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AUTHOR	Lavin, Marvin H.
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ABSTRACT

A graduate thesis investigated the value of notetaking and prepared notes as adjunctive activities in audiovisual instruction. In the first experiment, taking notes on prepared topic outlines was found to be better than taking notes on blank paper. In the second experiment, not taking on topic outlines and the use of study guides were shown to be similarly effective for both learning and retention. Printed introductions however had little effect. The conclusion is that printed material may be developed for guiding learners to specific content, for providing them with information vital to the understanding of a lesson, and for eliciting student participation when indicated. (RB)

THE RELATIVE EFFECTIVENESS OF THREE TYPES OF NOTES USED AS ADJUNCT STUDY ACTIVITIES TO GROUP AUDIOVISUAL INSTRUCTION

by

Marvin H. Lavin

An Abstract

Of a thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the College of Education in the Graduate College of The University of Iowa

August, 1971

Thesis supervisor: Assistant Professor John R. Bullard

ABSTRACT

Commercially prepared audiovisual software seldom meets the specific requirements of objective-oriented course designers. The problem in using such material is in overcoming existing deficiencies so as to increase their effectiveness and, also, permit course designers to adapt it for specific instructional needs. An obvious solution might be found by using variations of topic outlines or study guides. Printed material may be developed for guiding learners to specific content, for providing them with information vital to the understanding of a lesson, and for eliciting overt student participation--where such activity is indicated.

The purpose of this investigation was to determine the value of notetaking and prepared notes, as adjunctive activities, in improving audiovisual instruction.

Three related experiments comprised this study. In Experiment I, eighty-four high school students were used to determine the relative effectiveness of two notetaking modes. Two audiotaped lectures, with appropriate visuals, served as stimuli. During the first lecture, half the Ss took notes on plain paper; the other half was provided

with a printed topic outline for notetaking. For the second lecture, treatments were switched and Ss received the alternate mode. A criterion test--yielding separate scores for each lecture--was then administered. Scores for Ss who received topic outlines were significantly higher ($p < .005$) than for those who took plain paper notes.

Experiment II used eight films with forty-one college seniors to investigate combination-effects of two factors, on both learning and retention. Factor 1 was designed to aid in studying the effects of printed introductions. Factor 2 consisted of the following four filmwatching treatments: (1) Ss take notes on topic outlines, (2) Ss take notes on plain paper, (3) Ss follow the progress of the film with the aid of a study guide, and (4) Ss attend film--without aids. One instructional film was shown each week, over an eight week period. Before each film-showing, Ss received a packet which included material and instructions for carrying out one of the four film-watching activities. At times the packet contained an introduction; at other times it did not. Immediately after the film-showing, a criterion test to measure learning was administered. One week later, the same test was given to measure retention. It was intended that each subject would have experienced all eight treatment combinations during the course of the experiment. These

intentions, however, were not realized. Results indicated that introductions produced little noticeable effect on either learning or retention. In addition, significant interaction between the two factors did not occur. Because of excessive student absences and extreme variations in film-stimuli characteristics, the effects of filmwatching treatments were inconclusive.

Experiment III was designed to overcome difficulties encountered in Experiment II. Absences were practically eliminated, and film variability was substantially reduced. Ss from the preceding experiment were again used. Because introductions had no significant effect, only the four filmwatching treatments were studied. Most other experimental conditions remained unchanged. Results produced sharply delineated tendencies. Notetaking on topic outlines and use of study guides were shown to be similarly effective for both learning and retention. These treatments were also superior to plain paper notes--especially for learning ($p < .14$). All three treatments were superior to the treatment in which Ss merely attended the film without use of aids ($p < .05$).

This study demonstrates that variations of topic outlines and study guides can result in increased learning and retention, when used as adjuncts to instructional presentations. If such material is not available, however,

learners should be encouraged to take notes on plain paper--providing the presentation is not too rapidly paced.

Abstract approved:

John R Bullard, thesis supervisor

Asst. Prof. - Educ. title and department

July 21, 1971 date

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Graduate College
The University of Iowa
Iowa City, Iowa

CERTIFICATE OF APPROVAL

PH.D. THESIS

This is to certify that the Ph.D. thesis of

Marvin H. Lavin

has been approved by the Examining Committee for the thesis requirements for the Ph.D. degree in the College of Education (Educational Media) at the August, 1971, graduation.

Thesis committee:

John K Bullard
Thesis supervisor

Member

Member

Member

Member

DEDICATION

In memory of

Professor Louis A. D'Amico

a good friend, whose inspiring faith in higher education and whose personal confidence and encouragement helped to make this work possible.

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CHAPTER I

INTRODUCTION

Concern with improvement of instruction has led to increased utilization of technology in American education. Unfortunately, there are those who equate "educational improvement," solely, with increased use of media. Educators who are actively involved with problems of designing instruction realize the fallacy of this assumption. More frequent use of sound-films, tape-slides, or video productions--by themselves--will not necessarily lead to increased quality or efficiency.

For certain types of instruction to be effective, specific goals and objectives must be established by the teacher or course planner. Commercially prepared audiovisual software--such as film, filmstrips, and audiotapes--is usually designed for a broad market. For this reason, lesson objectives of instructor and producer rarely coincide. Unless the instruction has been prepared by the lesson planner, a decision to use existing audiovisual material generally represents a compromise of instructional intent.

In selecting audiovisual material for classroom use, a number of content factors should be examined. Common

deficiencies of commercially prepared instructional productions are often found in pacing, lesson structure, content, narration style, audio quality, continuity, or emphasis.

The Problem

The problem in using some audiovisual software is in overcoming existing deficiencies so as to increase their effectiveness and, also, permit course designers to adapt such material for specific instructional needs.

Notetaking in Education

A set of good classroom notes provides the learner with a personal study guide. In the process of notetaking, the student becomes involved with the content of the lesson and, to some degree, may begin to integrate parts of it into his knowledge bank. Research has not conclusively shown the superiority of either overt or covert responses, although these topics have been studied extensively (Briggs and Angell, 1964; Schramm, 1964). Investigators seem to be in agreement, however, that overt or covert responses produce more learning than "no" responses (Allen, 1957). One obvious advantage of overt activity, such as notetaking, is that students are likely less susceptible to distraction.

Learners are often hampered when they attempt to take notes during a classroom audiovisual presentation

for two main reasons. First--in order to use filmstrip, slide, or movie projectors, the room must be darkened. Under such conditions, sufficient light for notetaking is usually unavailable. Second--most recorded narration moves too fast for would-be notetakers. That learners may miss content, when taking notes under such conditions, is supported by at least one study (Ash and Carlton, 1951). This investigation indicated that students who attempted to take notes during an instructional film learned less than those who did not.

Other conditions which may interfere with notetaking include: vague lesson points, unfamiliar vocabulary and other inadequate entry behavior, faulty cue interpretation, and perceptual confusion.

If learners could be guided into taking effective notes, or if they were provided with a set of prepared notes which have been designed to overcome existing software deficiencies, there is a possibility that the effectiveness of such instruction may be enhanced.

Another obstacle to progress in the improvement of instruction is the shortage of audiovisual software which is capable of meeting the specific requirements of lesson or course designers. Many existing productions might be employed for these purposes if it were possible to guide the learner's attention to specific content in the production which would aid in carrying out the instructional

intent of the designer. If the production format is not fixed, such as in a series of slides or overhead transparencies, visuals and narration may easily be altered to meet virtually any requirement. In fixed-format productions, such as films or filmstrips, alterations may be difficult or impossible to achieve. Prepared notes, however, have the potential for permitting existing software to be adapted to specific instructional needs.

Purpose of the Study

It seems reasonable to the investigator that adjunctive activities, such as notetaking, could be used with audiovisual instruction to increase learning. It is the purpose of this study to investigate the effectiveness of several alternative forms of learner participation techniques. Experimental treatments will compare the effectiveness of conventional notetaking, a study sheet for taking notes, a conventional study sheet, and just "watching" and "listening" to audiovisual instruction.

Study sheets, based on the content of the presentation, can provide the learner with a concise set of study notes. It is possible to design sheets to include all or part of the following cue-related material:

1. Instructional goals
2. Behavioral objectives
3. Motivational instruments

4. Vital pre-entry behavior
5. Important names, vocabulary, and concepts
6. Content outline
7. Complete content
8. Space for student's notes
9. Diagrams
10. Organizational charts
11. Study questions
12. Related instructional material

The kinds and number of cues to appear on st dy sheets should be determined by the learner's entry behavior. Study sheet information is customized to the instructional problem. Content vital to the lesson planner's design is the only material requiring cueing; extraneous information should be omitted from these handouts. Through this selective cueing technique, the lesson planner can effectively shift content emphasis.

Definitions

Adjunctive Learning Activity--any overt or covert learning activity, in addition to the usual "watching" and "listening," which accompanies an instructional presentation. In this study Blank Outline Notes, Completed Outlines, and Plain Paper Note Treatments are considered as adjunctive learning activities.

Blank Outline Notes (BON)--notes recorded directly on a specially prepared topical outline. Each outline is designed for a specified unit of instruction. Sufficient space is provided between topics to permit learners to take notes in their own style.

Change-Scores--criterion test score differences between Learning and Retention Tests. Change-score values are obtained by subtracting Retention scores from Learning scores.

Completed Outlines (CO)--study sheets which contain all essential information presented in the instruction; a filled-in Blank Outline.

Cues--terms, words, or ideas which serve to alert the learner to major points of the lesson.

Effectiveness--the between-treatment comparison of the amount of factual information Learned or Retained, as measured by the Criterion Test.

Film-Watching Activities--any of the four treatment activities in which the learner participated while viewing films.

Fixed-Format Presentation--an externally paced instructional unit upon which alteration of sequence or content is not readily accomplished, i.e., a film or video tape.

Instructional Unit--a single lesson; a presentation having goals and specific objectives; a module of instruction.

Learning--the amount of factual information assumed to be acquired by a subject from an instructional stimulus, as measured by the Criterion Test administered immediately following the presentation.

Motivator (M)--a short printed message, designed to motivate the learner by pointing out the value of the instruction about to be experienced.

No Motivator (NM)--absence of the Motivator described above.

No Notes (NN)--the "watching" and "listening" only treatment.

Note-Treatments--the three treatments which are related to "notes": Blank Outline Notes, Completed Outlines, and Plain Paper Notes.

Plain Paper Notes--the style of notes a learner makes from an instructional presentation, on plain paper.

Presentation--a unit or module of instruction; a lesson with goals and specific objectives; an instructional unit.

Retention--the amount of factual information remembered by a subject from an instructional stimulus, as measured by the Criterion Test administered one week after the presentation.

Sight-Sound Presentation--a unit of instruction which employs both auditory and visual stimuli in any proportions.

Treatment Packets--the assembled package of instructions and treatment activities which was given to Ss participating in experimental treatments.

CHAPTER II

RELATED RESEARCH

Material in the following three sections of this chapter provide background and rationale for the direction of the present investigation. In the first section, an attempt is made to justify the author's position for generalizing the results of research which employs audio-visual instruction. The last two sections cite studies pertaining to the use of introductions and participation activities as adjuncts to audiovisual presentations.

Relative Effectiveness of Media

Numerous investigations in the audiovisual field have found that alternative modes of transmitting instruction--without loss of message effectiveness are possible. In referring to the long history of investigations which have compared the relative effectiveness of two different media in presenting similar information, Travers (1967) stated that this type of research had not resulted in clear conclusions.

Allen (1960), in reviewing fifteen studies which compared filmstrips and slides with motion picture film, found little difference in effectiveness. Similarly,

Wendt and Butts (1962) referred to three investigations which showed no significant difference in comparing filmstrips, slides, and transparencies with lectures and still or motion pictures. These eighteen studies involved learners from primary grades to graduate school and represented a wide range of subject matter.

A college algebra course was used by Carpenter and Greenhill (1963) to test three methods of presenting programmed instruction. When teaching machines, programmed textbooks, and filmstrips were compared, no significant differences in learning were revealed.

After an extensive literature review, Lumsdaine and May (1965) concluded that from the standpoint of presentation, television and motion picture film can be considered identical media.

Houser, Houser, and Van Mondfrans (1970) investigated the ability of motion pictures and slides to present two different concepts. One concept involved motion as a defining attribute; the other did not involve motion. Although use of motion picture resulted in significantly more correct identifications for both motion and non-motion concepts, the investigators stated that it ". . . should not be assumed that this is evidence of a generalized superiority of motion picture presentation . . ." In their discussion they point out that motion picture presented

clearer contrast between motion concepts and non-motion concepts than did slides.

Allen and Weintraub (1970) studied the treatment effects of motion picture, sequenced still pictures, and single still pictures on fact learning, serial ordering, and concept learning on fifth and sixth graders. Using these treatments, three experiments were conducted in science, motor skills, and social studies. Motion pictures were found to be the most effective medium for transmitting cognitive learning information.

From the foregoing studies, it would appear that information transmission alternatives are possible for, at least, some types of instruction. These investigations tend to verify Allen's (1960) conclusions which found little difference in effectiveness for media comparisons. In cases where alternatives exist, the media involved probably have common characteristics which are critical to the effective transmission of a message. For this reason, discoveries based upon research employing one medium may be cautiously generalized to other media possessing similar characteristics.

The Use of Introductions

One of the few unchallenged, time-honored pedagogical principles concerns use of introductions preceding viewing of instructional films. Most teaching methods textbooks

suggest such preparation to facilitate learning (Dale, 1969; Brown, Lewis, and Harcleroad, 1969). The terms set and attention have been closely associated with the concept of introduction and, as such, are more frequently referred to in educational literature.

Sjogren (1967) suggests that set is a frame of mind designed to facilitate learning. He cites Ausubel and associates (1960, 1961, 1962, 1963) who demonstrated that the reading of "advance organizers"--prior to study of a topic--facilitated learning from instruction given on that topic. It was pointed out that Ausubel had not associated "advance organizers" with set inducers. This relationship was established in a study by Wittrock (1963).

Most of the set or attention devices that have been studied consisted of such activities as asking anticipatory questions, previewing difficult vocabulary, or using study guides (Allen, 1952; Wittich and Fowlkes, 1946). One such study was conducted by Vandermeer (1950). One group of subjects was permitted to study a film guide both before and after the showing. A second group, merely viewed the film--without use of study guides. A test for learning--administered after all subjects had viewed the film--revealed no significant difference. When subjects were tested three months later, however, the film-guide group did significantly better.

In McNiven's (1955) experiment, the treatment variable was the period of time that elapsed between the film showing and the test covering the content of the film. In the introduction, groups were told different dates on which they would be tested over the film's content. It was found that shorter waiting periods--for using information contained in the film--led to significantly more learning.

The findings of most past research have been inconclusive and conflicting. Although there is some evidence that certain types of introductions--such as "advance organizers"--facilitate learning, guidelines for their appropriate selection are unavailable. One of the difficulties in communicating information pertaining to the application of introductions, is the absence of a taxonomy. At present, relevant research is reported under such descriptors as set, cue, attention, motivation, and Ausubel's "advance organizers." These same descriptors, unfortunately, are also used for ideas unrelated to the concept of introduction. To further complicate analysis, research variables often combine pre-, adjunct, and post activities into a single study factor. It appears that many investigations in this area are intuitively, rather than theoretically, based.

Learner Participation

Overt-Covert Activities

Travers (1967) defines participation as techniques which provide for overt student activity during the showing of a film. Allen (1957) speaks of "active participation" and thereby implies the existence of "inactive" or covert participation, as well. In this investigation, participation will refer to any overt, or covert, activity in which the student engages as an adjunct to instruction.

In reviewing twenty-six studies, Allen (1957) found that thirteen favored participation, two favored non-participation, and eleven were inconclusive. Controversy pertaining to the relative effectiveness of overt or covert participation has not been resolved. In citing investigations by Evans (1960), Evans, Glaser, and Homme (1959), Kanner and Sulzer (1961), McGuire (1961), and Michael and Maccoby (1961), McKeachie (1966) concludes that overt participation may be detrimental if it interferes with the reception of instruction. Such interference, he believes, can occur in rapidly paced presentations. Lumsdaine, May, and Hadsell (1958) systematically evoked participation by splicing questions between sections of a stimulus film. They found that significantly more learning took place with the spliced version of the film than did with the straight version. Schramm (1964) reported on

sixteen investigations of overt and covert methods of responding. He concluded that the majority of these studies found no significant difference between modes.

After examining the large body of overt-covert studies, one may conclude that while participation is a likely essential to effective learning, such activity need not be overt. Present indications are that the decision to use either overt or covert participation techniques may depend upon the learner and the task to be learned.

Notetaking

There is little research pertaining to the value of notetaking, or to the use of notes, in the learning process. The earliest investigation that the present writer could find on the subject was reported by Vernon (1946) in which the notetaking activity was not of central importance. An instructional film was shown to a group of adult learners. As a postfilm activity, two different study procedures were compared. In the first, learners were directed to spend one hour viewing a study filmstrip, based on the film, and taking notes. In the second procedure, the same period of time was spent in practical instruction without taking notes. No clear advantage of one procedure over the other was found.

The study most closely related to the present investigation was conducted by Ash and Carlton (1951), and

reported by Travers (1967). Two-hundred-sixteen college freshmen were divided into three groups. Each of the groups were shown two different instructional films. After the film-showing, the first group was immediately tested. The second group was directed to take notes during the viewing activity. At the conclusion of the film, notes were collected and the test was given. The third group took notes and, in addition, were allowed a ten-minute study period before being tested. The "no note" group did significantly better on a test for factual information than either of the notetaking groups. Based on these findings, Travers believed that notetaking had not been established as an effective adjunct for learning from film.

Howe (1970) studied two experimental variables--modes of notetaking and the opportunity to review. Sixty college students served as subjects. The stimulus consisted of an audio-taped passage from a modern novel. The three notetaking modes were verbatim notes, brief notes, and no notes. Half the subjects--in each of the treatments--were permitted a three-minute period for reviewing, after which notes were collected. For the remaining subjects, notes were collected immediately after the tape presentation. Two weeks later, a recall test was administered to all groups. Subjects who were allowed to review their notes did significantly better than the "no

review" groups. Differences between notetaking groups were not significant.

From these studies, it would appear that increased learning is not a product of the notetaking act alone. However, both the Ash and Carlton study and the Howe study found that the review of notes was significantly beneficial.

CHAPTER III

THREE EXPERIMENTS: METHODS, PROCEDURES, AND RESULTS

The experiments described in this section were performed within frameworks of existing courses of instruction. Experiment I was conducted in high school chemistry classes; Experiments II and III in a graphic communication course for college seniors. In all cases, stimuli used in the experiments represented learning material that was part of the course content being taught. Each succeeding experiment of the series represented a refinement of technique or an alteration, designed to overcome a difficulty encountered in the prior study.

Experiment I

Background

The subjects (Ss) used in this experiment had previously experienced Blank Outline Notes with a number of other presentations in the same chemistry course. Blank Outlines had been prepared for use with films, filmstrips, audio-tapes, and lectures. Up until the time of this experiment, the effectiveness of Blank Outline Notes as an adjunctive learning activity to instructional sight-sound

presentations had not been objectively evaluated.

Purpose

This experiment was designed to provide evidence related to the following questions: Are Blank Outline Notes superior to Plain Paper Notes for learning factual chemistry information from sight-sound instructional presentations? Do students prefer Blank Outline Notetaking to taking Plain Paper Notes?

Subjects

This experiment was conducted in the spring of 1969 at a Chicago high school. The school is located in a lower-middle class neighborhood that is beginning to show signs of degradation. Approximately three percent of the school's total enrollment came from the wealthy Lake Front Area of the city.

The Ss were enrolled in four mixed chemistry classes composed of sophomores, juniors, and seniors. Class sizes varied from nineteen to twenty-three students. A total of eighty-four Ss were involved. An analysis of the four classes is found in Table 1.

In past years, approximately ninety-seven percent of students from this school who elected chemistry have applied for college entrance, whereas only twenty percent of the school's total enrollment applied. In order to enroll in the chemistry course, students must have

achieved a minimum grade point average of 2.0, on a 4.0 scale.

TABLE 1

MEETING TIMES AND SEX AND SIZE CHARACTERISTICS OF THE FOUR CLASSES USED IN EXPERIMENT I

Class Designation	Approx. Meeting Time	Composition Male	Composition Female	Group Size
I	9:00 a.m.	3	20	23
II	11:00 a.m.	4	16	20
III	1:00 p.m.	5	17	22
IV	3:00 p.m.	5	14	19
Total				84

Treatments

The two treatments evaluated were Plain Paper Notes (PPN) and Blank Outline Notes (BON).

Stimuli

Two tape recorded lectures, on the subject of the "Halogens"--with accompanying overhead transparencies designed to illustrate the lectures--were used.

Measuring Instruments

Because experimental treatments were applied to high school students who were enrolled in a chemistry course, regular taped lectures and unit examinations were used for stimuli and criteria measures.

Criterion Measure

This instrument was a forty-item objective test with four possible choices per item. Twenty questions were formulated from each of the two lectures. The examination was arranged so that items from the two presentations alternated--odd numbered items were taken from the first lecture; even numbers from the second. Questions were ordered in an effort to control experimental error caused by item sequence.

Questionnaire

Accompanying the Criterion Test was a brief questionnaire. Its purpose was to aid in revealing the extent of treatment contamination. Such contamination could have been due to Ss discussing stimulus material--or exchanging classroom notes--with one another prior to receiving the Criterion Test. A second purpose of the instrument was to aid in disclosing Ss' feelings regarding the use of Blank Outline Notes.

Hypotheses

H_o 1. There is no difference in the amount of factual information learned, as measured by a forty-item Criterion Test, from a fixed-format presentation when Ss take Plain Paper Notes or when they take Blank Outline Notes.

H_o 2. Ss will prefer Plain Paper Notes and Blank Outline Notes with equal frequency.

Procedure

Instructions to Ss

Groups were told that they would be participating in an experiment to determine the effectiveness of their notes as study aids. They were also told that they would be examined on the stimulus material in four days, and to make use of their notes and outlines in preparing for the test. Their cooperation was requested in not permitting fellow students to use these materials. This precaution was undertaken in an attempt to reduce the possibility of treatment contamination.

Experimental Environment

As with all regular chemistry instruction, the entire experiment was conducted in the chemistry lecture-laboratory room of the school. Measures were taken to insure that all classes experienced as nearly identical conditions for the

presentation as was possible. In each case, a class meeting in the morning was paired--for treatment purposes--with one meeting in the afternoon. This was done in an attempt to control the time-of-day variable. Figure 1 shows the treatment schedule and general plan for Experiment I.

Data

Tabulation

Each of the eighty-four Criterion Examinations yielded two scores--one for odd numbered items; the other for even numbered items. Because of differences in difficulty of odd and even numbered items, separate means and standard deviations were calculated for the two sets of scores. These values have been recorded in Table 2.

TABLE 2

MEAN AND STANDARD DEVIATION OF ODD AND EVEN NUMBERED CRITERION TEST ITEMS USED IN EXPERIMENT I

	Mean	Standard Deviation
Odd	25.5	4.60
Even	23.7	6.10

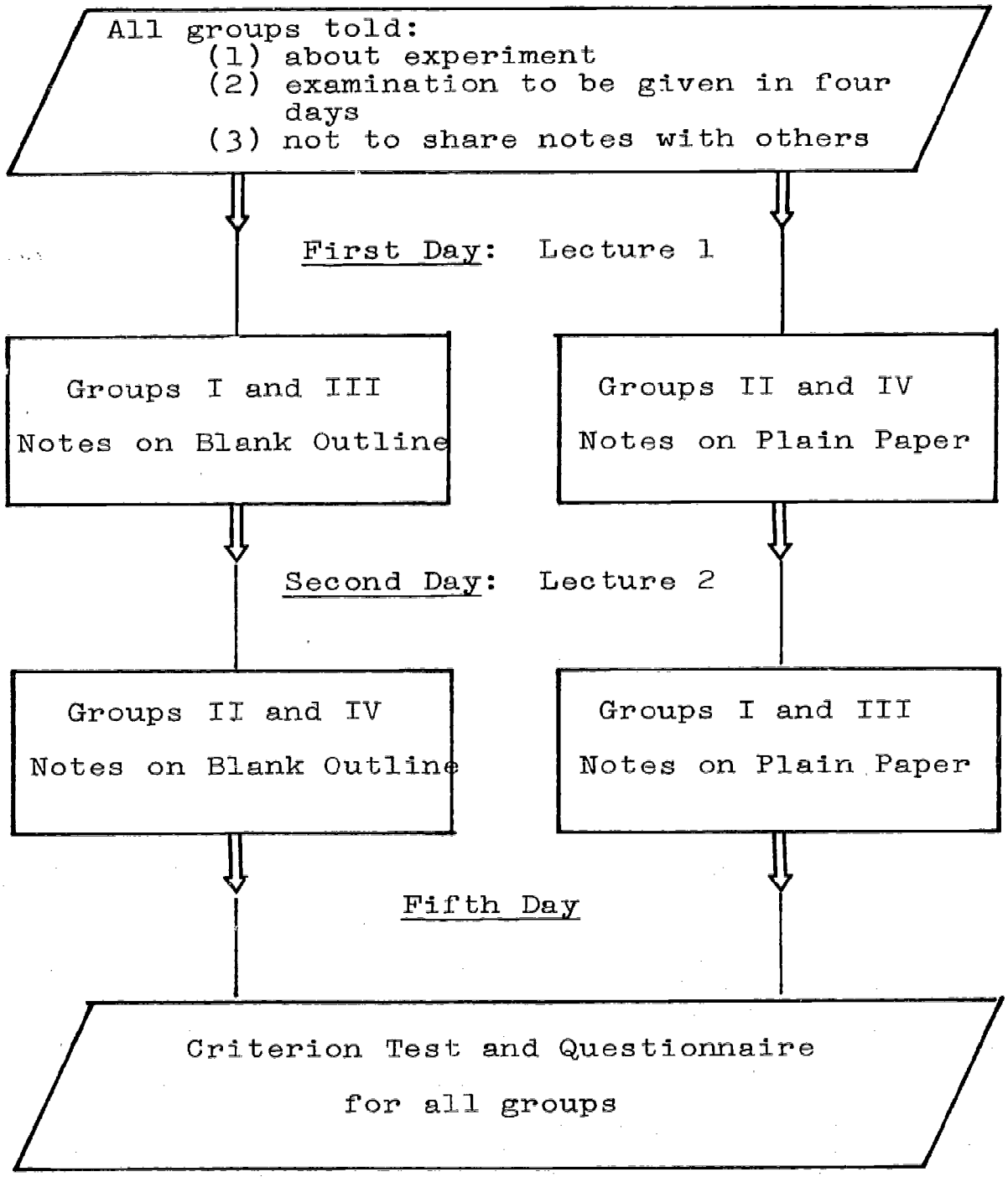


Fig. 1. General plan and treatment schedule for Experiment I.

In compiling data that had been gathered through the use of the questionnaire, only yes responses were tabulated for each of the five questions. A summary of these results is found in Table 3.

TABLE 3

PERCENTAGE OF CHEMISTRY STUDENTS RESPONDING YES TO ITEMS ON A QUESTIONNAIRE ADMINISTERED AT THE CONCLUSION OF EXPERIMENT I

1.	Did you discuss the two halogen lessons with other members of this class?	27.7%
2.	Did you discuss these lessons with a member of another class?	24.1
3.	Did you use, in any way, the notes of another chemistry student?	46.7
4.	Do you think that the Blank Outline practice has helped you to improve your note-taking skills?	82.0
5.	Do you prefer taking notes on a Blank Outline rather than on Plain Paper?	97.6

Selection of Scores for Analysis

Because no absences occurred during the two days of lectures, all scores were used in the analysis.

Analysis

In order to be able to compare odd and even test item scores, raw-scores were converted into z-scores. Mean

z-scores for the two treatments--by class groups--are shown in Table 4. Data generated by the Criterion Test were analyzed using a treatment by subject statistical design. This design was selected in order to control inter-subject differences as a source of error. Table 5 summarizes the analysis of variance for the Criterion Test score data.

TABLE 4

MEAN Z-SCORES FOR THE TWO TREATMENTS OF EXPERIMENT I--ARRANGED BY CLASS-GROUPS

Class-Groups	Blank Outline Notes	Plain Paper Notes
I	0.062	-0.192
II	0.299	-0.134
III	0.151	-0.129
IV	0.206	-0.204

After yes responses were recorded for questionnaire items (Table 3), percentages based on the total number of respondents were calculated. The proportion of yes responses to Item 5 were statistically tested in order to determine the probability of obtaining a proportion as high as the one obtained by chance.

TABLE 5

SUMMARY OF ANALYSIS OF VARIANCE BETWEEN BLANK OUTLINE NOTES (BON) AND PLAIN PAPER NOTES (PPN) IN EXPERIMENT I

Source	SS	df	ms	F	P
Total	129.41	167	-	-	-
Subjects	91.04	83	-	-	-
Treatments	3.60	1	3.60	8.57	<0.005
Error	34.77	83	0.42	-	-

Conclusions

All four classes, as shown in Table 4, obtained higher mean z-scores through use of Blank Outline Notes. Table 5 indicates that the difference between z-scores for Blank Outline Notes and Plain Paper Notes is highly significant. Based on this outcome, we may reject the null hypothesis of ". . . no difference between treatments." Apparently, Blank Outline Notes--as used in this experiment--are superior to Plain Paper Notes.

Considerable treatment contamination was revealed by the questionnaire, summarized in Table 3. Surprisingly, nearly forty-seven percent of Ss admitted to making use of another student's notes (Item 3), disregarding pre-experiment instructions. Responses to Items 1 and 2 disclosed other sources of contamination.

Most Ss felt that their experience with Blank Outline Notes had helped to improve their notetaking skills. Almost ninety-eight percent of Ss preferred taking Blank Outline Notes to Plain Paper Notes (Item 5). Since this proportion is significant at the 0.001 level, we may reject the null hypothesis of ". . . no difference in preference."

Experiment II

Background

The instructor-investigator had been assigned teaching responsibilities for a course in graphic communications. A part of the content of this course was to be taught with the aid of instructional films. This situation presented an opportunity to refine the preceding experiment and to seek answers to some related problems. The following input served as a basis for modifications to Experiment I:

1. A study by Ash and Carlton (1951) found that notetaking (called PPN by the present investigator) during a film was less effective than watching, without taking notes. The investigator wondered if BON or CO Treatments could overcome handicaps existing in PPN.

2. Almost every student-teacher has been indoctrinated with the idea of preparing her classes for all film-

watching experiences. This pedagogical process usually takes the form of a short lecture, at which time attempts are made to motivate or to provide the learner with cues designed to maximize the instructional experience. If such introductions or overviews are effective, one might expect Learning and Retention to be facilitated through use of printed Motivators as well.

3. The BON Treatment can be considered as a form of cueing for selective notetaking (Moore, 1968). If cueing has been an element responsible for increasing the effectiveness of a presentation, then further benefits might likely be a consequence of increased cueing. The CO Treatment is designed to provide learners with more cues than Blank Outlines.

4. In order to form a base-line by which to evaluate note-treatments, a watching-and-listening only treatment should be included. In this experiment, a No Note (NN) Treatment will serve that function.

5. The need to reduce or eliminate treatment contamination was revealed by the questionnaire used in Experiment I (Table 3). In this experiment, students were prevented from using each other's notes, thus controlling an important source of contamination.

Purpose

The purpose of this experiment was to provide information related to the following questions: Will printed introductions--read by learners before viewing instructional films--increase Learning and Retention of factual information? Which adjunctive instructional film-watching activity--Blank Outline Notes, Completed Outlines, Plain Paper Notes, or No Notes--will produce the greatest amount of Learning and Retention of factual information?

Subjects

This experiment was conducted in the fall semester of 1970, at a midwestern university. Forty-one female dental hygiene seniors, enrolled in a required graphic communication course, were used as Ss.

Part of the philosophy of the Dental Hygiene Program includes a professional responsibility to community dentistry objectives. To the practicing hygienist, this may mean contributing up to one-fourth of her professional life teaching concepts of hygienic and preventive dentistry to groups of various sizes and ages.

In order to be admitted into the Dental Hygiene Program, a student must have completed at least sixty hours of college credit, and have met the College of Liberal Arts general course requirements, with a minimum cumulative grade point average of 2.0--on a 4.0 scale.

Generally, women enrolled in the program are goal-oriented and extremely competitive. The course load, required of enrollees in the program, is considered heavy and fully occupies the student's time. Almost eighty-five percent of these students believed their course loads, and demands placed on them by their instructors, were excessive (Lavin, 1971).

Treatments

Two factors were studied in this experiment. Factor 1 consisted of two treatments:

A. Ss allowed to read a printed introduction--called a Motivator (M) in this experiment--before viewing a stimulus film.

B. Ss were not provided with the printed Motivator--referred to as No Motivator (NM).

Factor 2, the main treatment, consisted of the following four film-watching activities:

A. Ss take Blank Outline Notes (BON)

B. Ss follow the progress of the film with the aid of a Completed Outline (CO)

C. Ss take Plain Paper Notes (PPN)

D. Ss just watch film--they take No Notes (NN)

Treatments A, B, and C are considered to be adjunctive learning activities; Treatment D served as a base-line for determining the relative effectiveness of the other treatments.

Concurrent administration of experimental Factors 1 and 2 generated eight treatment combinations.

Stimuli

Eight different commercially produced instructional films, with a wide range of characteristics, constituted the stimuli. Descriptive data for the films is found in Table 6; titles and general content are listed in Appendix A. Each of the film presentations was an integral part of the course instruction. All films were related either to graphic production, audiovisual topics, or functional and aesthetic composition.

TABLE 6

SELECTED CHARACTERISTICS OF EIGHT INSTRUCTIONAL FILMS USED AS STIMULI IN EXPERIMENT II

Film Stimulus Number	Showing Time in Minutes	No. of Concepts Presented	Narration Rate*	Color or Black/White	Release Date
1	14	6	4.85	b/w	1956
2	14	7	1.92	c	1959
3	22	6	3.50	b/w	1955
4	17	7	5.31	c	1965
5	11	10	8.18	b/w	1957
6	17	11	4.77	c	1960
7	16	6	4.62	c	1964
8	14	7	4.57	c	1962

*Number of words per minute of showing time

Measuring Instruments

The Criterion Measure was the number of correct responses to a twenty-item true/false test that had been designed to measure Learning of factual information. Correct responses were multiplied by two in order to be consistent with previous scoring procedures used with these students. This test was administered immediately after Ss had been exposed to treatments. In order to measure Retention, the identical test was given one week later.

Hypotheses

Learning

The three hypotheses, related to Learning, to be tested were:

H_o 1. There is no difference between treatments of Factor 1 in the amount of factual information Learned from an instructional film, as measured by a twenty-item Criterion Test.

H_o 2. There is no difference between the four treatments of Factor 2 in the amount of information Learned from an instructional film, as measured by a twenty-item Criterion Test.

H_o 3. There is no interaction between Factor 1 and Factor 2 for Learning.

Retention

The three related hypotheses for Retention were:

H_o 4. There is no difference between treatments of Factor 1 in the amount of factual information Retained from an instructional film, as measured by a twenty-item Criterion Test.

H_o 5. There is no difference between the four treatments of Factor 2 in the amount of information Retained from an instructional film--as measured by a twenty-item Criterion Test.

H_o 6. There is no interaction between Factor 1 and Factor 2 for Retention.

Procedure

Subject Assignments

Ss were randomly assigned to one of eight groups. Each group consisted of at least five Ss. Ss were not told of the existence of groups.

Film-Showing and Treatment Assignments

From the second through the ninth weeks of the semester, Ss were shown a different instructional film each week, on a topic of graphics. During film showings, pairs of the eight groups of Ss participated in one of the four film-watching activities of Factor 2 treatments. One group, of each of the pairs of groups, was furnished with a

printed Motivator (Factor 1), to be read by Ss before viewing the film; the other group of the pair was not provided with the Motivator. Each week--with every new film shown--group pairing was changed. Treatment order was arranged so that each of the eight groups followed a different sequence through Factor 1 and Factor 2 treatments. The treatment schedule is shown in Figure 2. By the eighth and final film, each group experienced all four Factor 2 treatments twice, and each of the two Factor 1 treatments four times. In other words, groups were scheduled to experience each of the four film-watching activities twice--once with Motivator (M) and once with No Motivator (NM).

Treatment Packets

For each film used in this experiment, eight different treatment packets were prepared. These packets consisted of the following material:

1. A white cover sheet which provided:
   a. Space for the student's I.D. number
   b. A film reference number
   c. Form designations to help in the proper assembly of packets
   d. General instructions to the Ss
   e. A Motivator or No Motivator, depending on the treatment

Stimulus Film Number	BON		CO		PPN		NN	
	M	NM	M	NM	M	NM	M	NM
1	VII	II	III	I	IV	VIII	VI	V
2	II	VII	V	III	VI	I	IV	VIII
3	VIII	IV	VI	VII	II	V	III	I
4	VI	III	I	II	VIII	IV	V	VII
5	III	VIII	VII	IV	V	II	I	VI
6	V	I	II	VI	VII	III	VIII	IV
7	IV	VI	VIII	V	I	VII	II	III
8	I	V	IV	VIII	III	VI	VII	II

Fig. 2. Group treatment schedule for the eight instructional film-showings used in Experiment II.

2. The blue second sheet contained:
   a. Form designation
   b. Instructions to Ss telling them what they are to do while the film is being shown. This sheet is keyed to one of the four treatments of Factor 2.
3. The treatment consisted of either a Blank Outline, a Completed Outline, or Plain Paper.

All treatment packets were made to appear as nearly alike as possible. See Appendix B for sample packet.

Prior to weekly class meetings, student I.D. numbers were written on the cover sheet of treatment packets,

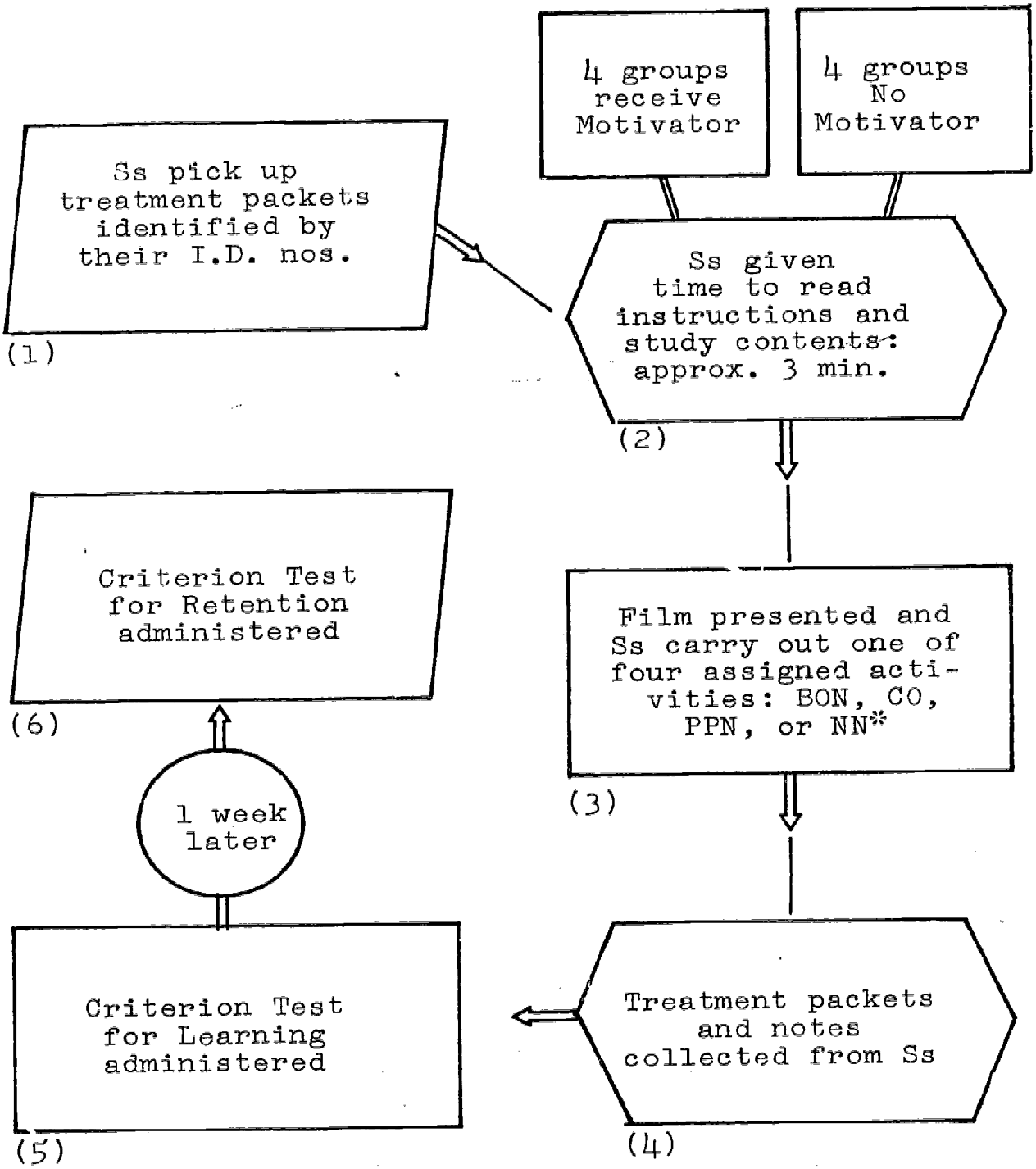
according to a predetermined group sequence schedule (Figure 2). Packets were then numerically arranged on a table in the classroom, so that all numbers were visible.

Logistics

On the week of the first film showing, Ss were told to pick up the packet with their I.D. number and then to return to their seats. After all Ss were again seated, they were permitted to read the instructions and other content of the packets. After approximately three minutes, fluorescent room lights were turned off and film-viewing lights were turned on. The scheduled film was then shown. Immediately after the film-showing, treatment packets were collected and the Criterion Test was given to measure Learning. One week later, the identical test was again given to measure Retention. At no time during the entire experiment were films or criterion tests discussed with Ss. Figure 3 shows the experimental procedure used for administering treatments and Criterion Test for one instructional film.

Instructions to Students

During the first class meeting of the semester, Ss were informed that they would be participating in an experiment designed to discover which film-watching activity produced the greatest amount of Learning. They were also



*All four adjunctive activities are carried on simultaneously, with each stimulus film.

Fig. 3. Procedure used in Experiment II for administering treatments and Criterion Tests for one instructional film.

told that test scores on the film content would have no bearing on their course grades. They were requested, however, to follow instructions carefully and to answer test items as accurately as possible. The general plan of the experiment was explained and specific instructions regarding their conduct--with rationale--were announced. During the experiment-portion of the class meetings, they were instructed not to talk to classmates and, instead, to concentrate on their treatment packets.

Experimental Environment

All class meetings were held in the audiovisual lecture room of the university. In addition to the usual audiovisual equipment, this room was provided with low-level lights for viewing films.

Data

Tabulation

Criterion Test scores, for both Learning and Retention, were first tabulated for Ss--by groups. After scores for all tests had been entered, they were reassembled into new tables based on the eight treatment combinations.

Selection of Scores for Analysis

For several reasons, most Ss had to be absent from class one or more times during the nine class meetings required to complete the cycle of treatments. When a subject missed one of the treatments, the same Ss' paired Factor 1 treatment score--in the M or NM category--was eliminated from the analysis. In this way, remaining scores were paired by Factor 2 treatments. This elimination procedure was used for both Learning and Retention scores. Table 7 shows the number of Criterion Test scores that remained for analysis after absences and unpaired scores were eliminated.

TABLE 7

PAIRS OF SCORES REMAINING FOR ANALYSIS IN EXPERIMENT II

Treatment	BON	CO	PPN	NN	Total Pairs
Learning	19	14	14	20	67
Retention	17	10	11	13	51

Analysis

In order to compare Criterion Test results for the eight films, it was first necessary to calculate the mean and standard deviation for each test (Table 8).

Raw-scores were then converted to z-scores. Mean z-scores for treatments appear in Tables 9 and 10.

TABLE 8

MEAN SCORES AND STANDARD DEVIATIONS FOR CRITERION LEARNING AND RETENTION TESTS FOR EIGHT INSTRUCTIONAL FILMS USED IN EXPERIMENT II

Stimulus Film No.	Learning Mean	Learning S.D.	Retention Mean	Retention S.D.
1	31.1	2.7	30.0	2.0
2	32.9	2.4	32.6	3.3
3	29.7	3.3	27.6	3.4
4	29.7	3.9	26.8	4.3
5	29.7	2.7	26.6	3.8
6	29.4	3.8	25.3	4.4
7	35.3	1.6	34.9	3.1
8	35.9	3.2	33.1	2.2

TABLE 9

TREATMENT Z-SCORE MEANS FOR LEARNING IN EXPERIMENT II

Factor 2	Factor 1 M	Factor 1 NM	$\frac{M + NM}{2}$
BON	0.028	0.289	0.158
CO	0.261	0.250	0.256
PPN	-0.139	-0.047	-0.093
NN	-0.296	-0.304	-0.300

TABLE 10

TREATMENT Z-SCORE MEANS FOR RETENTION IN EXPERIMENT II

Factor 2	Factor 1 M	Factor 1 NM	$\frac{M + NM}{2}$
BON	0.324	0.372	0.348
CO	-0.291	0.012	-0.140
PPN	-0.340	-0.192	-0.266
NN	-0.037	-0.322	-0.180

To test for significance between the two treatments of Factor 1, and to determine if interaction between Factors 1 and 2 occurred, an A by B factorial design was used to analyze data. Learning data has been summarized in Table 11; Retention data in Table 12.

TABLE 11

SUMMARY OF ANALYSIS OF VARIANCE FOR LEARNING BETWEEN FACTORS 1 AND 2 OF EXPERIMENT II

Source	SS	df	ms	F	p*
Total	105.39	133	-	-	-
Factor 1	0.26	1	0.26	0.33	0.60
Factor 2	6.63	3	2.21	2.83	0.04
Factors 1 x 2	0.45	3	0.15	0.19	0.67
Error	98.05	126	0.78	-	-

*Approximate values

TABLE 12

SUMMARY OF ANALYSIS OF VARIANCE FOR RETENTION BETWEEN FACTORS 1 AND 2 OF EXPERIMENT II

Source	SS	df	ms	F	p*
Total	102.77	101	-	-	-
Factor 1	0.03	1	0.03	0.03	0.99
Factor 2	6.80	3	2.27	2.25	0.09
Factors 1 x 2	1.19	3	0.39	0.39	0.52
Error	94.75	94	1.01	-	-

*Approximate values

The probability (p) associated with F-values for Learning and Retention for Factor 2 fell below the 0.10 level. For this reason, all possible mean z-score differences were checked for significance through use of t-tests. A summary of t-tests for Learning is found in Table 13; for Retention in Table 14.

TABLE 13

EXPERIMENT II: LEARNING: T-TEST FOR ALL POSSIBLE DIFFERENCES OF MEANS

Comparisons	t-values	p*
BON - CO	0.38	0.72
BON - PPN	0.99	0.38
BON - NN	2.01	0.05
CO - PPN	1.29	0.26
CO - NN	2.22	0.04
PPN - NN	0.83	0.46

*Approximate values

TABLE 14

EXPERIMENT II: RETENTION: T-TEST FOR ALL POSSIBLE DIFFERENCES OF MEANS

Comparisons	t-values	p*
BON - CO	1.69	0.10
BON - PPN	2.16	0.04
BON - NN	1.99	0.04
CO - PPN	0.80	0.42
CO - NN	0.26	0.80
PPN - NN	0.58	0.56

*Approximate values

Conclusions

Based on a conservative 0.05 level of significance, of the six hypotheses being tested, only H_o 2 may be rejected (Table 11). Apparently, treatments BON, CO, PPN, and NN have been responsible for increasing between-group variance.

When mean Learning scores for each of the Factor 2 treatments were compared in all possible combinations (Table 13), the following results were obtained:

1. BON proved superior to NN at the 0.05 level.
2. CO proved superior to NN at the 0.05 level.

The apparent inconsistencies between Tables 13 and 14 will be discussed in Chapter IV.

Comparison of all possible combinations of mean Retention scores (Table 14) provides some evidence that only the Blank Outline Note Treatment was significantly superior to the Plain Paper Note and the No Note Treatments.

Experiment III

Background

Soon after Experiment II was under way, the need to reduce or eliminate absences in future experiments became apparent. Because almost half the anticipated data failed to develop, it was felt that the experimental intent had been considerably weakened. To improve the experiment,

attendance should be made mandatory.

An additional weakness of Experiment II may have been due to the wide assortment of stimulus films used. Northrop (1952) furnishes evidence that film organization may affect the usefulness of outline material to the learner. It might, therefore, be desirable to control this variable by using stimulus films having similar organization.

Purpose

This experiment was designed to provide evidence concerning the following question: Do Blank Outline Notes consistently produce more Learning and greater Retention of factual information--when used as adjunctive film-watching activities--than do Completed Outlines, Plain Paper Notes, or No Notes?

Subjects

This experiment was conducted during the last five weeks of the fall semester, 1970. Ss were the same forty-one dental hygiene seniors, used in Experiment II.

Treatments

The four adjunctive activity-treatments--called Factor 2 in Experiment I--were used in this experiment, also. They consisted of:

A. Blank Outline Notes (BON)

B. Completed Outlines (CO)

C. Plain Paper Notes (PPN)

D. No Notes (NN)

Stimuli

Four instructional films--produced by a single studio and under the supervision of the same director--served as stimuli. Each film dealt with a few graphic-related concepts and employed vocabulary and ideas consistent with member-films of the series. Selected characteristics of these films are summarized in Table 15; titles and general content are listed in Appendix A.

TABLE 15

SELECTED CHARACTERISTICS OF FOUR INSTRUCTIONAL FILMS USED AS STIMULI IN EXPERIMENT III

Film Stimulus Number	Showing Time in Minutes	No. of Concepts Presented	Narration Rate*	Color or Black/White	Release Date
1	21	5	6.87	c	1967
2	15.5	8	4.58	c	1965
3	18	5	7.45	c	1965
4	16	6	5.67	c	1966

*Number of words per minute of showing time.

Measuring Instruments

The Criterion Measure was the number of correct responses--multiplied by two--to a fifteen-item true-false test, designed to measure both Learning and Retention of factual information. Because each stimulus film covered only a few concepts, it was necessary to reduce the number of Criterion Test items from twenty to fifteen. As in Experiment II, a Learning test was given immediately after the film-showing; the Retention test was administered one week later.

Hypotheses

H_o 1. There is no difference in the amount of factual information Learned from an instructional film--as measured by a fifteen-item Criterion Test--between four film-watching activities.

H_o 2. There is no difference in the amount of factual information Retained from an instructional film--as measured by a fifteen-item Criterion Test--between four film-watching activities.

H_o 3. Treatments will not affect change-scores which occur between Learning and Retention tests.

Procedure

The procedure was identical to one used in Experiment II. Group compositions were not altered, and similar

treatment scheduling was also employed. Figure 4 shows the group treatment schedule.

Stimulus Film No.	BON	CO	PPN	NN
1	VII-II	VIII-IV	I-V	III-VI
2	III-I	VI-VIII	IV-VIII	V-II
3	IV-VIII	II-V	III-VI	I-VII
4	VI-V	III-I	VII-II	IV-VIII

Note: Roman numerals identify eight groups of Ss.

Fig. 4. Group treatment schedule for the four instructional film-showings used in Experiment III.

Except for the elimination of Motivator/No Motivator Treatments of Factor 1, treatment packets were similar to those used in Experiment II.

Instructions to Ss.

Ss were told that attendance at the next four film-showings would be required, and that scores made on the Criterion Tests would be considered in computing final grades. If they found it necessary to miss one of these classes, they would be expected to attend an evening make-up session.

Experimental Environment

Attempts were made to duplicate, as closely as possible, the environmental conditions of Experiment II.

Data

Tabulation

Criterion Test scores were first entered on a treatment by subject table. Separate tables were used to record Learning and Retention scores.

A set of change-scores were generated by subtracting Ss' Retention Test scores from their Learning Test scores, for each of the treatments. From these data, mean change-scores were calculated for further statistical analysis.

Selection of Scores for Analysis

Thirty-nine Ss were used in this experiment. Two Ss--of the original forty-one--missed one of the films and were thus excluded from the analysis. A total of eight Criterion Test scores were recorded for each of the Ss--four each for Learning and for Retention.

Analysis

In order to compare Criterion Test scores for the four films, separate means and standard deviations were calculated for each of the tests. These values are reported in Table 16. From this, raw-scores were converted

to z-scores. The z-score treatment means (Table 17)--for both Learning and Retention data--were analyzed using a treatment by subject statistical design to determine if they differed significantly. Results of these tests are summarized in Tables 18 and 19. Because F-values were significant, it was necessary to use a multiple comparisons statistical technique to determine which specific scores differed significantly. These data have been summarized in Tables 20 and 21.

TABLE 16

CRITERION TEST MEANS AND STANDARD DEVIATIONS FOR MEASURING LEARNING AND RETENTION IN EXPERIMENT III

Film Stimulus Number	Learning		Retention	
	Mean	S.D.	Mean	S.D.
1	25.0	3.2	27.4	2.6
2	25.2	1.8	24.6	1.3
3	26.4	3.0	24.9	2.9
4	25.3	2.6	24.6	3.2

TABLE 17

MEAN CRITERION LEARNING AND RETENTION Z-SCORES FOR FOUR TREATMENTS OF EXPERIMENT III

Treatment	Learning	Retention
Blank Outline Notes (BON)	0.29	0.20
Completed Outlines (CO)	0.27	0.18
Plain Paper Notes (PPN)	-0.08	-0.004
No Notes (NN)	-0.48	-0.41

TABLE 18

SUMMARY OF ANALYSIS OF VARIANCE FOR LEARNING IN EXPERIMENT III

Source	SS	df	ms	F	p
Total	154.95	155	-	-	-
Treatment	15.31	3	5.10	6.90	0.001
Subjects	55.48	38	1.46	-	-
Error	84.16	114	0.74	-	-

TABLE 19

SUMMARY OF ANALYSIS OF VARIANCE FOR RETENTION IN EXPERIMENT III

Source	SS	df	ms	F	p
Total	218.22	155	-	-	-
Treatment	9.00	3	3.00	2.73	0.05
Subjects	82.98	38	2.18	-	-
Error	126.24	114	1.10	-	-

TABLE 20

EXPERIMENT III: LEARNING: T-TESTS FOR ALL POSSIBLE DIFFERENCES OF MEANS

Comparisons	t-values	p*
BON - CO	0.09	0.99
BON - PPN	1.61	0.10
BON - NN	3.35	0.002
CO - PPN	1.52	0.14
CO - NN	3.26	0.002
PPN - NN	1.74	0.10

*Approximate values

TABLE 21

EXPERIMENT III: RETENTION: T-TESTS FOR ALL POSSIBLE DIFFERENCES OF MEANS

Comparisons	t-values	p*
BON - CO	0.09	0.99
BON - PPN	0.88	0.40
BON - NN	2.65	0.01
CO - PPN	0.78	0.44
CO - NN	2.56	0.02
PPN - NN	1.78	0.10

*Approximate values

An additional analysis was made to determine if mean change-scores--that occurred between Learning and Retention Tests--had been affected by treatments. A treatment by subject design was used in this instance, also. These data have been summarized in Table 22.

TABLE 22

SUMMARY OF ANALYSIS OF VARIANCE FOR LEARNING AND RETENTION SCORE DIFFERENCE (CHANGE-SCORES) IN EXPERIMENT III

Source	SS	df	ms	F	p
Total	163.37	155	-	-	-
Treatments	1.70	3	0.57	0.51	0.48
Subjects	40.81	38	1.08	-	-
Error	120.86	114	1.12	-	-

Conclusions

Analysis of variance for Learning was significant at the 0.001 level (Table 18); for Retention, the 0.05 level was attained (Table 19). Based on these outcomes, hypotheses H_o 1 and H_o 2 may be rejected. From these results, it may be concluded that experimental treatments have influenced both Learning and Retention.

After examining Tables 20 and 21, the following conclusions may be made:

1. BON and CO Treatments are similar in overall effectiveness.
2. The observed differences between BON and PPN favored BON, but were not significant.
3. The observed differences between CO and PPN favored CO, but were not significant.
4. The observed differences between PPN and NN favored PPN, but were not significant.
5. Both the BON and CO Treatments proved superior to the NN Treatment, at less than the 0.05 level.

Analysis of variance for change-scores (Table 22) indicated that observed differences were not significant; therefore, H_o 3 must be retained.

CHAPTER IV

DISCUSSION

Experimental Design

Statistics

In order to control inter-subject differences as a source of error, a treatment by subject statistical design was employed to analyze data collected from Experiment I. Because scheduling complications were encountered with Experiment II, it was not possible to use this design. During the period in which Experiment II was being conducted, almost all Ss missed one or more of the experimental treatments. Due to this circumstance, group composition changed from week to week. For this reason, an A by B factorial design was substituted for testing data obtained from Experiment II.

In Experiment III, where absences were greatly reduced because student attendance was required, the treatment by subject design was again used. When a significant F-ratio was found, t-tests for all possible differences between means were employed. A more appropriate test for multiple comparisons would have been the Tukey Proposal, as modified by Snedecor (1956). This test was not used

for two reasons. First, the investigator believed it to be too conservative for the nature of the situation. Second, available tables of q-values yielded information for the 0.01 and 0.05 levels of significance, only. For this study, it was felt that experimental outcomes would be more useful if expressed in probability values. These units permit results of the three experiments to be compared and thus enable readers to decide on acceptable levels of significance.

Traditional levels of significance (0.01 or 0.05) may not be appropriate for all types of educational research. Potentially valuable research findings may be discarded because of unreasonably stringent alpha-levels. Barnes (1960, p. 16) states, "If the average teacher could be assured of making the right judgement 75 times in 100, this would be a most welcome advance." In stating this idea another way, he says, ". . . if the teacher could teach at the 25 per cent level of significance, this would be a worthwhile gamble." Each of the F-values associated with the three experiments comprising this study (Table 23) are associated with probabilities of less than 0.09. As alpha increases, the likelihood of committing a Type I error--rejecting a null hypothesis when it is, in fact, true--also increases. In this study, the consequences of a type II error--failure to reject a false null hypothesis--would be more serious than a Type I error. With

conservative alpha-levels, the probability of overlooking an activity which may facilitate Learning or Retention for large numbers of students, is increased. If a Type I error is committed, however, adverse effects on the learner are practically non-existent. Cost is often a factor when weighing the consequences of a Type I error. Since Blank or Completed Outlines may be prepared and distributed at small expense, the increased risk of higher alpha-levels may easily be justified.

TABLE 23

APPROXIMATE PROBABILITIES ASSOCIATED WITH F-VALUES FOR EXPERIMENTS I, II, AND III

	I	II	III
Learning	*	0.043	0.001
Retention	0.005	0.089	0.050

*Appropriate data unavailable

Experiment I

In this experiment, the BON Treatment proved superior to PPN. As previously pointed out, chemistry students represent a highly select group of high school learners. For this reason, it is difficult to generalize this experimental outcome without follow-up investigations.

The fact that stimuli consisted of instructional material, and that Criterion Measures were test questions--both parts of the actual chemistry course--add to the practicality of the findings.

It was not possible to measure the full instructional impact of the BON Treatment on the Ss. If their note-taking skills improved--as they reported (Table 3, Item 4)--through previous experience with Blank Outlines, one might expect even greater differences in treatment means if the Blank Outline Group had been compared to an experimental control group that lacked this experience.

Another possible source of experimental error was that four classes, meeting at different times during the day, were used. In order to compare class results, the identical Criterion Test was administered to all classes. Because classes could not be tested at the same time, students had opportunity to pass on information about the test to students from classes meeting later in the day.

In experiments of this type, treatment sequence--as it relates to recency--may also lead to error. This may occur if one or more of the treatments used in the study have a recency advantage at the time that Ss are given a criterion test. In this study, control was exercised by counter-balancing the sequence of treatments for the four classes (Figure 1). Two groups--I and III--received the Blank Outline Treatment during the presentation

which was given on the first day; the remaining two groups received it on the second day.

Experiment II

Soon after this experiment had begun, the investigator realized that it would be logistically impossible to have all Ss experience all treatments, as originally intended. Becuase this condition could not be met, some of the power of the intended experimental design had been lost.

In order to apply a suitable statistical test, it was found necessary to remove Criterion Test scores of seventeen Ss from Learning-score data and thirty Ss from Retention-score data. This represented a loss of twenty-eight percent of the anticipated data. In conducting this radical elimination process, it is likely that a sizeable statistical bias had been introduced into the analysis.

Lack of significance for the effect of Factor 1 (Motivator/No Motivator Treatments) seems fairly conclusive. Introductions, of the type used in this experiment, had not been influential in producing significantly more Learning or Retention. This outcome does not support previous research which had investigated the value of other types of introductions. Similarly, the very low F-value obtained for testing interaction of Factors 1 and

2 removes most doubt in this area. The use of Motivators had not significantly influenced the treatment effects of Factor 2 (note modes).

Superficial examination of the combined mean z-scores (M/2 + NM/2) for Learning compared to the mean z-scores for Retention (Tables 9 and 10) seems to defy simple explanation. The Pearson product-moment correlation--for the two sets of scores--yields an r-value of 0.46. A higher correlation might be expected if important variables had been controlled. This relatively low correlation could, therefore, reflect serious experimental procedural errors--perhaps, due to one or more of the following factors:

1. Since attendance was not required, the possibility that frequently absent Ss had some characteristic which interacted with treatments cannot be eliminated.
2. Ss had been told that Criterion Test scores would not be computed into course grades. For this reason, they may have become indifferent to stimuli or criterion questions.
3. Because Ss knew they were participants in an experiment, a Hawthorne Effect may have influenced early treatments.

4. Treatments and Criterion Tests were administered over a nine-week period. During this time, boredom may have developed.
5. The stimulus films used in this experiment could have contributed to the apparent outcome inconsistencies. Inter-film differences, based on general characteristics, were quite extreme (Table 6 and Appendix A).

No attempt had been made to study the film-variable in this experiment. The films shown to Ss were primarily selected for their instructional value to the course, and secondarily for their research value. Ideally, future studies should attempt to either study or control this variable.

In the only area where procedures of Experiment I were comparable to Experiment II, findings were in agreement. In both experiments, BON was significantly superior to PPN (Table 26).

Experiment III

Weaknesses in Experiments I and II were reduced through procedural changes initiated in this final experiment. Through elimination of Factor 1, treatment combinations were reduced from eight to four. This reduction had the effect of doubling the number of Ss available

for remaining treatments, thus increasing statistical power.

After experiencing erratic attendance behavior exhibited by Ss in the previous experiment, the instructor announced that attendance would be required for the remainder of the semester (the duration of Experiment III). In this way, usable data was collected from thirty-nine Ss, representing ninety-five percent of those starting in the experiment.

In an attempt to discourage indifference to instructional stimuli, Ss were informed that Criterion Test scores--covering the next four films--would be computed in their final grades.

Attempts to control the film variable were also somewhat successful. Four film stimuli, with the following characteristics, were found:

1. Subject-matter was consistent with course objectives.
2. They were all produced by the same studio and director.
3. All belonged to a single series of instructional films.
4. Organization, technique, and narration style were comparable.
5. The same voice was used on all narration.

A summary of mean Criterion z-scores (Table 17) provides evidence for the superiority of the three note-related treatments--BON, CO, and PPN--over the NN Treatment for Learning and Retention of factual information. Treatment differences between BON and CO were small--slightly favoring BON. When BON and CO were compared to the PPN Treatment, the former proved superior--especially for Learning. With exception of the BON - CO Treatment comparison (Tables 20 and 21), all t-tests for Learning reached a level of significance acceptable to standards for evaluation of educational research ($p < 0.25$), suggested by Barnes (1960); for Retention, the three note treatments proved significantly superior to the No Note Treatment.

Summary of Results

In comparing mean z-scores obtained from BON and PPN Treatments for Experiments I and III (Table 24), the high school learners seemed to derive relatively greater Retention benefit through use of BON, than did dental hygiene seniors. Further, the high school group received lower mean z-scores with the PPN Treatment. Such results could be anticipated if one considers the likelihood of college seniors having had more experience at notetaking than high school students.

TABLE 24

COMPARISON OF MEAN RETENTION Z-SCORES OBTAINED BY HIGH SCHOOL CHEMISTRY STUDENTS AND DENTAL HYGIENE SENIORS FOR BON AND PPN TREATMENTS FROM EXPERIMENTS I AND III

Subjects	Treatments BON	PPN
High School Chemistry Students (Experiment I)	0.179	-0.165
Dental Hygiene Seniors (Experiment III)	0.200	-0.004

Because of the low probabilities associated with F-values for the three experiments (Table 23), Tables 25 and 26 were generated. Each tabled value may be regarded as an index of difference, or similarity, between any of the two treatments being compared. Comparisons yielding high values ($p < 0.25$) indicate that similar effects were produced by the treatments. Low values ($p < 0.100$)--by contrast--indicate a marked superiority, favoring the first of the two treatments being compared.

If one is in agreement with the position taken by Barnes, and is willing to make allowances for the inadequacies of Experiment II, the following conclusions may be drawn from Tables 25 and 26:

1. Blank Outline Notes and Completed Outlines are probably similarly effective.

TABLE 25

EXPERIMENTS I, II, AND III: LEARNING: SUMMARY OF APPROXIMATE PROBABILITIES ASSOCIATED WITH T-TESTS FOR ALL POSSIBLE DIFFERENCES OF MEANS (FROM TABLES 13 AND 20)

Comparisons	I	II	III
BON - CO	*	0.72	0.99
BON - PPN	*	0.38	0.10
BON - NN	*	0.05	0.002
CO - PPN	*	0.26	0.14
CO - NN	*	0.04	0.002
PPN - NN	*	0.46	0.10

TABLE 26

EXPERIMENTS I, II, AND III: RETENTION: SUMMARY OF APPROXIMATE PROBABILITIES ASSOCIATED WITH T-TESTS FOR ALL POSSIBLE DIFFERENCES OF MEANS (FROM TABLES 5, 14, AND 21)

Comparisons	I	II	III
BON - CO	*	0.10	0.99
BON - PPN	0.005	0.04	0.40
BON - NN	*	0.04	0.01
CO - PPN	*	0.42	0.44
CO - NN	*	0.80	0.02
PPN - NN	*	0.56	0.10

*Appropriate data not available

2. Blank Outline Notes and Completed Outlines are probably superior to Plain Paper Notes--especially for Learning.
3. Blank Outline Notes are superior to No Notes.
4. Completed Outlines and Plain Paper Notes are probably superior to No Notes.

Weaknesses of the Study

Ss used in the three experiments represent highly select groups of, mostly female, learners. Generally, chemistry students are more academically talented than other high school learners. Dental hygiene majors differ markedly from the general population of college students in that they had successfully completed three years of satisfactory academic work before becoming Ss in this study. Further, motivational levels in both groups are likely to be substantially higher than respective peer groups. Almost all chemistry students expressed a desire to attend college after completion of their high school studies; dental hygiene majors had already decided upon a career in dentistry before entering the program. For these reasons, conclusions based on this research may be generalized only to groups of learners having similar characteristics.

Additional weaknesses of the study were:

1. Treatments were used to measure the Ss ability

to process factual information, only.

2. Treatment contamination for Retention score data was not adequately controlled.
3. The benefit of notes, as study aids, was not measured.
4. Experimental control groups were not used.
5. Film, as a variable, was not fully controlled.

Suggestions for Improvement

A simple randomized, or completely randomized, statistical design (Bruning and Kintz, 1968) would permit more adequate control of several variables which have likely influenced experimental outcomes. Through use of this design, exposure to a single audiovisual stimulus would enable an investigator to collect data on the effects of all four treatments. With an appropriate target audience, a number of design weaknesses--listed in the preceding section--could have been eliminated. Using this design would also permit inclusion of an experimental control group--one which would not be exposed to either treatments or stimulus material. Such a group could aid in establishing realistic base-lines for evaluating treatment benefits.

Educational Implications

When Blank or Completed Outlines are not available, learners should be encouraged to take Plain Paper Notes in

most instructional situat' ıs. When a presentation is rapidly paced, attempts at notetaking--without the aid of printed outlines--may have debilitating effects.

Through use of Blank Outline Notes or Completed Outlines, the instructor may guide a learner's attention to specific factual information contained in a presentation. Outlines may be prepared for use with lectures, demonstrations, and any mode of audio, visual, or audio-visual presentations. They may be used with instruction for individual learners, and for large or small groups. When used with existing instructional material, the teacher may wish to stress some concepts and to ignore others. Blank or Completed Outlines may be designed which will accomplish these purposes. When used with teacher-made presentations, such as lectures, Outlines may serve to inform the learner what should be derived from the instruction he is experiencing.

When effective instruction requires written, overt responses, Blank Outlines may be used. If covert responses will serve equally well, Completed Outlines may be provided. Completed Outlines would also prove useful in situations where notetaking is difficult or impossible, such as with rapidly paced presentations or in darkened rooms.

Current trends in education--toward use of educational media, individualized instruction, and independent

study--increase the need for simple methods which will permit instructional designers to incorporate a wide variety of existing media into course systems. Properly designed Blank or Completed Outlines can be useful in improving Learning and Retention of factual information.

CHAPTER V

SUMMARY

The problem in using some audiovisual software is in overcoming existing deficiencies so as to increase their effectiveness and, also, permit course designers to adapt such material for specific instructional needs.

The purpose of this investigation was to determine the value of notetaking and prepared notes, as adjunctive activities, in improving audiovisual instruction.

Methods

A series of three related experiments comprised this study. In Experiment I, four high school chemistry classes--composed of a total of eighty-four students--were used as Ss to determine the relative effectiveness of two notetaking modes. Two audio-taped lectures, with projected visuals, were used as stimuli. During the first lecture, half the Ss took notes on plain paper; the other half was provided with a specially prepared Blank Outline on which to take their notes. For the second lecture, the alternate treatment was given to the two groups. In this way, each of the Ss experienced both treatments. A few days after the conclusion of the second lecture, a

Criterion Test--consisting of twenty questions which were formulated from the two lessons--was administered. This instrument was constructed so that test results yielded two scores--one for each presentation. Results regarding the value of Blank Outline Notes were encouraging and, therefore, prompted further investigation.

Experiment II was conducted within the framework of a required graphic communication course. In order to more adequately study the effects of outlines on Learning and Retention from audiovisual presentations, eight treatment combinations were devised. Ss were forty-one female dental hygiene college seniors. Experimental treatments were made up of two factors. Factor 1 was designed to study the effects of printed introductions--called Motivators (M)--on Learning and Retention from instructional films. Factor 2 consisted of the following four film-watching activities:

A. Ss take Blank Outline Notes (BON).

B. Ss follow the progress of the film with the aid of Completed Outlines (CO).

C. Ss take Plain Paper Notes (PPN).

D. Ss just "watch" and "listen" to films--they take No Notes (NN).

Eight film stimuli were shown in the course of the experiment--one each week. With each presentation, Ss

received a packet which included material and instructions for carrying out one of the four film-watching activities. Half the Ss were provided with a Motivator in their packets; the other half received No Motivator. Immediately after presentation of each film stimulus, notes were collected and a twenty-item Criterion Test was administered to measure Learning. One week later, the same test was used to measure Retention.

Both Motivator and film-watching activities were carefully scheduled in the hope that each participant would have experienced the two Motivator treatments four times and each film-watching activity twice, by the conclusion of the experiment. Unforeseen class-scheduling difficulties led to a high subject-absence rate, which interfered with the intended experimental design. For this and other reasons, portions of the results exhibited inconsistencies.

Experiment III was designed to overcome difficulties encountered in Experiment II. Subject-absences were practically eliminated, and a way was found to partially control the variable film. Ss from Experiment II were again used. Because the Motivator Treatment failed to increase between-group variance significantly, Factor 1 was eliminated from this design. This had the effect of substantially increasing the power of the experiment.

Further, the number of Criterion Test items were reduced from twenty to fifteen. All other conditions remained as in Experiment II.

Results

In Experiment I, which compared Blank Outline Notes and Plain Paper Notes, the former treatment proved superior.

Experiment II showed that Motivators failed to produce noticeable improvement on the effects of instruction for either Learning or Retention. Similarly, use of Motivators had not produced significant interaction with treatments of Factor 2 (film-watching activities). Based on mean z-scores for treatments, Ss seemed to both Learn and Retain more factual information through use of BON and CO Treatments. The results produced by this experiment, however, may lack reliability because of the high student-absence rate and the wide variation in stimulus film characteristics.

Findings in Experiment III produced sharply delineated tendencies. BON and CO were shown to be similarly effective for the stimuli used in this experiment. These treatments were also shown to be superior to PPN--especially for Learning. Each of the Note treatments indicated a decided tendency to be more effective than NN. Considering allowance for inadequacies of

Experiment II, conclusions drawn from the three experiments seem consistent.

Implications

Proper use of Blank or Completed Outlines can result in more Learning and Retention when used as adjuncts to audiovisual presentations. When outline material is not available, learners should be encouraged to take Plain Paper Notes, if the presentation is not too rapid for notetaking.

Outlines may be prepared which will serve a variety of important instructional functions. They have the potential for directing learner's attention to specific content, they are capable of providing preliminary information--vital to the understanding of a lesson, and they may be used as a medium for overt student participation in situations where such activity is indicated.

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APPENDIX A

DESCRIPTIONS OF INSTRUCTIONAL FILM-STIMULI*

Experiment II

Film Stimulus Number	Film Descriptions
1	**FILM RESEARCH AND LEARNING** 34265 A (WITICH-IFB 1956) 14 min b/w 4.25 Presents some of the basic research relating to the values of educational motion pictures and the results obtained when they are used in the classroom. States a strong case for the establishment and effective use of the audiovisual program in a school system.
2	**MORE THAN WORDS** 35757 IJSCA (-STRAUS 1959) 14 min color 5.25 This film analyzes problems to better communication between people. Outlined are methods which can be employed to build an atmosphere conducive to understanding and receptivity.
3	**LETTERING INSTRUCTIONAL MATERIALS** 44568 JSCA (-UIND 1958) 22 min b/w 5.75 The film surveys easy-to-use lettering methods and shows how the inexperienced person can use the methods described for lettering on signs, posters, bulletin boards, and displays
4	**DISCOVERING CREATIVE PATTERN** 30023 IJS (-BFA 1965) 17 min color 6.10 Pattern is visual organization. Through rhythmic repetition it enriches a surface, leading the eye across it. Man makes use of pattern in his art; weaving, printed textiles, architecture, painting, and sculpture. Pattern is found in the art of all ages.
5	**PHOTOGRAPHIC SLIDES FOR INSTRUCTION** 24596 SCA (-UIND 1957) 11 min b/w 3.30 Shows the preparation and use of slides made by the photographic process. The use of color and black and white film is illustrated in outdoor and indoor situations. Flash photography, copying, and the use of Polaroid transparency film for making slides in a variety of subject areas are shown.
6	**PROJECTING IDEAS ON THE OVERHEAD PROJECTOR** 35334 CA C (-UIOWA 1960) 17 min color 5.85 SALE 150.00 Advantages of the overhead projector as a visual aid to learning in classrooms, in business and industry. Variety of uses of the equipment, with opaque, translucent, and transparent materials, in contrasting colors and monochrome. Ease with which effective presentations can be improvised through use of movable graphic components, overlays, polaroid filters, transparent working models, and even chemical reactions in a test tube.
7	**DISCOVERING COMPOSITIONS IN ART** 36245 SCA (-FA 1964) 16 min color 6.85 Defines composition and sets forth a systematic procedure for developing good composition in drawing or painting
8	**DISCOVERING PERSPECTIVE** 30027 IJSCA (-BFA 1962) 14 min color 5.20 *(Discovering Art Series)* We live in a world of depth, of distance. Some things are close to us, some far away. We can create the appearance of distance on the flat surface by using perspective. Overlapping, vertical position, grayed colors, varying detail, varying size, and converging lines are techniques used to create perspective.

Experiment III

Film Stimulus Number	Film Descriptions
1	**DISCOVERING FORM IN ART** 40016 IJS (-BFA 1967) 21 min color 6.80 Five basic forms in art; the sphere, cube, cone, cylinder, and pyramid. Each is a structure of planes or surfaces which join to create a distinctive volume. The artist creates with these forms, combining and varying the proportions endlessly.
2	**DISCOVERING IDEAS FOR ART** 30026 IJS (-BFA 1965) 16 min color 5.85 Learning to see the difference in things around us stimulates artistic invention. A particular object consists of many parts that may differ in shape, color, line, texture, pattern, and value. In creating art, we transform, simplify, or emphasize one or another of the characteristics of the objects we see.
3	**DISCOVERING DARK AND LIGHT** 40015 IJS (-BFA 1965) 16 min color 6.00 Variation in dark and light is called value. Artists vary value in colors by adding black or white, or by contrasting dark or light color values. Sculptors create value by the way they form the surface to catch light and cast shadows
4	**DISCOVERING HARMONY IN ART** 30025 IJS (-BFA 1966) 16 min color 6.00 In the world of nature, we see many examples of harmony. In art, we achieve harmony by limiting the number of objects, colors and shapes we use; by repeating objects, colors and shapes; using a family of objects, colors, or shapes.

*The above information adapted from: University of Iowa, Audiovisual Center. Films (Catalog). 1971

APPENDIX B

SAMPLE TREATMENT PACKET

aceg

Film No. 30027 I. D. No._____

READ THIS FIRST.....

Please DO NOT seperate these sheets

MOTIVATOR

THIS IS A BEAUTIFUL FILM!

- You will see how to.....
  - Make yourgraphics COME ALIVE
  - Add the dimension of DEPTH to your efforts
  - give SPECIAL emphasis to IMPORTANT PARTS OF YOUR MESSAGE

NOW, PLEASE TURN TO THE BLUE SHEET.....

---

bdfh

Film No. 30027 I. D. No._____

READ THIS FIRST.....

Please DO NOT seperate these sheets

NO MOTIVATOR

XXXX XX X XXXXXX. .XXX

- Xxx xxxx xxx xxx xx.....
  - Xxxx xxx xxxxxxxx XXXX XXXXX
  - Xxx xxx xxxxxxxxx xx XXXXX xx xxxx xxxxxx
  - xxxx XXXXXXX xxxxxxxx xx xxxxxxxxx XXXXX XX XXXX XXXXXXX WAIT ABOUT 15 seconds....

NOW, PLEASE TURN TO BLUE SHEET.....

APPENDIX B--Continued

ab

I. D. No._____

NOTE TO STUDENT:

During the film showing, make your notes directly on the Blank Outline that is attached below. Study this outline so that you become familiar with its contents. This will make your note-taking, during the showing, easier.

When the film showing is completed, these papers will be collected.

.....Now.....Please examine the outline.

---

cd

I. D. No._____

NOTE TO STUDENT:

During the film showing, carefully follow the progress of the film by looking at the attached outline, while watching the film. Study this outline so that you become familiar with its contents. This will make it easier for you to check the film's major points. DO NOT MAKE ANY NOTES DURING THE FILM SHOWING.

When the film showing is completed, these pap rs will be collected.

.....Now.....Please examine the outline.

APPENDIX B--Continued

Title: DISCOVERING PERSPECTIVE Film No.30027

Producer: FILM ASSOCIATES of CALIFORNIA

HOW WE SEE THINGS IN THE WORLD AROUND US...we see things close or far away. Ours is a world of depth .....of distance.

DEFINITION OF PERSPECTIVE...The appearance of distance on a flat surface.

HOW PERSPECTIVE IS CREATED

1) Overlapping
When objects are overlapped, those partly hidden seem farther away.

COMPLETED OUTLINE

2) Lower and Higher Placement
Lower objects appear closer to us than objects that have been placed Higher on the page.
We usually see close things below those which are farther away. Same size frogs used.

3) Use of Full Color and Gray
Lighter objects seem farther away than darker ones.
Close things are seen in full color.
Mountains seem very far from us and are painted gray.

4) Use of Detail
We see many details in things that are close; less detail in things that are far away.
Objects seem far from us when their lines are soft and fuzzy.

5) Large and Small Objects
Large objects seem close to us; small ones farther away.
The closer they are, the larger they seem to be.

6) Lines of Objects that get Closer and Closer
When objects form lines that stretch away from us, the lines seem to get closer and closer together.

SUMMARY

1) We can creat Perspective by Overlapping objects,
2)..by placing some objects lower and others higher in the picture,
3)..by showing some objects in full color and graying others.....
4)..by showing greater detail and less detail in objects.....
5)..by showing distant objects small...by showing close objects large.....
6)..and by making objects form lines that get closer and closer together.

APPENDIX B--Continued

Title: _____ Film No. 30027

Producer: _____

HOW WE SEE THINGS IN THE WORLD AROUND US

Definition of Perspective

HOW PERSPECTIVE IS CREATED

1) Overlapping

BLANK OUTLINE

2) Lower and Higher Placement

The Frog example:

3) Use of Full Color and Gray

4) Use of Detail

5) Large and Small Objects

6) Lines of Objects that get Closer and Closer

SUMMARY

1)

2)

3)

4)

5)

6)