't see any arrows		Saw some arrows but not the directions they were going to		Saw arrows going in different directions

( ) a. zero
( ) b. 1
( ) c. 2
( ) d. 3
( ) e. 4
(X) f. zero* *Example

60. On a scale from 0 to 4, rate how good was the physical position of your seat in relation to the central focus of the screen.

0	1	2	3	4
Bad position				Good position

( ) a. zero
( ) b. 1
( ) c. 2
( ) d. 3
( ) e. 4
(X) f. zero*

*Example

61. On a scale from 0 to 4, rate how well you did in this Performance Test, from your assigned seat.

0	1	2	3	4
Did poorly		Did average		Did very well

( ) a. zero
( ) b. 1
( ) c. 2
( ) d. 3
( ) e. 4
(X) f. zero*

*Example

APPENDIX D

REASONS FOR CLASSROOM SEATING PREFERENCE FOR

VIEWING AN INSTRUCTIONAL FILM

Reasons for Classroom Seating Preference for Viewing an Instructional Film

The statements of reasons for seating preference in classroom for viewing a film were based on studies made on students' seat location in class and other studies related to this approach. These statements of reasons were classified as academic reasons, physical conditions, seat location, and personal space. Each statement was grouped as follows:

Academic Reasons for Seating Preference

(a) "Have interest in the subject matter" and (b) "Have no interest in the content" were based on the following studies: Walberg (1969, pp. 67-68), McCroskey and McVetta (1978, pp. 109-11); and

(c) "Like to participate in classroom" and "Don't like to speak in classroom" were based on the following studies: Hare and Bales (1963, pp. 481-82, 485), Adams (1969, pp. 318-20), Walberg (1969, pp. 67-68), Delefes and Jackson (1972, pp. 122-23), and McCroskey and McVetta (1978, pp. 109-11).

Physical Condition and Seating Preference

(a) "Can see and hear better" and (b) "auditory defects" and "visual problems" were derived from Walberg's study (1969, pp. 67-68).

Preferred Seat Location

(a) "Like to be by the door" was derived from Bloom and Winokur (1972, p. 86) and Green (1976, pp. 248-49).

(b) "Like to be by the window" was derived from Walberg's study (1969, pp. 67-68).

(c) "No special reason: just like that seat" and (d) "Like that seat's position in the classroom" were taken from Farnsworth's study (1933, p. 375).

Personal Space for Seating Preference

(a) "Eye-contact with instructor" was taken from the following studies: Argyle and Dean (1965, pp. 302-304), Lott and Sommer (1967, p. 94), Knight et al. (1973, pp. 399-400), and Koneya (1976, pp. 278-81).

(b) "To receive professor's attention" was derived from the following studies: Farnsworth (1933, p. 375), Horowitz (1968, p. 31), Adams (1969, pp. 318-20), Delefes and Jackson (1972, pp. 122-23), Evans and Howard (1973, pp. 338-41), and Dykman and Reis (1979, pp. 352-54).

(c) "Like to be alone" was derived from the following studies: Horowitz (1968, p. 31), Evans and Howard (1973, pp. 338-41), Greene (1976, pp. 248-49), Koneya (1976, pp. 278-81), and Dykman and Reis (1979, pp. 352-54).

(d) "To interact with others" was derived from the following studies: Hare and Bales (1963, pp. 481-82), Argyle and Dean (1965, pp. 302-304), Walberg (1969, pp. 67-68), Adams (1969, pp. 318-20), Delefes and Jackson (1972, pp. 122-23), Knight et al. (1973, pp. 399-400), Koneya (1976, pp. 278-81), and McCroskey and McVetta (1978, pp. 109-11).

(e) "Feel anxiety in middle of the room" was derived from Hare and Bales' study (1963, pp. 481-82, 485).

(f) "Afraid of being called by instructor" was derived from the following studies: Horowitz (1968, p. 31), Walberg (1969, pp. 67-68), Evans and Howard (1973, pp. 338-41), Greene (1976, pp. 248-49), and Dykman and Reis (1979, pp. 352-54).

(g) "Avoiding noisy and inattentive person" was taken from Farnsworth's study (1933, p. 375).

(h) "Keeping distance from instructor" was derived from the following studies: Argyle and Dean (1965, pp. 302-304), Horowitz (1968, p. 31), Walberg (1969, pp. 67-68), Evans and Howard (1973, pp. 338-41), Knight et al. (1973, pp. 399-400), Greene (1976, pp. 248-49), and Dykman and Reis (1979, pp. 352-54).

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