LISTENING TIME AS IT RELATES TO LEARNING INFORMATION PRESENTED BY AUDIO TAPE ON A DIAL ACCESS SYSTEM

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ON A DIAL ACCESS SYSTEM

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CHAPTER I

STATEMENT OF THE PROBLEM

Introduction

Today's colleges operate in a rapidly changing society. The world has become an international community with varied and unique problems. Population is mushrooming at a rapid rate. Today's population with its modern means of transportation is the most mobile the world has known. Knowledge is increasing at a tremendous pace; this is particularly true in areas where the computer is allowing man to tackle many new and complex problems. (3)

This rapid change has caused colleges and universities to face many new problems in educating the youth of today. Educators are called upon to impart to increasing numbers of students more knowledge yearly in a variety of situations. The small liberal arts colleges have found that they have more students with a wider range of academic background than in the past. Among the various colleges and universities which are making innovative attempts to solve some of the instructional problems is Oklahoma Christian College. (19)

Oklahoma Christian College (OCC) is a liberal arts college located on the northern edge of Oklahoma City, Oklahoma. The college, which has an enrollment of slightly more than 1,000 students, is unique in that each student has his own independent study carrel which is connected to the college's dial-access system. (Definition, page 4 and photographs, Appendix F) This dial-access system allows the individual student to use tape recorded instruction in various ways during his educational program at the college.

The college was one of the first in the nation to use a dial-access system. Although growth in the number of colleges now having some form of dial access has been rapid, the number of colleges using the techniques is still relatively small. In working with this type of instruction, educators need research data on instructional design of materials. This study deals with research on one type of problem in this area.

Purpose of the Study

The Oklahoma Christian College access system has been in operation long enough that a pattern of instructional development has been established. This study compared the effects of the established instructional approach and other listening time arrangements on the learning of information presented to the student by tape on a dial-access system. The basic instructional approach at the college is built around a fifty-minute tape and an interaction response sheet. (19) The response sheet is usually packaged in a special notebook designed to supplement the tapes used in a course.

The present inquiry was a preliminary probe into the design of materials for use on the access system. Is the traditional time arranged for the material the proper one, or is there some other time arrangement that is more effective in the obtaining of information? This was the problem studied. The outcome is of importance to the design of material for the Oklahoma Christian College dial-access system. Hopefully the findings will be of use to those employing similar systems in other institutions.

The Problem

This study attempted to determine whether a variation of the listening time arrangement of audio tape materials presented on a dial-access system affected the learning of information. The study attempted to do this by examining and modifying the fifty-minute period of recorded instruction employed in the infomational mode of the dial-access system. This fifty-minute period was broken down into various modules or listening arrangements such as two twenty-five-minute sessions, or four twelve-and-one-half-minute sessions. An analysis was performed by means of an objective test based on the listening experience to determine whether varying the listening time had an effect on test performance.

Definitions

1. Time: The independent variable in this study which refers to the length of listening and responding time the student has with the tape-recorded instruction. This time is administratively controlled by the experimenter and the limitations of the access system.

2. Tape Workbook: A means of presenting pictorials and interaction material to supplement and correspond with the tape. The typical tape workbook at OCC consists of written materials relating to 16 fifty-minute tapes.

3. Tape Response Sheet: An interaction sheet designed to correspond with a particular tape. It is designed to supplement the tape

with written and pictorial stimuli such as outlines, questions, diagrams, etc.

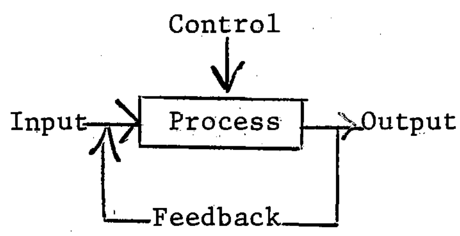
4. Dial-Access System: A system by which a student may dial a lesson from his carrel. It uses telephone switching networks and a computer to select the information to be relayed to the carrel. The system used in this study is limited to audio tape playback on 117 channels.

5. Instructional Software: The instructional message, information, or visualization presented to the learner by some means of communication. In this experiment it is the information conveyed through the tape response sheet and the audio from the taped listening experience.

6. Instructional Hardware: The mechanical equipment used to aid the instructional process in this experiment, i.e., a dial-access information system.

7. Systematically Designed Instruction: An instructional learning experience designed by means of the systems approach. Two aspects are involved: the analysis phase and the synthesis phase. Analysis involves breaking the learning experience down into tasks, objectives, and purposes; searching prepared materials; and developing resources and criterion measures. Synthesis is the process of putting the material from the analysis together into a learning experience. The system provides for pretest (input data), process (the experience), output (the post test data), and feedback (the comparison of results of learning experience to task criterion level and objectives in order to facilitate redesign of the learning experience until the criterion levels can be met). The approach can be presented in the following

model:



8. Size of Step: The size or amount of material given in one step or frame in programmed instruction.

9. Pacing: The rate at which a student progresses through a program's instructional sequence.

10. Mediated Instruction: Any instruction that is prepared and packaged prior to use by the students and is presented by means of some instructional hardware.

11. Massed Review: The listening, viewing, or reading of material all at one sitting.

12. Spaced Review: The listening, viewing, or reading of material in shorter, spaced time intervals, rather than all at one sitting.

13. Carrel: An individual study space. In this case it consists of a three-sided cubicle with a listening station, dial system, desk, typing table, and book storage area; it is five feet high, four feet deep, and four feet wide. (Photographs, Appendix F)

Summary

Many problems face the modern college and university in today's society. Among the various colleges which are making innovative attempts to solve some of the instructional problems is Oklahoma Christian College. This inquiry was a probe into the design of instructional material for the college's dial-access system. The purpose of the investigation was to analyze the effect of listening time arrangement on the learning of information presented to the student by audio tape on a dial-access system.

CHAPTER II

BACKGROUND FOR THE STUDY

This chapter is concerned with the review of related research dealing with the use of time as it related to learning via tape recorded instruction and dial-access systems. Materials reviewed will include information regarding the growth of dial-access systems, the systematic planning of instruction, the modes of instruction available on such access systems, and selected studies from film (motion picture) and programmed instruction research that used time as a variable in the experiment. Because of the relationship of concepts on listening skills to the model which guided this research, a review of selected research findings in listening is included.

Interest in Dial Access Systems

A recent study, directed by Ofiesh (20) at Catholic University, indicates that the number of schools installing access systems has increased rapidly since 1961. This growth has been attributed to a shortage of instructors and to the information explosion. Implementation of the dial-access system allows the instructor the freedom to use various kinds of audio or video recordings as a part of the instructional program. Most of the systems in operation are audio playback systems.

The arguments for dial-access systems are numerous. Students have immediate access to various recorded materials. The access system provides learning opportunities that are more convenient to the student's pattern of living. The instructor may function in more humanistic roles such as counseling, individual instruction, and instructional design. (20)

The arguments against dial-access systems are concerned with lack of research in the designing of instructional materials for use on such systems and the initial cost of the system's hardware (20). The "Impact Study" (17) done at Oklahoma Christian College over the first three years of operation of the college's dial-access system indicates that both students and faculty were satisfied with the use of the system and the roles it can play in the college's instructional program. On the topic of audio tapes, the "Impact Study" reported that one of the students' major complaints was their feeling that the length of the instructional tapes was too long. The study also states that the dial-access system has been cost-effective. Another study by McConeghy (14) indicates that dial-access systems can represent considerable savings in large group instructional cost. McConeghy states that when a dial-access system such as that at Grand Valley State College in Allendale, Michigan, is used for direct instruction instead of supplementary instruction, the cost per student hour becomes $.015, when at least 200 students are involved. The cost for the same live instruction at that institution was $.04 per hour per student. The savings are clearly in favor of instruction via the dial-access system.

Historical Background

Dial-access systems began as an outgrowth of language laboratories in the early 1950's. The early movement was centered in private colleges in New England. In late 1965 the Oklahoma Christian College dial-access system went into operation, extending the method from languages to all subject matter areas. The Oklahoma Christian College dial-access system was the most innovative of the 121 access systems operating in 38 states in 1968. Presently, there are 50 systems located in elementary and secondary schools, 71 operating in junior colleges, colleges, and universities, and 56 institutions are planning to install systems. (20)

Recently there have been several new approaches to the design of mediated instruction such as that used on dial-access systems. The most effective of these seems to be the systems design of instructional materials. One of the important elements in a system is feedback in the form of operationally designed research. Gage (5) says that the systems approach applied to mediated instruction allows the operational researching of smaller segments of the learning process.

The systematic design of mediated instruction for use on a dial-access system will constantly improve because of operational research.

This development of dial-access hardware and the better approaches to the design of instructional materials promises a bright future for more effective use of dial-access systems in colleges and universities.

Types of Instruction That Can Be Presented on Dial Access Systems

The types of mediated instruction which can be systematically designed for dial-access systems use one of four modes of instruction (or a combination of these). The instructional modes are the informational, the programmed, the drill, and the audio-tutorial. The access system may be used instructionally in one other way: the random accession of resources.

The informational mode of instruction is one of the more important uses of the dial-access system. In this case the dial system is used solely to disseminate information. This learning mode is basically concerned with presentation of factual information which the student is to maintain for future use or study. (18)

A second way that the dial-access system may be used is in the programmed mode. This type of program in audio will usually consist of frames of information, student response, and feedback. The dial-access system allows the instructional designer to be flexible in the design of materials for the access system, especially in the programmed mode. (18)

A third mode of learning used is a drill, which is easily adapted to the dial-access system. Learning activity cannot be restricted to drill and memorization, of course. However, there are times when drill materials are not only proper but necessary. (18)

The audio-tutorial method of instruction is readily available on the dial-access system. This method of instruction lets the tape become a tutor; the tape guides the student through the learning experience. The audio-tutorial approach usually takes on the appearance of a semi-programmed learning mode, which is especially keyed to the needs and differing learning speeds of different students. (18)

The final way that the access system may be used is to provide accessibility to random resource materials in audio or video format. This is of course confined to the various resources that are available in tape format. (18) More than one of these modes may be necessary in a single tape.

The learning objectives should be the key to deciding which learning modes are to be used. The students' needs should determine the frequency of utilization of the access system and the design of the instruction, not the limitations of the systems hardware.

Listening Studies

A brief report on listening research findings seems necessary because of its relationship to the rationale of this study.

Listening is a skill which must be learned. Students vary in their abilities to listen. Taylor (21) points out that listening skills do not necessarily correlate with reading skills. Often the poor reader is a good listener and the good reader a poor listener. Research suggests that the less competent students prefer listening to reading and that they retain more from listening. Nolan (16) reports that listening is 155% to 360% more efficient than reading for the mastery of content.

Brown (2) has shown that ability to listen with correct understanding varies from child to child. Also, Brown reports that children from large families are usually poor listeners while children from small families are usually good listeners. (2) However, it should be remembered that listening habits can be learned. In fact, many students show gains in listening ability with experience. (21)

Finally, Thompson (22) cites the need for two additional types of research into the area of listening: "Are there certain times when students seem to listen better than others? ... Do certain topics consistently generate better listening?..."

Film Studies

In most forms of mediated instruction, time (the length of the presentation) becomes an important factor in the design of the instruction. Two studies which investigate time and closely parallel this inquiry are research studies in the use of film (motion picture). Below are reviewed the two film studies which closely parallel this research.

The trend in the design of instructional films is clearly that of smaller time packages or single concepts. (10) Research findings are inclusive in studies relating to the packaging of film material in long or short time packages. Lumsdaine (13) indicates that time is a variable in comparing instructional techniques. This variable is especially important in instruction where time is administratively set.

Lumsdaine (13) cites two studies which are useful in the present inquiry. Ash used two film series, each consisting of four fifteen-minute silent film clips. He found no difference in learning effect when showing all four films in a single one-hour session, or in time modules of two thirty-minute showings, or four fifteen-minute showings. Effects were assessed in terms of retention over a one and a two-week period as indicated by a multiple choice test.

Faison, Rose and Podell conducted an experiment in which three short thirty-second rest periods were designed into a twenty-minute film presentation. They compared this with the same film without the rest periods incorporated into the film. The use of infrared photographic technique was incorporated into the experiment to observe the audience. There was a progressive gradual loss of attentiveness in the showing without the rest periods, while the showing with the rest periods showed an abrupt rise in attentiveness after each rest period. They also found greater learning as measured by a post film test in favor of the film with the rest periods.

Programmed Instruction

There have been studies of programmed instruction on the problems of pacing and size of step; these studies have dealt with the effect of the length (time) of instructional experiences and its effect on learning, and are related to the central rationale of the present investigation.

In research on programmed instruction, step-size is listed as a program variable. There are a large number of meanings attributed to "step-size", ranging from "difficulty of responding" to "amount of reading material per response requested." (1) Briggs (1) states that the trend in research findings is in favor of smaller step-sizes. Gropper, (8) in two experiments with programmed instruction, used video taped presentations to teach the assembly of the electric motor. The size of the demonstration unit (time length of presentation step) was one of the independent variables. The longer the presentation, the more errors per student committed during the practice sessions.

Summary

Dial-access systems are relatively new hardware systems which allow the student to dial a prerecorded lesson from his carrel. The growth in numbers of institutions employing dial-access systems in their instructional programs has been rapid, but the total percentage of institutions of higher education with such systems is small. The most innovative dial-access system is located at Oklahoma Christian College.

Because of the relatively newness of dial-access systems, there is a lack of research on the design of instructional materials for use with the systems. Therefore, this review of the literature dealt with studies in listening, programmed instruction, and film utilization which were sufficiently similar to this study to help sharpen the investigation's research rationale.

CHAPTER III

METHODOLOGY AND DESIGN

Introduction

The purpose of the investigation was to analyze the effect of listening time arrangement on the learning of information presented to the student by audio tape on a dial-access system. This was done knowing that the basic instructional development package for the college was a fifty-minute audio tape and a response sheet. The question asked in this research was: Is the traditional time arrangement for the materials the most efficient, or is there some other time package that is more effective in the communication of information?

Hypotheses

Using the dial-access system to present the experimental tapes and then using the instrument developed to test this listening experiment, the research sought to deal with two hypotheses:

> Hypothesis 1: There is no difference in the information learned from a fifty-minute recorded listening experience, when the students listening to the audio tape in a single session are compared to the students listening to the audio tape in varying listening modules.

> Hypothesis 2: There is no difference in the information learned from the second half of the fifty-minute listening experience when the students listening to the audio tape in a single session are compared to students listening to the audio tape in varying listening modules.

Limitations of the Study

No attempt was made to force the selected students in the experiment to participate. Once a student had been notified he had been selected, he decided for himself whether he would participate in all stages of the research.

The inquiry was conducted at one small, private liberal arts college that has a unique campus environment.

Generalizations from the study should be limited to those situations which are sufficiently similar to the Oklahoma Christian College environment.

The research data were collected entirely from an undergraduate student population.

Selection of the Sample

The sample of students was obtained by a random process. A carrel list containing the names of carrel number of 1,062 full-time students at OCC was used to define the available population.

A number was assigned each student, and 320 student numbers were drawn. These 320 persons were identified by name and renumbered. Then, four random samples of 80 were drawn using numbers from one to 320. Finally, each one of these groups drawn from the random sample was randomly assigned to an experimental listening arrangement. All random selections were made by using the table of random numbers from Standard Mathematical Tables, 12th Edition. (9)

The students were notified by letter (Appendix A) that they were to participate, and instructions were given to each student, according to his experimental grouping. This letter was given to the student one week before the experiment began. Only one schedule change was made after the original letter was sent. This changed the day of testing from the Friday of the experimental week to the Wednesday after the experimental week. This was done due to a conflict with an all-campus activity. Each student was given a brief reminder two days prior to the experiment. (Appendix A) During the experimental week, daily reminders were read in chapel and a listing of names for each experimental group was placed on the student bulletin board in the learning center.

Because the study was limited by the experimenter's having to rely on the voluntary participation of those students selected, two methods were used to get the required sample size and to check that the sample remained representative. One, a large original sample was drawn from the population; and two, a questionnaire (Appendix B) was administered to the total population and to each individual who participated. A comparison of the demographic data obtained was done by means of a chi-square analysis. (Supporting data in Appendix C.) Those students in the sample were found to be representative on grade point average, previous experience with access system, family income, size of high school, rank in high school, academic major, age range, and sex. Non representativeness was found on classification, size of home town, region of nation, and occupational interest. A disproportionate number of freshmen and seniors participated. The population contained 39% freshmen and 15% seniors, while the final sample contained 55% freshmen and 8% seniors.

Construction and Administration of Listening Experience

The fifty-minute package of instructional information that was designed for the experiment was developed and a script was written prior to the experiment. The topic for the tape was carefully chosen in view of the need to develop a tape in an area of subject content that was basically new to all students in the population. This was done to eliminate the possibility of previous knowledge comprising a contaminating factor in the experiment.

An attempt was made to balance the concepts and facts presented in the various areas of the tape. Table I describes the four experimental listening arrangements, with the groups identified as T1, T2, T3, and T4.

TABLE I

DESCRIPTION OF EXPERIMENTAL GROUPINGS

Group Identity	Method Used to Listen to Tape
T1	Listened to the audio tape in a single fifty-minute session
T2	Listened to the audio tape in two twenty-five-minute sessions
T3	Listened to the audio tape in three eighteen-minute (approximately) sessions
T4	Listened to the audio tape in four twelve-and-one-half-minute sessions

The tapes were made available on the dial-access system for a period of one week. Each tape was labeled (Table II) and given a dial number. This arrangement necessitated the use of 10 channels and dial numbers on the dial-access system. The tapes were mechanically placed on the dial-access system in such a way that students in the experiment listening to the modules could not listen to the modules in order without first waiting for a period that ranged from three to 10 minutes.

TABLE II

DESCRIPTION OF METHOD FOR LABELING TAPES

T1		50 minutes
T2:	Part I	25 minutes/part
	Part II	
T3:	Part I	18 minutes/part (approximately)
	Part II	
	Part III	
T4:	Part I	12½ minutes/part
	Part II	
	Part III	
	Part IV	

The students turned their response sheets in as soon as they had completed each listening experience. This was a control to prevent the students from studying the response sheet prior to the evaluation. A copy of the tape transcript and response sheet may be examined in Appendix D.

Construction and Administration of the Instrument

The instrument used in this experiment contains 48 multiple choice items (Appendix E). There were 24 items from the content transmitted in the first half of the listening experience and 24 items taken from the content in the second half. The items from the two halves of the listening experience were counter balanced throughout the instrument in modules of eight. Each module had eight items, four from the first half and four from the second half. In the first module, the odd numbered items were from the first half. This procedure was reversed in the second module. This reversing procedure was used in the six modules so that in questions one through eight, the odd items were from the first half; for questions nine through 16, the odd numbered items were from the second half; for questions 17 through 24, the odd numbered items were from the first half, and so on.

The 48 items were selected from a pool of 100 original items. This pool contained 25 items from each quarter of the listening experience.

In a pilot study completed for the purpose of instrument development, a group of students in Education 4122 at Oklahoma State University listened to the fifty-minute tape and responded to the 100 original items. An item analysis was completed on the 100 original items to determine the discriminating power and the level of difficulty for each item. Items of the final instrument were selected for these reasons: (1) they came from pre-determined content areas of the tape (24 were chosen from each half of the tape); (2) the items discriminated between the student with high scores and those with low scores; and (3) the difficulty of the items was held near 50 percent.

An item was said to be discriminating between the student with high scores and those with low scores if the difference between the number correct from the students with high scores on the item was four or more greater than the number correct on the item for the students with low scores. (16) There were 16 students in both the upper third and lower third of the range of scores on the instrument in the pilot study. The number four was determined by dividing the number of students in one third of the range of scores on the instrument in the pilot study by four. There were only two items used which exhibited a difference of less than four; both of these had a difference of three. (6)

The difficulty level of an item was determined by using this formula: (6)

$$\text{percent of difficulty} = \frac{\text{number correct in upper third} + \text{number correct in lower third}}{\text{total number of responses possible in both upper and lower third}}$$

The items on the final instrument had a difficulty of 54 percent when the pilot study scores were used to compute the difficulty ratio.

A Spearman-Brown reliability formula was employed on the final 48-item instrument using the scores of the 47 students in the experimental groups. The final instrument yielded a Spearman-Brown reliability of .68. (6)

In the final experiment, students were administered the instrument on the Wednesday following the Friday of the experimental week. This meant that at least four days had passed since any student had listened to the tape. The students were allowed 40 minutes to answer the 48 items. The time of administration was mid-morning. The instrument was scored for each individual in the experiment. Two scores were obtained for each participant: a total score and a score for the items from the second half of the listening experience.

Experimental Design and Statistical Application

From the random sample and random assignment, only 47 or 320 students participated. The statistical design demanded a minimum of 10 students in each cell or a total of 40 students. The original design as well as the one used throughout the experiment was a randomized design employing a one-way analysis of variance on the two scores yielded by the instrument.

The 47 participants were grouped into the experimental cells as shown in Table III.

Two scores were collected on each subject in the experiment. Two analyses of variance were run on these data using the total scores in one analysis and the second half scores in the other analysis. The assumption of randomness was made because of the sampling technique and because the samples were determined to be representative on all important demographic items. An F test and Bartlett's test were applied and the variance was found to be homogeneous.

TABLE III

NUMBER OF SUBJECTS PER EXPERIMENTAL GROUPING

T1	12
T2	11
T3	13
T4	11
Total	47

Summary

The purpose of the study was to analyze the effect the length of a listening session might have on the information learned by students from a tape designed to present information through a dial-access system and a worksheet. The researcher sought to discover if there was a difference in the total scores on a multiple choice test for various listening arrangements and particularly if there was a difference in the second portion of the listening experience where fatigue should be the greatest in those listening to the fifty-minute tape.

The subjects were chosen by means of a table of random numbers and then were randomly assigned to four groups of 80. Each of these groups was randomly assigned to an experimental treatment. As the experimenter could not force participation, a scheme was devised to check the representativeness of those who finally participated. Two analyses of variance were accomplished to determine between-group differences on both the total scores gained by the subjects and the scores yielded from items measuring learning from the second half of the listening experiment.

CHAPTER IV

RESULTS OF THE STATISTICAL ANALYSIS

Introduction

Forty-seven subjects participated in the experimental listening sessions. Two scores were obtained from the instrument for each of these students: a total score and a score representing the student's performance on information from the second half of the listening experience. These scores were used to test the two hypotheses of the experiment by means of the analysis of variance. Each of the hypotheses was repeated with the results of the statistical analysis following it.

Statistical Analysis

> Hypothesis 1: There is no difference in the information learned from a fifty-minute tape recorded listening experience when the students listening to the audio tape in one session are compared to students listening to the audio tape in varying listening modules.

Presented in Table IV are the raw data for the participants' total performance on the instrument. The total mean scores for T1, T2, T3 and T4 respectively were 21.116, 23.182, 20.461 and 24.363.

The analysis of variance yielded an F ratio of 0.72 (Table V). Rejection of the null hypothesis at the .05 level of confidence with 3 and 44 degrees of freedom called for an F ratio of 2.82. The null hypothesis failed to be rejected; the groups did not differ significantly.

TABLE IV

TOTAL SCORES

T1 Subject	Score	T2 Subject	Score	T3 Subject	Score	T4 Subject	Score
S1	36	S13	34	S37	29	S37	34
S2	30	S14	33	S25	26	S38	31
S3	23	S15	29	S26	24	S39	28
S4	23	S16	28	S27	24	S40	28
S5	23	S17	27	S28	23	S41	26
S6	22	S18	23	S29	23	S42	22
S7	22	S19	23	S30	21	S43	21
S8	20	S20	20	S31	19	S44	21
S9	18	S21	16	S32	18	S45	21
S10	13	S22	16	S33	18	S46	21
S11	12	S23	15	S34	16	S47	15
S12	12			S35	15		
				S36	10		
Sum.	254		255		266		268
Mean	21.166		23.182		20.461		24.363

TABLE V

ANALYSIS OF VARIANCE TABLE FOR TOTAL SCORES

Source	SS	DF	MS	F Ratio
Between Groups	113.73	3	37.91	0.72
Within Groups	2058.55	43	47.87	
Totals	2172.28	46		

Hypothesis 2: There is no difference in the information learned from the second half of the fifty-minute listening experience when the students listening to the audio tape in one session are compared to students listening to the audio tape in varying listening modules.

Presented in Table VI are the raw data for the participants' scores on the second half of the listening experience as tested by the instrument. The second half mean scores for T1, T2, T3 and T4 respectively were 10.58, 10.63, 9.0 and 11.2.

The analysis of variance yielded an F ratio of 0.52 (Table VII). Rejection of the null hypothesis at the .05 level of confidence for 3 and 44 degrees of freedom called for an F ratio of 2.82. The result was that the experimenter failed to reject the null hypothesis; again, the groups did not differ significantly.

TABLE VI

SECOND HALF SCORES

T1		T2		T3		T4	
Subject	Score	Subject	Score	Subject	Score	Subject	Score
S1	18	S13	17	S24	13	S37	18
S2	15	S14	19	S25	14	S38	15
S3	11	S15	14	S26	6	S39	14
S4	12	S16	12	S27	13	S40	15
S5	13	S17	15	S28	12	S41	12
S6	10	S18	11	S29	10	S42	8
S7	14	S19	9	S30	12	S43	9
S8	12	S20	9	S31	8	S44	7
S9	8	S21	7	S32	7	S45	9
S10	3	S22	6	S33	7	S46	9
S11	5	S23	7	S34	6	S47	7
S12	6			S35	5		
				S36	4		
Sum.	127		117		117		123
Mean	10.58		10.63		9.0		11.2

TABLE VII

ANALYSIS OF VARIANCE TABLE FOR SECOND HALF SCORES

Source	SS	DS	MS	F Ratio
Between Groups	32.64	3	10.88	0.52
Within Groups	888.19	44	20.66	
Total	920.83	47		

Summary

The 47 students were divided into four experimental listening arrangements for a fifty-minute tape recorded instructional presentation. Each of the 47 students was administered a multiple choice instrument which yielded a total score (used to test Hypothesis 1) and a second half score (used to test Hypothesis 2). The data used in this analysis were gained from the instrument responded to by the 47 participants. The analysis of variance tests yielded a less than significant F ratio in both cases, which caused the experimenter to fail to reject the two null hypotheses.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

The data presented in the preceding chapter have been analyzed with careful adherence to the original experimental design. The experimenter made every effort to apply the cautious interpretation which is characteristic of a research report. The conclusions and recommendations may not be as conservative in nature, but will reflect what the experimenter viewed as logical and rational.

Summary of Study

The purpose of this study was to conduct a preliminary investigation of instructional development and design procedures for the preparation of instructional tapes using the informational mode of instruction. The problem was attacked in order to help in the development of tapes for use on the dial-access system at Oklahoma Christian College. The population from which the study sample was drawn was the carrel list of Oklahoma Christian College. Since every student enrolled on a full-time basis at the College has a carrel assigned, the population comprised the entire Oklahoma Christian College student body.

The instructional tape used in this experiment was developed to teach subject matter not likely to coincide with the students' previous learning experiences and background information. The study used a randomized sample and assignment design. A limitation on this design was the fact that the experimenter could not require those students chosen in the random sampling procedure to participate. To encourage more participation students were reminded by daily announcements during the experimental week that the experiment was under way. A questionnaire was given to the total population rather than only to each of the experimental group in an effort to check the representativeness of the participants.

The tapes were placed on the dial-access system for one week and the students listened much as they would to any other tapes placed on the system. Five days after the close of the experimental week the students were tested using an instrument of 48 multiple choice items. This yielded a Spearman-Brown reliability of .68. Two scores were obtained from the instrument for each of the 47 participants.

The data were analyzed using the analysis of variance. The F ratios were not sufficient to reject the two null hypotheses tested in the experiment.

Conclusions

The experimenter failed to reject either of the two null hypotheses tested. One must conclude that there was no statistical difference in the total amount of information retained from the different listening arrangements. Also, it must be concluded that the subjects listening to the tape in one continuous fifty-minute session did statistically no better or no worse than those students whose listening pattern allowed them to be less fatigued during the last 25 minutes of the listening experience.

However, an inspection of the means for the total scores and for the second half scores indicates that a closer look might need to be taken in terms of instructional development. While there was not statistical difference in the mean scores for the four experimental groups on either the total listening experience or the second half of the listening experience, it appears that the groups T2 and T4 might have been the best in terms of total performance. On the information from the second half it appears, by inspection, that group T4 might have been the best in terms of performance.

In reflecting on the conclusions, the experimenter was left with several questions:

1. Is there some optimum length of listening time for informational tapes that is perhaps shorter than the smallest modules used in this experiment?

2. Is there a point at which the discontinuity of several short listening modules creates more of a disadvantage than the fatigue of the longer listening sessions? Also, is there another point after which the advantages of the shorter listening arrangements begin to outweigh the disadvantages of the longer listening sessions?

3. Would there be a significant difference favoring T4 if there were a longer learning experience; for example, 15 fifty-minute audio tapes in a semester?

Recommendations for Future Research

The following recommendations for future research must be interpreted by the reader based on his comparison of his situation and system to that unique situation which exists on the Oklahoma Christian College campus.

Recommendations for Oklahoma Christian College

1. In the design of future tapes for an informational purpose the instructional designer should consider the use of either two twenty-five-minute or four twelve-and-one-half-minute listening sessions instead of the basic fifty-minute sessions. This recommendation is based on the mean scores in this study and on the indication from students responding to the "Impact Study" (17) that they disliked the longer listening sessions.

2. Oklahoma Christian College should conduct an experiment using the existing tapes for some course, breaking all of the tapes into three differing experimental listening arrangements for the semester. The suggested times for the research are: one fifty-minute session, two twenty-five-minute sessions, and four twelve-and-one-half-minute sessions.

Recommendations for Future Research in the Area of Tape Recording

1. Experiments designed to investigate whether there is some optimum-length learning session. For example, a series of three thirty-minute audio tapes and three groups of students could be employed. One group of students could listen to the three audio tapes in three sessions of 30 minutes each. The second group could listen to each of the three audio tapes in three listening sessions of 10 minutes listening times, followed by a two-minute break, then the next 10

minutes of audio, a second two-minute break, and the final 10 minutes of audio. The third group could listen to each of the three audio tapes in three listening sessions. The sessions would be six minutes of audio tape listening, followed by a two-minute break and repeated until the five six-minute modules of the thirty-minute listening experience were completed.

2. Experiments designed to establish the degree of relationship between length of listening and other factors related to listening ability such as learning style, experience in listening, and family size. A good example of this type of study would be to replicate the present study, using two groups for each of the listening experiences, one group with little experinece in listening to audio tapes, and another group with much experience in listening to audio tapes. It could be hypothesized that the inexperienced listeners would do best on short listening sessions while the experienced listeners would do better on the longer sessions.

3. Other experiments might be designed as the one above to compare listeners from large families and listeners from small families.

Summary

The purpose of the investigation was to analyze the effect of listening-time arrangement on the learning of information presented to students by audio tape and worksheet on a dial-access system. The study was carried out at Oklahoma Christian College, Oklahoma City, as a preliminary probe into one of the instructional-development problems encountered by the college in designing instructional materials for use on its dial-access system. It was suggested that the College

should use shorter listening periods than it is presently using and that the College should do further long range research into the length of audio tape instructional materials.

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APPENDIX A

Dear Student:

You have been selected to participate in an experimental study of the development of instructional tapes for this learning center. The major benefactors from this experiment will be you and the other students like you on this campus. Your participation and cooperation are very vital. If for any reason you do not complete the experiment, please write a one paragraph statement as to why you cannot participate and turn it in to Dr. Gunselman's secretary.

The experiment will run during the week of October 27-31. It will take less than two hours of your time. Everyone involved in the experiment will be evaluated immediately after chapel on Friday October 31. Please be there. There will be a retest to look at long range retention on Thursday afternoon, November 6 at 4:00 in a yet unassigned place. You will be notified where this will be prior to the evaluation on October 31.

You are to participate in experimental group 1. This means you will listen to Tape 1 and use Response Sheet 1. This tape will be identified on the learning center directory as Experimental Tape 1. Pick up your response sheet at the testing center prior to listening to the tape. Please turn the response sheet in to the testing center.

Thank you,

Larry Alexander and Marshall Gunselman

Dear Student:

You have been selected to participate in an experimental study of the development of instructional tapes for this learning center. The major benefactors from this experiment will be you and the other students like you on this campus. Your participation and cooperation are very vital. <u>If for any reason you do not complete the experiment, please write a one paragraph statement as to why you cannot participate and turn it in to Dr. Gunselman's secretary.</u>

The experiment will run during the week of October 27-31. It will take less than two hours of your time. Everyone involved in the experiment will be evaluated immediately after chapel on Friday October 31. Please be there. There will be a retest to look at long range retention on Thursday afternoon, November 6 at 4:00 in a yet unassigned place. You will be notified where this will be prior to the evaluation on October 31.

You are to participate in experimental group 2. This means you will listen to Tape 2 which consists of two 25 minute parts. Please listen to these separately. These tapes will be identified on the learning center directory as Experimental Tape 2, Part I and Part II. Pick up your response sheets in the testing center before you listen to the tape. As soon as you have listened to each part turn in the portion of the response sheet for that part to the testing center.

Thank you,

Larry Alexander and Marshall Gunselman

Dear Student:

You have been selected to participate in an experimental study of the development of instructional tapes for this learning center. The major benefactors from this experiment will be you and the other students like you on this campus. Your participation and cooperation are very vital. <u>If for any reason you do not complete the experiment, please write a one paragraph statement as to why you cannot participate and turn it in to Dr. Gunselman's secretary</u>.

The experiment will run during the week of October 27-31. It will take less than two hours of your time. Everyone involved in the experiment will be evaluated immediately after chapel on Friday, October 31. Please be there. There will be a retest to look at long range retention on Thursday afternoon, November 6 at 4:00 in a yet unassigned place. You will be notified where this will be prior to the evaluation on October 31.

You are to participate in experimental group 3. This means you will listen to Tape 3 which consists of three 18 minute listening sessions. These tapes will be identified on the learning center directory as Experimental Tape 3, Part I, Part II, and Part III. Pick up a series of response sheets in the testing center prior to listening to the tapes. Listen to the parts at separate times; and as soon as you have finished with each part, turn in part of the response sheet you have completed to the testing center. Please listen to the parts in order.

Thank you,

Larry Alexander and Marshall Gunselman

Dear Student:

You have been selected to participate in an experimental study of the development of instructional tapes for this learning center. The major benefactors from this experiment will be you and the other students like you on this campus. Your participation and cooperation are very vital. <u>If for any reason you do not complete the experiment, please write a one paragraph statement as to why you cannot participate and turn it in to Dr. Gunselman's secretary</u>.

The experiment will run during the week of October 27-31. It will take less than two hours of your time. Everyone involved in the experiment will be evaluated immediately after chapel on Friday, October 31. Please be there. There will be a retest to look at long range retention on Thursday afternoon, November 6 at 4:00 in a yet unassigned place. You will be notified where this will be prior to the evaluation on October 31.

You are to participate in experimental group 4. This means you will listen to Tape 4 which consists of four twelve minute listening sessions. These four tapes will be identified on the learning center directory as Experimental Tape 4, Part I, Part II, Part III, and Part IV. Pick up a series of response sheets in the testing center prior to listening to the tapes. After each part, return the completed response sheet to the testing center. Please listen to the tapes in order.

Thank you,

Larry Alexander and Marshall Gunselman

REMINDER!

This is a reminder that you have been selected to participate in the learning center experiment. Please check with Dr. Gunselman's office if you have questions.

APPENDIX B

No.__________

OCC Student Population
Questionnaire

This questionnaire is for use with research that will be conducted on this campus throughout the 1969-1970 school year. In all cases, answer as best you can and as accurately as possible. Answer by writing the number that most applies in the box to the left of the item.

[ ] A. What is your estimated grade point average?
1. 0 - 1.0
2. 1.1 - 2.0
3. 2.1 - 3.1
4. 3.1 - 4.0
5. First semester Freshman

[ ] B. How much previous experience have you had with the access system?
1. None
2. 1 course
3. 2-4 courses
4. 5 courses
5. 6 or more courses

[ ] C. What is your classification?
1. Freshman
2. Sophomore
3. Junior
4. Senior

[ ] D. What is your family income?
1. Less than $4,000
2. $4,001 - $7,000
3. $7,001 - $10,000
4. $10,001 - $15,000
5. Over $15,000

[ ] E. How large was your home town?
1. 0 - 1,000
2. 1,001 - 2,500
3. 2,501 - 10,000
4. 10,001 - 50,000
5. Over 50,000

[ ] F. How large was your high school?
1. 0 - 499
2. 500 - 999
3. 1,000 - 1,499
4. 1,500 - 1,999
5. Over 2,000

[ ] G. Do you live in?
1. New Mexico
2. Kansas
3. Oklahoma
4. Arkansas
5. Texas

[ ] H. What was your estimated rank in high school?
1. Upper 10%
2. Upper 25%
3. Second quarter (upper 26%-50%)
4. Lower half

[ ] I. What is your occupational interest?
1. Business
2. Teaching
3. Ministry
4. Other

[ ] J. What major division is your degree program in?
1. Humanities
2. Science
3. Fine Arts
4. Education - Psychology

[ ] K. What is your age range?
1. 18 - 19
2. 20
3. 21
4. Over 21

[ ] L. What sex are you?
1. Male
2. Female

APPENDIX C

RAW DATA TABLE AND CHI-SQUARE VALUES

Item	Population Totals	Individual Experimental Group Totals T1	T2	T3	T4	Sample Total	Sample Percentage (O)	Population Percentage E	(O-E)	$\frac{O-E^2}{E}$
A. Student Grade Point Average										
1.	4	0	0	0	0	0	0	½	-½	0.00
2.	103	2	1	2	2	7	14	12	2	0.16
3.	356	4	1	4	5	14	29	41	-12	3.51
4.	163	2	5	2	2	11	23	19	4	0.83
5.	225	4	4	5	2	15	31	26	5	0.96
Total	851					47				X^2=5.47
B. Previous Experience with Dial Access System										
1.	441	9	8	10	8	35	74	58	16	2.70
2.	28	0	0	1	0	1	2	3	-1	0.33
3.	101	1	1	1	2	5	10	13	-3	0.70
4.	54	1	0	0	0	1	2	7	-5	3.57
5.	130	1	2	1	1	5	10	17	-7	2.88
	754					47				X^2=10.18
C. Student Classification										
1.	333	7	6	8	5	26	39	55	-16	4.00
2.	225	1	2	2	2	7	26	14	12	5.50
3.	162	2	3	1	4	10	19	21	-2	0.20
4.	130	2	0	2	0	4	15	8	7	3.20
	851					47				X^2=12.90*

D. Family Income

1.	75	2	0	0	2	4	8	9	-1	0.11
2.	171	5	2	5	3	15	31	20	11	6.00
3.	254	2	6	3	2	13	27	30	-3	0.30
4.	237	2	2	4	4	12	25	28	-3	0.30
5.	87	1	1	1	0	3	6	10	-4	1.60
	824					47				X^2=8.31

E. Size of Home Town

1.	112	2	0	3	5	10	21	11	10	9.09
2.	74	0	0	0	1	1	2	7	-5	3.50
3.	176	2	5	3	2	12	25	18	7	2.70
4.	229	3	3	4	3	13	27	24	3	0.37
5.	355	5	3	3	0	11	23	37	-14	5.33
	946					47				X^2=20.99*

F. Size of High School

1.	250	4	4	0	6	14	29	26	3	0.35
2.	171	3	2	3	2	10	21	17	4	0.94
3.	177	2	1	3	2	8	17	18	1	0.05
4.	145	1	2	2	1	6	12	15	3	0.60
5.	215	2	2	5	0	9	19	22	3	0.41
	958					47				X^2=2.35

G. Region of Country

1.	21	1	0	0	0	1	2	2	0	0.00
2.	68	1	0	0	1	2	4	7	-3	1.29
3.	355	6	3	3	5	17	36	36	0	0.00
4.	20	0	0	2	1	3	6	2	4	8.00
5.	143	2	4	3	1	10	21	14	7	3.50
6.	368	2	4	5	3	14	29	38	-9	2.13
	965					47				X^2=15.92*

H. Rank in High School

1.	297	4	3	8	5	20	42	31	11	3.90
2.	283	4	6	1	2	13	27	29	-2	0.14
3.	295	4	2	4	3	13	27	30	-3	0.30
4.	79	0	0	0	1	1	2	8	-6	4.50
	954					47				X^2=8.84

I. Occupational Interest

1.	181	0	1	3	0	4	8	20	-12	7.20
2.	403	6	4	4	6	20	42	45	-3	0.20
3.	82	3	3	1	2	9	19	9	10	10.90
4.	288	3	3	5	3	14	29	32	-3	0.28
	894					47				X^2=18.58*

J. Division Which Major is Located

1.	119	2	3	1	2	8	17	13	4	1.23
2.	246	3	1	5	2	11	23	27	-4	0.59
3.	130	4	3	2	2	11	23	14	9	5.81
4.	386	3	4	5	5	17	36	43	-7	1.10
	881					47				X^2=8.73

K. Age Range

1.	543	7	9	9	7	32	68	57	9	1.40
2.	210	1	2	2	2	7	14	22	-8	2.90
3.	129	2	0	1	1	4	8	13	5	1.90
4.	70	2	0	1	1	4	8	7	1	0.14
	952					47				X^2=6.34

APPENDIX D

TAPE TRANSCRIPT

Today's society in America has produced many trends that have affected our educational policies. In particular, there have been three major trends affecting education in today's society. These are population, growth in knowledge, and technology.

Population is changing in two ways - mobility and increased numbers. This means there will be more students in our schools, and their backgrounds could be more diverse due to mobility. One elementary classroom might have students in it who have lived in the east, midwest, or west. There may be children from a rural background and others from an urban background. Thus, students at different levels of understanding would be in the same classroom. The instruction must be more individualized in order to manage this type of instructional situation.

As we look at the knowledge explosion in our society, we are often unable to comprehend the rapidity of its growth. If we took all that man knew in A.D. 1 and called it "K" we can diagram the doubling effect of knowledge. Complete the charts on your response sheet as we go along. The small circle at the bottom is lettered "K". It represents man's knowledge in A.D. 1. It took 1,750 years for man to double his knowledge so place "2K" in the circle marked 1750. In order to double man's knowledge again, it took only 150 years; so in the circle labeled 1900, place "4K". (Yes, we must double 2K this time.) The doubling effect of man's knowledge is a geometric progression. It then took only 50 short years to double the "4K" or man's knowledge in 1900, so that in 1950, man now had knowledge totaling eight times what he had in A.D. 1. It is predicted that by 1975 man's knowledge will be doubling at least twice a year or perhaps even every three months. This knowledge explosion could be compared to a snowball rolling down a hill; it grows in all directions. This knowledge explosion is forcing us to concentrate more, in our schools, on the process of a discipline and less on storage of facts.

Technology may be defined as the process of identifying a problem and reaching its solution. Technology is not just "nuts and bolts" or the machines and gadgets that we receive from the process. Technology is a problem-solving process. In education, technology has been applied to many problems and the results can be seen in the areas of hardware development and software design. Hardware is the "nuts and bolts" of education. We have better desks, air conditioning, sound-proofing, television, etc. Yes, this access system is hardware. You have a headset, a carrel, a control room, a switching network, and various other electrical gadgets in the hardware system. Software is the instructional material, the taped sounds you are listening to, the response sheet you are using, and the images you see when you view television, films, or slides. Software design is the process of technology applied to the design of instructional material. In this tape we wish to look at one way technology is being applied to software design, the systems design of instruction.

On your response sheet you may wish to write a brief summary on the topic of instruction. This may be done in the space provided below the word instruction.

Instruction is essentially the process of communication. The instruction must bring about change in behavior. Often our picture of instruction in the classroom centers on a teacher at the chalkboard with thirty students looking on. This idea tends to overstress the informational role of instruction and causes us to overlook the basic fact that the primary role of instruction is to effect a change in the behavior of the student. Instruction must be concerned with behavioral change; therefore, our objectives to some extent must be stated behaviorally.

A second point about the designing of instruction, with student learning defined as a behavioral change, is that we must get their attention. One of the primary tasks of instruction then, must be to gain the individual student's attention. Once you have gotten their attention, then you must hold it if a change in behavior is to be effected.

Instruction is the managing of information. As we noted earlier, the knowledge explosion is making this function of instruction more difficult. The managing of information in terms of creation, diffusion, storage, and retrieval is a formidable task for the instructional designer. This mass of information affects the teacher or instructional manager in at least two ways. The first problem is that we must teach more and more and the learner must learn more in essentially the same amount of time that we used in the past. The second problem is that today's concepts and ideas are more complex. This means that today a teacher can no longer be the sole source of information for thirty students in a box. Information has gone beyond the capacity of one person to manage so that a coordinated effort between various individuals is needed.

The final point is that instruction must be concerned with the interpretation of feedback. This role in the past has been that of the teacher as the evaluator. Today the instruction must be designed so that it is effective. The instructional manager or designer must not only evaluate the progress of the student, but also the effectiveness of the instructional process.

Instruction then, is that which gets the student's attention so that he may evaluate and assemble information in a manner that causes the student to change behavior, appropriate evaluation of the student's behavioral change, and the process used to effect the change.

The task of instruction must be to find the means which will enable our students to master the subject under consideration. Carrol has shown that most students can master what we have to teach them. Mastery is more related to the time it takes different students to master a subject. Aptitude for a subject tells you basically how long it will take a student to master the subject. Instruction then, must be concerned with allowing the students time for mastery.

Perhaps no instructional innovation in recent history has caused so much furor, has captured so much interest, and at the same time resulted in such a critical analysis of the instructional process as programmed instruction. The systematic design to instruction grew out of the programming process and the systems analysis process used in business, industry, and the military service.

Perhaps the greatest impact of programmed instruction is the fact that it has given us the process of inspecting and designing instruction. Programmed instruction (the process) as we know it today, represents the earliest phases of systematic analysis of the instructional learning process. Unless we take a careful look at the learning process we may face many complex and difficult problems in the future. We can increase the size of our schools, cut down on class size, or pay our teachers better; but instruction will not be better until we learn more about the instructional process.

Programmed instruction has led to the development of a base for the development of educational systems. A system, as defined by a programmer, is a program which can utilize what we know about out attempts to use films, filmstrips, language labs, and other instructional mediums in such a way as to bring fruit to our efforts. This system or program can be only as good as those who planned it. It has caused educators not to look on efficiency and effectiveness as "dirty words" in education. If the student does not learn, something may be wrong with the design of the instruction rather than the student having to bear the blame for failure in all cases. The material should be revised and evaluated until the student does learn. The development of programmed instruction and related research is one phase in the historical development of systems design of instruction.

The second phase has been in the area of business, industry, and military service. For example, business must be concerned with accounting and cost analysis systems; industry with cooling and guidance systems; and the military with missile and weaponry systems. During and after the second World War the military began to apply systems to the design of the material it used in its schools.

In the early 1950's, two events of significance in the history of systems development took place. First, the Air Force formalized the systems concept; and second, it drew together within its research and development program those agencies concerned with systems, both their hardware and human components. It was during the 1953-1960 period that the terms "systems approach" and "systems designer" first appeared. In

1960 the term "total systems approach" came to be associated with the total interaction that takes place when humans and machines are used together.

In the late 1960's we then began to see the merger of book publishers, film producers, and equipment producers into large educational software complexes with more concern for the overall system of education. It was also at this time that colleges and universities became interested in the systems design of instruction.

At this point let us define systems, both in general and as they apply to education. On your response sheet you should be answering the question, "What is a System?"

In recent years education literature has frequently seen the term "systems" or "systems approach" used. One of the first problems, and perhaps one of the hardest problems, has been that of defining what different people mean when they use these terms. We want to define these terms as they are used in this tape and in general as you will encounter them as a citizen interested in our schools.

E. B. Montgomery (Syracuse University, 1965) says that "a system is a set of parts dynamically interrelated." He also states that all systems are composed of sub-systems or dynamic parts and that a system is in itself a part of a system, thus making it a sub-system.

Leonard Silvern says that "a system is the structure or organization of an orderly whole, clearly showing the interrelationship of the parts to each other and the whole itself." Two terms are crucial in his definition--"interrelationship" and "clearly showing." All things may be related even if they are not dependent, and for this reason "interrelationship" is a better term than "interact" or "interdependence." By "clearly showing" he means that you can quantitatively measure the performance against a criterion measure. Silvern used a model or flow diagram to develop his system. This model is Figure 1 on your response sheet. Please analyze this model briefly.

In order to clarify these two basic definitions which are typical of the definitions of "systems" found in the literature, we must look in depth at systems theory. Stanford Optner will be used as our basic source on "systems" theory as it relates to systems models and as we try to illustrate our definitions of systems.

The simplest system model is stated in terms of input, processor, control, output, and feedback. This can be represented in a systems diagram. This diagram is Figure 2 on your response sheet. In Figure 2, box number 1 represents the control; box number 2, the input; box number 3, the processor; box number 4, the output; and the arrow, number 5, the feedback.

A second diagram will serve to illustrate that all systems are subsystems and vice versa. This is Figure 3 on your response sheet. It is simply a series of the basic models. These are the interrelated parts of the system.

Optner lists the elements of a system as the following:

1. Identifying the system understudy (processor). What is the system? Is it elementary math, high school physics, or college English?
2. Identifying the purpose for which the system exists (output). What are the students to be able to do after they have been through the systems?

3. Identifying the ingredients (input) whose functional relationship can be arranged to produce the required end results. What are the characteristics of the students for whom the system is designed?
4. Show the existence or non-existence of mechanisms whose purpose is to maintain reliability, accuracy, and other desirable operational attributes (controls). These are standards of operation.
5. Show the existence or non-existence of mechanisms to correct malfunctioning output (feedback).

Finally, there is a third diagram which is rougher in nature, but must be used to show the relationship of the subsystems to the whole system which is an on-going process. This should be the first step in analyzing the process.

David Merrill makes application of Optner's theory to education. In terms of education, input is the means by which information enters into the system. Output is the information the system is capable of handling as a result of the process of the system. The processor is the way in which the process of the system modifies the information of the system; and the feedback is the output that is fed back into the process of the system as input.

Having defined "systems" in general, the next logical question is: What is a systems approach to instruction? Again we turn to Silvern and Montgomery for some explanation as an introduction to the definition and as an introductory description of the "systems approach to instruction." Montgomery says that the systems approach to instruction is an analysis of the total environment in which instruction takes place and views all parts as an integrated dynamic system. One must ask the following kinds of questions: What is the system understudy? Who are the learners? What are the total results of this teaching and learning, etc.? What is it supposed to do? What are the educational objectives of the system? How is it supposed to do it? What are the parts which achieve what is to be done? What are the criteria for quality in the performance of the task? How can a plan be put together for the system to perform, measure its performance against the criteria, and improve this performance, all the while finding better definitions of what it is supposed to do?

Silvern says that it is the application of analysis and synthesis to a system (an educational problem). He terms this process as "anasynthesis." It is the process by which we take the old process and come up with a new process. "Anasynthesis" consists of analysis (identifying, relating, separating, and limiting) and synthesis (identifying, relating, combining, and limiting).

Optner lists the steps in general systems design as being: (1) investigation, (2) hypothesis, and (3) implementation. Investigation is concerned with the existing system and how we can develop a conceptual model for developing an attack on the problem and the way in which the system should be redesigned. The hypothesis stage is where you test the model and generate a more perfect model. The most severe test the model can meet is in its use. In a new system it is desirable to test the system in its parts and as a whole, statistically measuring its results against its criterion. The final step in implementation consists of a pilot run of the new system, re-evaluation, and full installation of the new system. This process can be illustrated by

Figure 5 on your response sheet. Study this figure briefly.

The systems approach requires that there should be a plan for conducting the system study which borrows liberally from the scientific method. In addition, the systems approach dictates that a problem be analyzed functionally and operationally, and that it consider suitable alternatives. To achieve a high order of effectiveness in problem solving, the systems engineer attacks the task using all available tools. He looks at problems as potential systems requiring input, processing, output, control, and feedback. Among the first tasks is the isolation of the problem area by specifying the boundary around it. The systems approach dictates that a problem be attacked in an orderly way--first by investigation, then by establishing a reliable hypothetical model of the problem.

We have defined both "systems" and "systems approach" in terms of instruction. It is our task in this section to continue to limit and define the "systems approach" to instruction as it relates specifically to use in education. This will basically be done by observations made around a conceptual model in use around the country.

Before discussing the model, some comment is necessary. It is important that you do not view the "systems approach" as a rigid unflexible model; it is not. The purpose of the feedback loop is to build change into the system. The system is a process. The system is limited only by the personnel that develop and evaluate the output of the system and by its cost.

Tying together our previous definitions, we see that the systems approach to instruction is composed of several basic elements. Input into instruction is concerned with purposes, behavioral objectives, criterion tasks, and entry level behavior. This is then processed by what Silvern called the "anasynthesis" process, the process of breaking instruction into its parts and putting it back together again. Finally, we have the output, a student who has been through the system developed by the process; and we must feed back the results of his performance on the criterion task to be evaluated in terms of the objectives, and feed back into the systems design to improve the system. All of our models have these steps, but in each model there is some uniqueness in steps included.

In summary then:

1. A "system" has a specific product.
2. Certain actions must be taken and functions performed so as to produce the product.
3. The organization of the system is such that it exercises a degree of quality control; the functions are kept in operational balance at a specified level of productivity.
4. The process of system development involves almost continuous appraisal to be sure that the system works and the product is up to date: this means feedback and modification, tryout and adjustment, concern for a better product and higher standards of productivity.

In adapting the systems concept to education, several changes must be noted. The purpose of an industrial system is to achieve the goal of a man-machine system that produces some item or product. The purpose of an educational system is to produce learning as the output; therefore, it is a learning system. Control of the educational system is the objective of the system. It has been suggested that a system must be designed so that 90% of the students learn 90% of the material. This is to be done by making the system learner-centered. In order for educational systems to accomplish the 90/90 criteria they must utilize more fully the available resources and technology and they must develop courses that allow students to pursue the course in a more individual pattern.

If you recall, Silvern talked about anasynthesis and Optner discussed systems in terms of input, control, processor, output, and feedback. Through a marriage of these two ideas we can create our basic educational systems model. Study this model carefully for its design in comparison to the models of Optner.

The learning system is also a series of subsystems, as illustrated on your response sheet. As we design the instruction for the learner today and in the future, we will increasingly use this chaining of subsystems into a course or system, the course also being only a subsystem in the overall system.

An educational system must be a closed system with the ability to become an open system built into its control. Basically a system is either totally opened or it is totally closed; but an educational system is neither--it is both. An open system is one which is sensitive to the total environment. A closed system is not sensitive to the environment. The educational system must be sensitive to the needs of the larger society; yet, it also must be basically sensitive to accomplishing its objective with the learner, an individual person. Therefore, it is a hybrid type system that is neither opened nor closed. Using figure number 8 on your response sheet, you can see this illustrated. The nega-system or the outer area of the figure is all that is not a part of the system. When a system is opened, it is sensitive to the nega-system and how its output affects the nega-system. When a system is closed, it is not sensitive to the nega-system.

Some examples will illustrate this point. A factory with the objective to manufacture a certain quality soap may be designed so that its manufacturing system gives you that quality of soap. This system is closed when there is no concern for what its waste products do to our air, water, and environment. This system is open when it is concerned with reducing its side affects on society.

An educational system is concerned with producing a learner with certain skills and abilities. It can be designed so that 90% of the learners accomplish 90% of the objectives. It is open when it concerns itself with how this learner will affect our society in general. It is closed when it is concerned only with producing an individual learner possessing 90% of the objectives 90% of the time. There are times when an educational system must be open to the larger society and times when it must be concerned with only the learner and the objectives. It is both open at times and closed at other times.

Albert Canfield suggests that the systems design of instruction functions inside of a structure composed of programs, courses, units, and learning steps. A program is composed of courses, while a course is composed of units, and units of learning steps. Each instructional level will have specific purposes and objectives. The learning step has the tightest, most concise behaviorally-stated objectives, while a program may have broader non-behavioral objectives, referred to as purposes. The instructional levels and their relationship can be seen in the diagram on your response sheet. Programs may run in time from two to four years or even longer, while a course usually lasts a semester or perhaps a year. A unit of work usually lasts one or two weeks and is the unit that has been found by Indiana University to be the most manageable in designing systems.

A learning step usually is an experience or series of tasks which takes one hour or less. The heart of the design of these different levels is the performance objectives which state both the task to be performed and the criterion for its performance. This performance can be measured with a criterion test.

Since performance or behavioral objectives play such a vital role in the design of a system, they need to be discussed in more detail before we inspect the criterion test and the systems model. In this section we will make a distinction between purposes or aims and objectives.

Purposes are usually broader statements than objectives. They are most often found at the program level, but may be found at the course or unit level. Usually they become more limited as they are used at one of these lower levels. An example of a purpose might be:

> The student, upon completion of the elementary math program, will demonstrate an understanding of our number system and an appreciation of its contribution to our society.

The behavioral objective is usually used at the unit or learning step level of instruction. It is very specific in the way it is stated. Each objective ought to include the task, the rationale, the criterion, and the condition. These behavioral objectives let both the student and the instructional manager know what the student is to do if the instruction is to be effective, why he is doing it, the condition he must do it in, and the level of proficiency he must display.

As previously stated each objective includes these four parts: the task, the rationale, the criterion, and the condition. Let us use the example objective on your response sheet to explain these four parts. Read with me the objective.

TASK	You will have three days, for example, Friday morning until Monday morning, in which to submit a 300-500 word paper on how to build a glider, not a self-propelled airplane, which will sail after being cast by hand.
CONDITION	Using only your paper as a guide, another student who has completed a year of woodworking will be able to build such a glider in eight hours or less. If you need knowledge about gliders, you can get ideas and information from the library, magazines, hobby stores, friends, or any other sources which you might find helpful.
CRITERION	The final test of your paper will be determined by the actual flight of the glider. The workmanship of the woodworking student will not be held against you should it fail to fly.
RATIONALE	This paper gives you practice in organizing your thinking, and in clearly explaining procedures for work, and in giving guidance and direction to others. The ability to prepare clear directions is an important part of the everyday work of supervisors and skilled craftsmen, and will help you clearly explain your ideas, correspondence, reports, etc. -- Albert Canfield

The first section was the task the student must do, what must be done to achieve the objective. The condition under which the student must perform the task is stated secondly in the example. How the student is to be evaluated, the criterion, is stated next. Finally, why the student should do this task is stated. So the task, conditions, criterion, and rationale are the what, how, how well, and why of the objective stated in behavioral terms.

The first task in the anasynthesis process is to determine the behavioral objectives. Once these performance objectives have been clearly defined and stated, the criterion test must be built. The criterion test is designed to determine if indeed the student has gained the desired behavior. The test can measure the student's ability to write, discuss, design, do, etc; the required task of the learning experience, under given conditions, thus exhibits that he has mastered the facts, ideas, concepts, or principles for which the instruction was designed. This can be seen only by the student's behavior.

Once the criterion test has been developed, the units of the course with their clearly defined performance objectives and tests must be sequenced properly. The criterion test has been concerned with the task that should be done when the objectives have indeed been completed. The sequencing process must be concerned with another type of task, the entry level task. An entry level task is the kind of behavior the student must have previously mastered for the instruction to be successful. One of the major causes of instructional failure, and often student failure, is that the student does not possess the needed skills to benefit from the instruction. In the sequencing of the units the instructional designer must observe to see if the previous units of instruction have indeed given the students the necessary skill to proceed to the next unit. The mastery concept allows time for the student to master these skills before being forced to move on.

Having sequenced the units we must select and develop the appropriate learning steps and organize these into the most efficient and effective learning environment possible to reach the desired objective. This is the final stage of the analysis and the beginning of the synthesis. The analysis broke the instruction down into parts to micro-inspect it. Synthesis puts it back together again so that it is a functioning course.

The final phase in the design of the instructional system is the evaluation or feedback loop. This is the process by which we adapt and revise the instruction based on the results of our experience with students.

Carefully then, let's look at the anasynthesis part of our model. On your response sheet you will note a blow-up of the anasynthesis process in the form of a box diagram. The analysis proceeds down the synthesis proceeds up. The first step in the analysis is the establishment of the performance objectives. Write performance objectives in the first box. The second step is to develop the criterion test. Please write this in the appropriate box. The next step is to organize and sequence units. The keystone box at the bottom is to select the learning task. The next step up is to develop and sequence the learning tasks. The final box in the synthesis represents the testing phase. The arrows in the diagram represent the fact that the analysis synthesis process is an ongoing nonlinear process. There is a time when several of these activities are being performed simultaneously.

For a final look at systems theory, let us fully develop our final systems model based on the theory of Optner, Canfield, Faris-Stowe, and Silvern. In the model we have the nega-system. This is the environment in which the system operates. The system may or may not be open to the nega-system. Our system is both open at times and closed at other times to this nega-system. The system then takes the input, processes it in the anasynthesis stage to produce a process by which a student learns. This output or student learning is then evaluated and fed back as input to improve the instruction. This may be seen as you study the model on your response sheet.

It has been the purpose of this investigation to sort from the literature, information about systems design to instruction and to make it relevant for people preparing to be citizens and parents in this country. We found that the systems approach is an ecological approach to instruction in that it is concerned with the interrelationship of variables in instructional learning situations. Secondly, we found that the systems approach required a detailed analysis and synthesis of learning objectives, tasks, and criterion. Silvern then points to the need for an anasynthesis which is an awareness of the interreaction between the analysis and synthesis. Finally, the systems process must be concerned with the evaluation of its results (output) in terms of quality control, research on the learning process, and the revision of the system so that more people at the terminal point will have the desired terminal behaviors and characteristics.

A statement quoted from a structural-linguist working with the Detroit public schools adequately sums up the way that most people working with systems have felt. "This matter of foreign language teaching is just too important to leave to foreign language teachers." The first to agree with him were the foreign language teachers. All too often in today's complex society, this statement can be made about other subject matter areas.

The systems approach to instruction has at all places pointed out that the instructional problem is complex, perhaps even more complex than previously realized. For this reason, almost without exception, it has become a team approach utilizing the talents and abilities of subject matter specialists, test specialists, applied learning specialists, and media specialists.

McPherson lists six barriers to the acceptance of the systems approach. An awareness of these barriers is important to see that the purposes of systems are understood. The barriers are:

1. The monoply on what is taught by the subject specialist.
2. The misconception that the approach is dehumanizing rather than humanizing.
3. The fact that almost all traditional media has been produced with the selfish concern for only one media, rather than integration of media.
4. The initial high cost and the failure to see the picture over a two to three year span.
5. Misunderstanding that says that the system is a fixed structure rather than seeing it as designed to change rationally because of purpose and design.

Comment should be given to the fact that the systems approach is a humanizing approach rather than a dehumanizing approach. When you are able to let the teacher do the things that as a human he can do best, such as love, guide, and recognize problem areas, and when you can make instruction become more individualized in nature, then you have humanized education. The systems approach helps in this process.

In conclusion, a citizen and parent in our future society needs to be aware of the systems design to instruction and the role it will play in our educational setup. The systems design to instruction is an attempt to humanize education by allowing the teacher to perform human functions and by making the learning process more individual in nature, whether it be in groups of one thousand, fifty, five or strictly an individual. The system will be flexible and will have the needed built-in change in order to be continuously updated, improved, and revised.

The citizen and teacher need to be aware of systems theory because of its use by the large learning corporations. This will allow a citizen to keep an effective check on what these corporations produce and sell to our schools. The trends of population, knowledge, and technology can be joined with the trend of book publishers, media producers, and hardware companies to form learning corporations. A detailed look at this can be seen in the Fortune magazine of August, 1966. What happened was that the hardware and electrical companies needed software and went out to get it. The Xerox Corporation was the first merger in 1965. It is a consolidation of University Microfilm, American Education Publications, and Basic Systems Corporation. Then came Time Incorporated, Silver Burdette, and General Electric to form General Learning Corporation headed by Francis Keppel. In 1966 came Raytheon a merger of Edex Corporation, Dage-Bell, McAlister Scientific Corporation, and D. C. E. Publishers. Newsweek joined with 3M corporations, Sylvania with Reader's Digest, McGraw-Hill with Viewlex, and on and on goes the list. Littons Industry is now running, on a contract basis, job corps and some public school systems. They hire, fire, and train the personnel to run the systems.

Curriculum developments such as the University of Illinois Common School Math, the SMSG math, and Science the Process Approach all employ variations of the systems approach in the instructional material design. From these trends we can see that in the future, the systems design to instruction will be used in the development of instruction for the schools.

Finally, one must remember that the major use of systems is to humanize, to determine what to use, when, and in which town, and to determine how to make instruction more effective for all students.

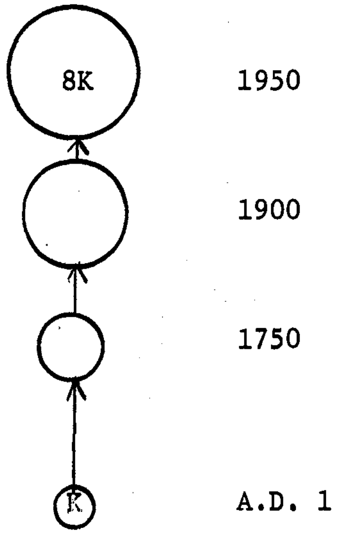
RESPONSE SHEET

I. Trends in Society
   A. Population
      1.

      2.

   B. Knowledge

      1975 at least every 6 months



   C. Technology

II. Instruction
   A. General
   B. Instruction must:
      1. change behavior
      2. get their ________
      3. manage ____________
      4. provide for _______
   C. The task of instruction is:

III. The Role of Programmed Instruction

IV. The Role of the Military

V. Systems defined: a general definition

A. Montgomery

B. Silvern

1.

2.

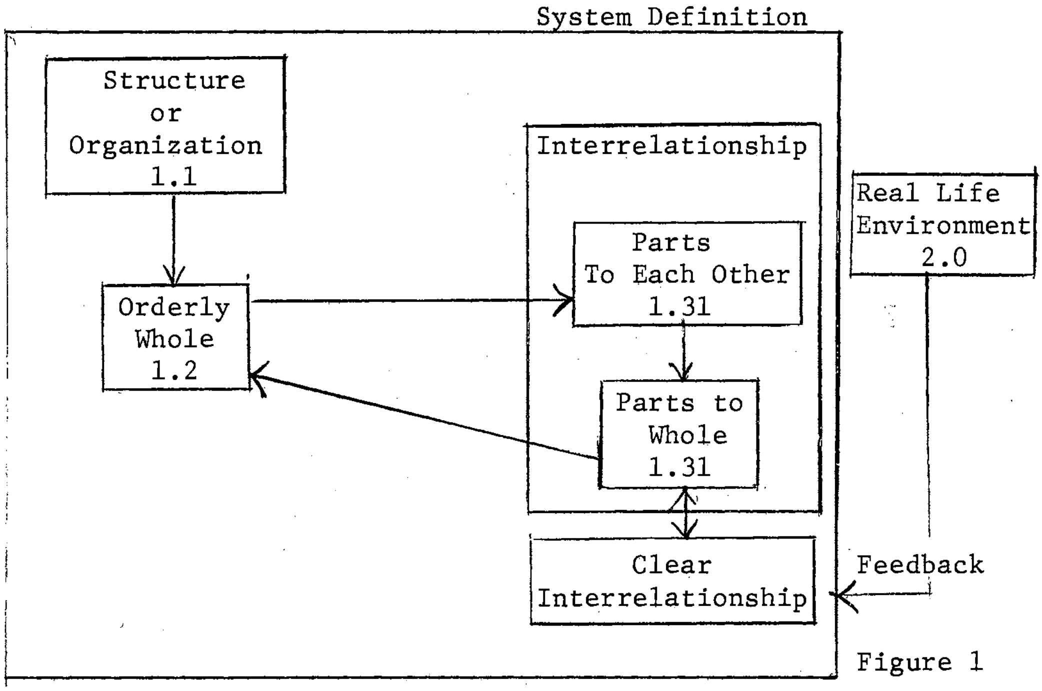


Figure 1

C. Optner's basic theory

1.

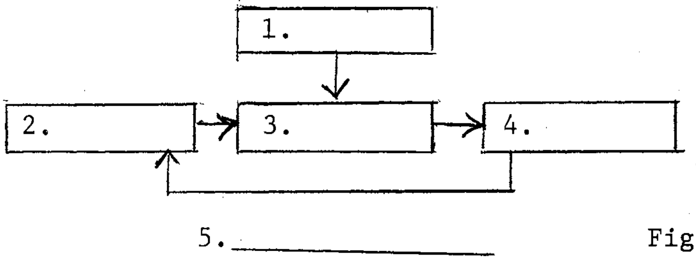


Figure 2

2.

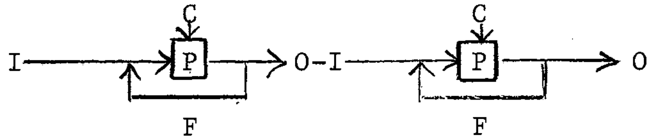


Figure 3

Comments:

3. Elements of system
   a. What is the system?______________________
   b. What are the students to be able to do after being through the system?___________________
   c. Ingredients that can be arranged are called__________
   d. Ability to remain reliable______________________
   e. Correct malfunctioning-update: ________________

4.

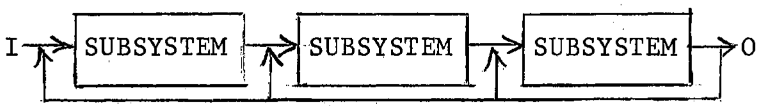


Figure 4

VI. System approach to instruction defined
   A. Montgomery

   B. Silvern - "ANASYNTHESIS"

   C. Optner
      1. General Steps
         a.

         b.

         c.

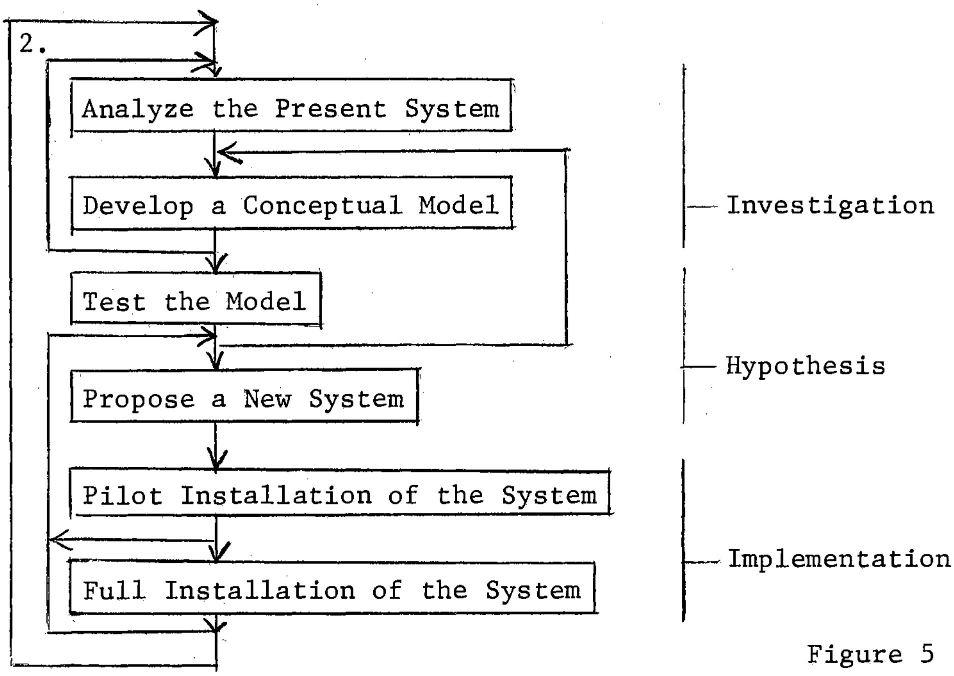
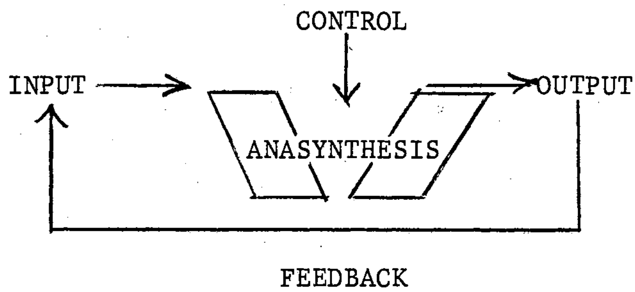


Figure 5

   D. General Comments

E. Tying together our definitions



F. In Summary
   A.

   B.

   C.

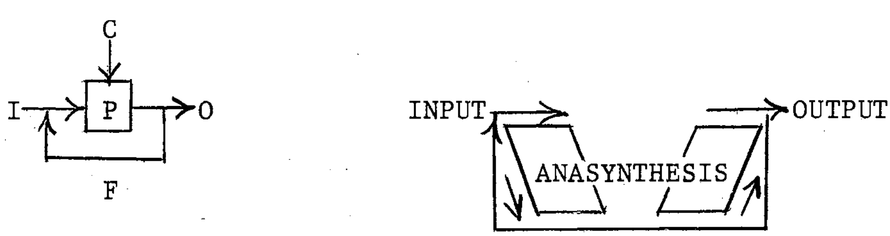
   D.

VII. Purpose of Educational System
   A. Industrial systems purpose-

   B. Educational systems purpose-
      1. learning system

      2. 90/90

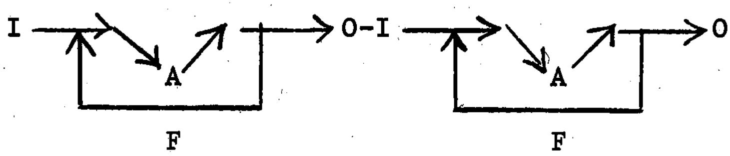
   C. Basic Models Comparison



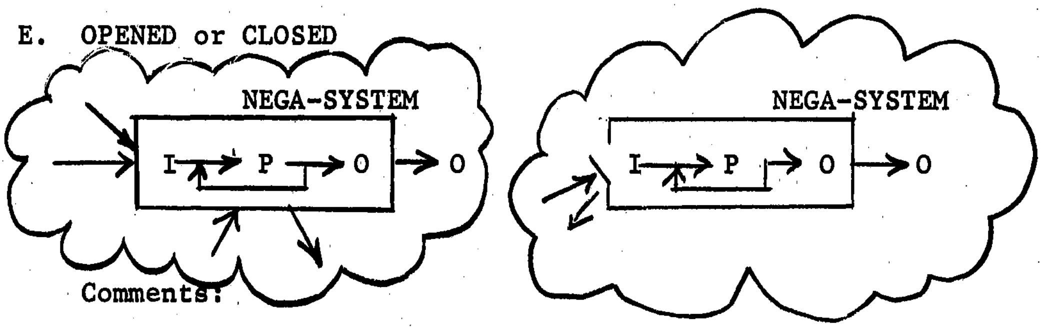
OPTNER'S

Figure 6

D. Series of Subsystems



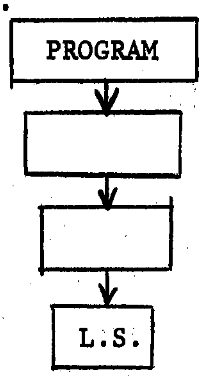
E. OPENED or CLOSED



Comments:

VIII. Framework or Structure in Which a System Must Work

A.



Comments:

Comments:

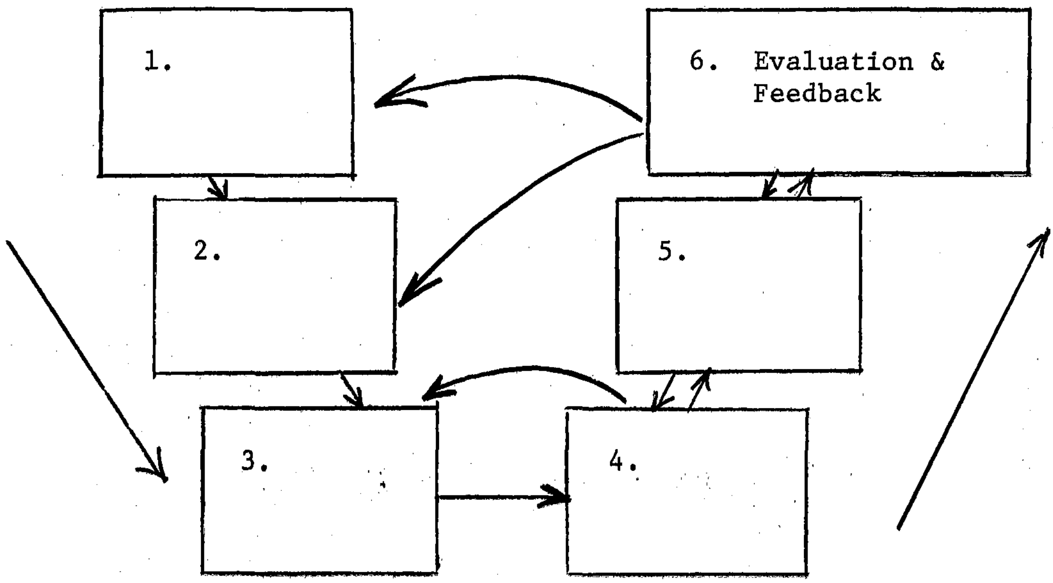
Comments:

Comments:

B. Behavioral Objectives

You will have three days, for example, Friday morning until Monday morning, in which to submit a 300-500 word paper on
TASK how to build a glider, not a self-propelled airplane, which will sail after being cast by hand. Using only your paper as a guide, another student who has completed a year of woodworking will be able to build such a glider in eight
CONDITION hours or less. If you need knowledge about gliders, you can get ideas and information from the library, magazines, hobby stores, friends, or any other sources which you might find helpful. The final test of your paper will be determined by the actual flight of the glider. The work-
CRITERION manship of the woodworking student will not be held against you should it fail to fly. This paper gives you practice in organizing your thinking, and in clearly explaining
RATIONALE procedures for work, and in giving guidance and direction to others. The ability to prepare clear directions is an important part of the everyday work of supervisors and skilled craftsmen, and will help you clearly explain your ideas, correspondence, reports, etc. - Albert Canfield

C. ANASYNTHESIS



1. State objectives behaviorally-

2. Develop criterion test-

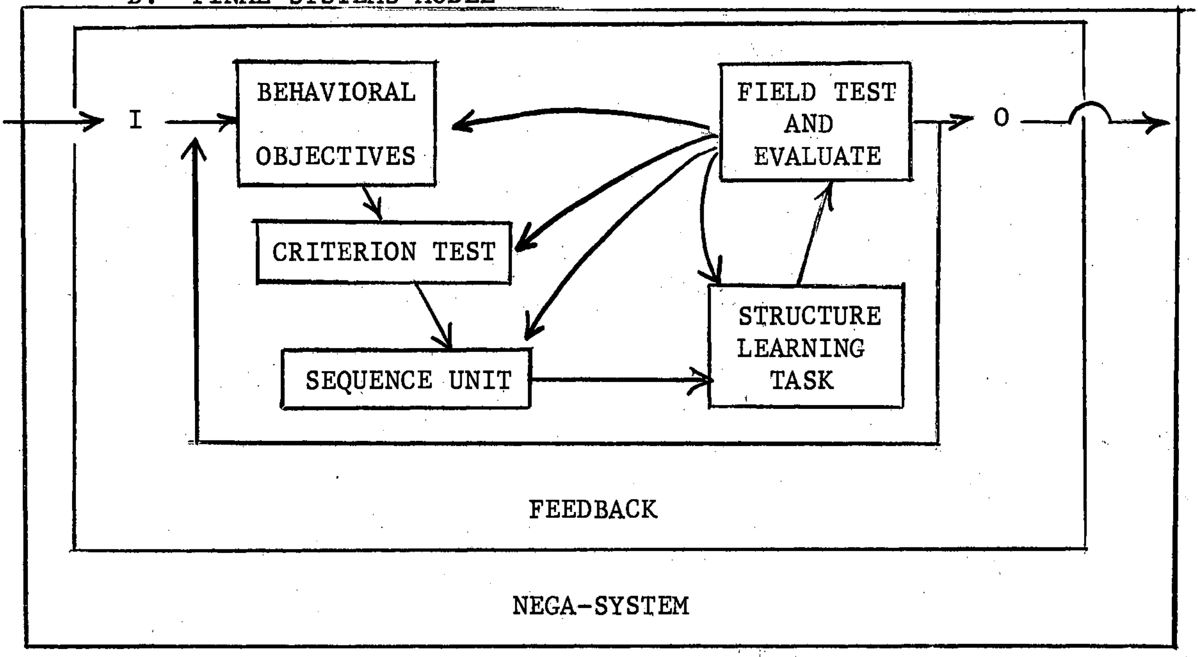
3. Sequence the units-
   a. General-

   b. Entry level task-

4. Develop and structure learning steps-

5. Feedback-

D. FINAL SYSTEMS MODEL



Comment:

IX. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A. A system is a _______________ approach.

B. _______________ of variables.

C. The Team Approach-

D. McPherson's barriers

1. Monopoly-

2. Humanization versus de-humanization-

3. Selfish concern of traditional media

4. Initial cost

5. Fixed structure fallacy-

E. Conclusions

F. Mergers

APPENDIX E

NAME________________________________ EXPERIMENTAL GROUP________

CARREL #____________________________

Mark the correct answer in the space to the left.

_____ 1. Which of the following was not a trend affecting today's education as discussed in the tape?
A. population
B. technology
C. values
D. knowledge

_____ 2. We married the ideas of ________ and ________ to create our systems model.
A. Optner and Morgan
B. Montgomery and Morgan
C. Silvern and Marshall
D. Optner and Silvern

_____ 3. The trend described in the tape as snowballing was:
A. population
B. technology
C. values
D. knowledge

_____ 4. An educational system is:
A. an open system
B. a closed system
C. open and closed by control
D. neither open or closed

_____ 5. The knowledge explosion causes us to:
A. teach more facts
B. teach the process of a discipline
C. teach less children each year
D. go to school more months of the year

_____ 6. An open system is:
A. open to control by man
B. sensitive to the environment
C. sensitive to any input data
D. all of the above

_____ 7. Software refers to:
A. tape recorders
B. desk
C. paper
D. recorder
E. dial access system

_____ 8. The nega-system is:
A. that part of the anasynthesis that deals with objectives
B. another term for output
C. a term for the environment created by the system
D. a term for the environment that the system operates in

_____ 9. Which of the following are presently operating school systems?
A. Raytheon
B. Xerox
C. Kepel-Bell Inc.
D. Litton Industries

_____ 10. A system is designed with:
A. a specified level of productivity
B. application to industry only
C. people playing only minor roles
D. dehumanization of education as a byproduct

_____ 11. A reason that both citizens and teachers need to be aware of systems is:
A. it is inherently bad
B. it is communist supported
C. industry is using it to develop materials
D. the merger of educational industries

_____ 12. A system must have:
A. machines to operate
B. a specific product
C. several ability levels designed in to work
D. none of the above

_____ 13. A strangle hold on what is being taught by the __________ is a barrier to systems utilization.
A. teacher
B. generalist
C. media specialist
D. subject specialist

_____ 14. The systems design to instruction should be considered:
A. a rigid model
B. a model for use only with higher education
C. as a flexible and adaptable model
D. as potentially a model for designing elementary school instruction

_____ 15. Systems are most often designed by:
A. teachers
B. principles
C. curriculum directors and supervisors
D. a team of people

_____ 16. Systems theory borrows liberally from
A. language research
B. political methods
C. traditional methodology of teaching
D. the scientific method

_____ 17. The process of technology applied to the design of insturction materials is:
A. curricular assemblage
B. problem solving
C. hardware design
D. software preparation

_____ 18. A factory thats purpose is to manufacture automobiles is a ____________ system if its automobiles pollute the air.
A. open
B. cyclic
C. sensitive
D. closed

_____ 19. Instruction is designed to:
A. put forth the facts
B. describe a subject
C. cover the material
D. change desired behavior

_____ 20. A course is made up of which two of the following:
A. learning steps and programs
B. programs and units
C. units and systems
D. learning steps and units

_____ 21. The role of the teacher as the evaluator of students is:
A. the full function of instruction
B. the feedback function
C. one part of the function of feedback
D. none of the above

_____ 22. The correct rank of the elements in the structure of a system is:
A. learning step, program, course, unit
B. unit, learning step, program, course
C. program, course, learning step, unit
D. program, course, unit, learning step

_____ 23. The task of instruction is:
A. to pass on information
B. to gain the student's attention
C. to cause the student to evaluate himself
D. to cause mastery to occur.

_____ 24. The length of a unit is usually about:
A. one day
B. one week
C. two weeks
D. three weeks

_____ 25. Systems design has:
A. pointed to the complexity of the educational problem
B. shown the need for just a teacher in planning
C. developed set time tables for students to follow
D. none of the above

_____ 26. The most severe test a system model can meet is:
A. inspection by experts in the design stage
B. in its hypothesis construction
C. in its actual use
D. none of these

_____ 27. The part of a system which keeps it an up to date dynamic process is:
A. anasynthesis
B. output
C. synthesis
D. feedback

_____ 28. Synthesis consists of which of the items in this list? (1. identifying, 2. combining, 3. separating, 4. relating)
A. 1 and 3
B. 1 and 4
C. 2 and 3
D. 2 and 4

_____ 29. The systems design to instruction is:
A. an ecological approach
B. very rigid
C. only slightly flexible
D. very haphazard in its design

_____ 30. Silvern uses the term "anasynthesis". This stands for analysis-synthesis. The analysis consists of which of these: (1. identifying, 2. separating, 3. relating, 4. combining)
A. 1 only
B. 2 and 3
C. 1 and 2
D. 3 and 4

_____ 31. The environment in which the system operates is:
A. the learning center
B. the outer-system
C. the resources area
D. the nega-system

_____ 32. For Montgomery, the systems approach to instruction is concerned with:
A. the machines of education
B. the analysis of the total environment
C. the unrelated segments of instruction
D. the gadgetry of the related sub-systems

_____ 33. Aptitude tells you how long it:
A. will take a student to master the subject
B. takes a smart student to finish his work
C. takes an average student to master a skill
D. none of the above

_____ 34. The time required for a learning step is usually:
A. one day
B. two days
C. slightly less than a week
D. none of the above

_____ 35. Which of the following instructional techniques has caused the greatest interest in the recent history of education?
A. films
B. filmstrips
C. programmed instruction
D. television

_____ 36. Purposes are usually:
A. a waste of time
B. very broad
C. very narrow
D. stated behaviorally

_____ 37. Many complex and difficult problems in the future of education can be expected:
A. because of public apathy toward education
B. due to federal mettling in education
C. without a careful look at learning processes
D. because of technology in our society

_____ 38. A behavioral objective would be most likely to be used at:
A. program level
B. unit level
C. learning step level
D. both B and C

_____ 39. Educators do not look on efficiency and effectiveness as "bad words" in education because of work with:
A. television
B. learning centers
C. programmed instruction
D. all of the above

_____ 40. A purpose is usually used at:
A. program level
B. unit level
C. learning step level
D. both B and C

_____ 41. Once you have developed the objectives, criterion task, and unit sequences, you need to ________.
A. feedback the output as input
B. design your lectures
C. develop learning steps
D. call the students in for a conference

_____ 42. In terms of education, according to Merrill, the processor is:
A. the means by which information enters the system
B. the way the system modifies the information
C. the output reused as input
D. the analytical design stage of the system

_____ 43. When a student does not have the needed skills to do a learning step, he is deficient in __________.
A. criterion level task
B. outgoing task
C. entry level task
D. teacher contact time

_____ 44. The feedback loop of a system is concerned with:
A. identifying the system under study
B. identifying the purpose for the system
C. identifying the ingredients which can be arranged
D. correction of malfunction

_____ 45. After you have stated your objectives and developed the criterion test, you should:
A. sequence the learning step
B. try out the objectives and test
C. order the units
D. be concerned with what lecture to give

_____ 46. The simplest model of systems that we used included which of the following? (1. input, 2. processor, 3. directional, 4. feedback)
A. none of the above
B. 1 and 2
C. 3 only
D. 1, 2, and 4

_____ 47. The first task in the anasynthesis process is _________.
A. to develop criterion
B. to state objectives
C. to design units
D. none of these

_____ 48. Both Silvern and Montgomery think that __________ between parts is the most appropriate word for a system definition.

A. interdependence
B. interrelationship
C. interaction
D. interruption

APPENDIX F

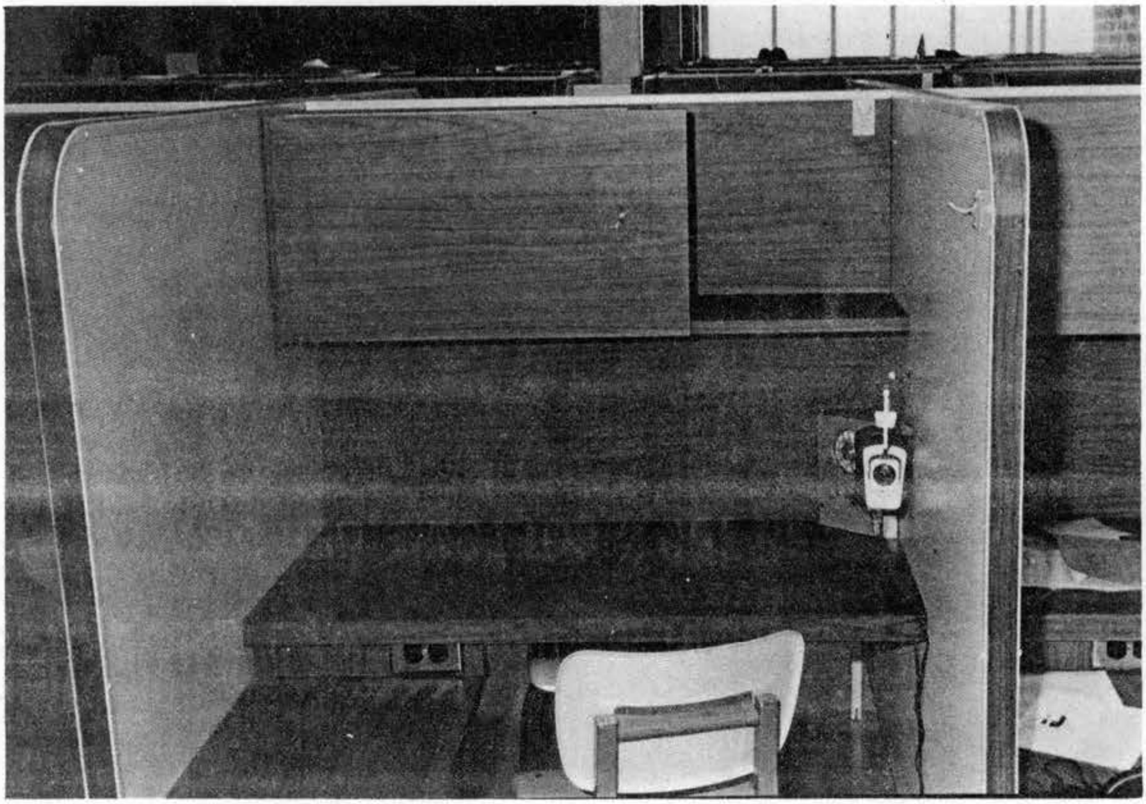


Figure 1. OCC Study Carrel

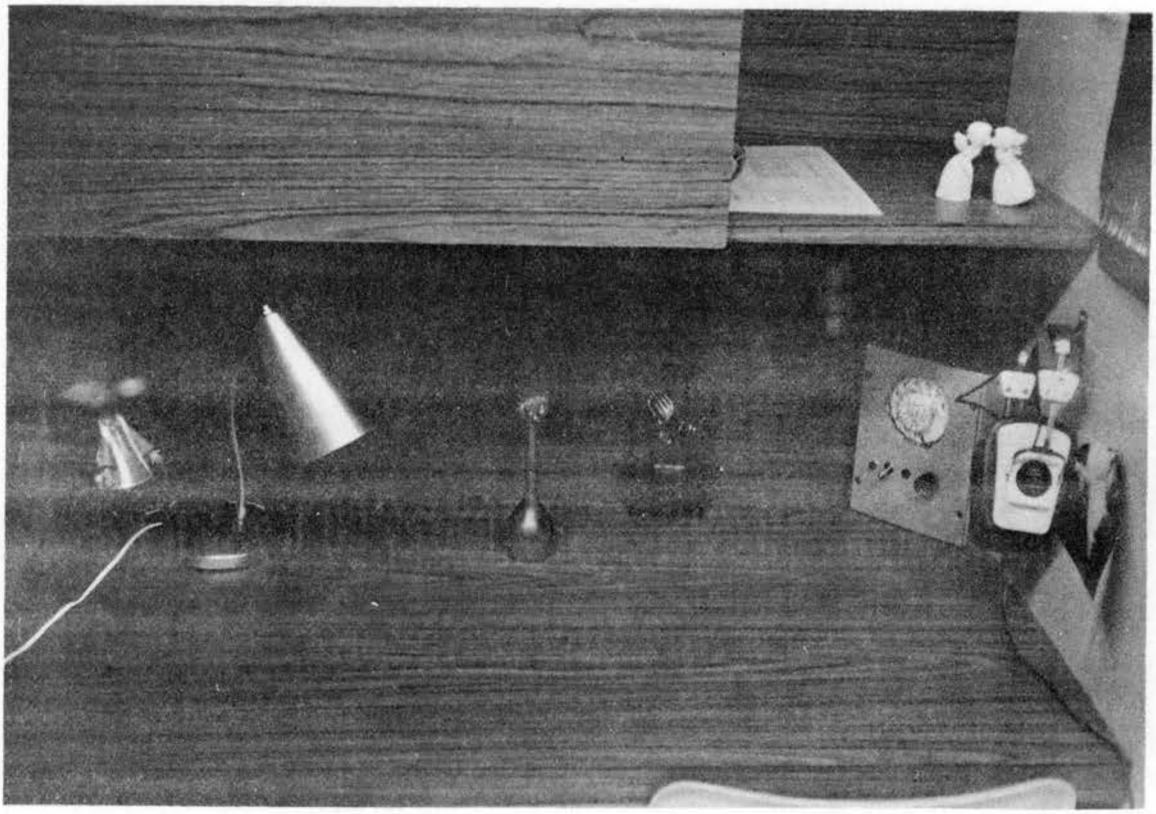


Figure 2. The Student Individualizes Carrel Space

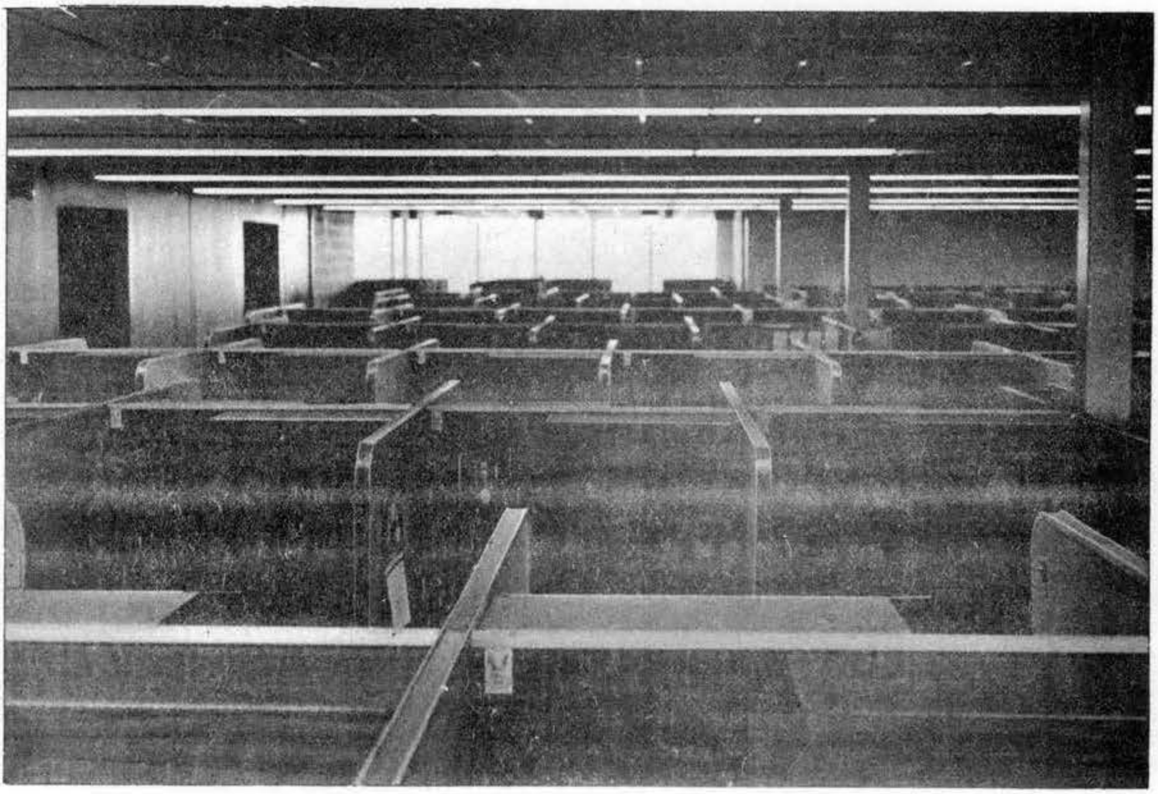


Figure 3. OCC has 1016 Carrels

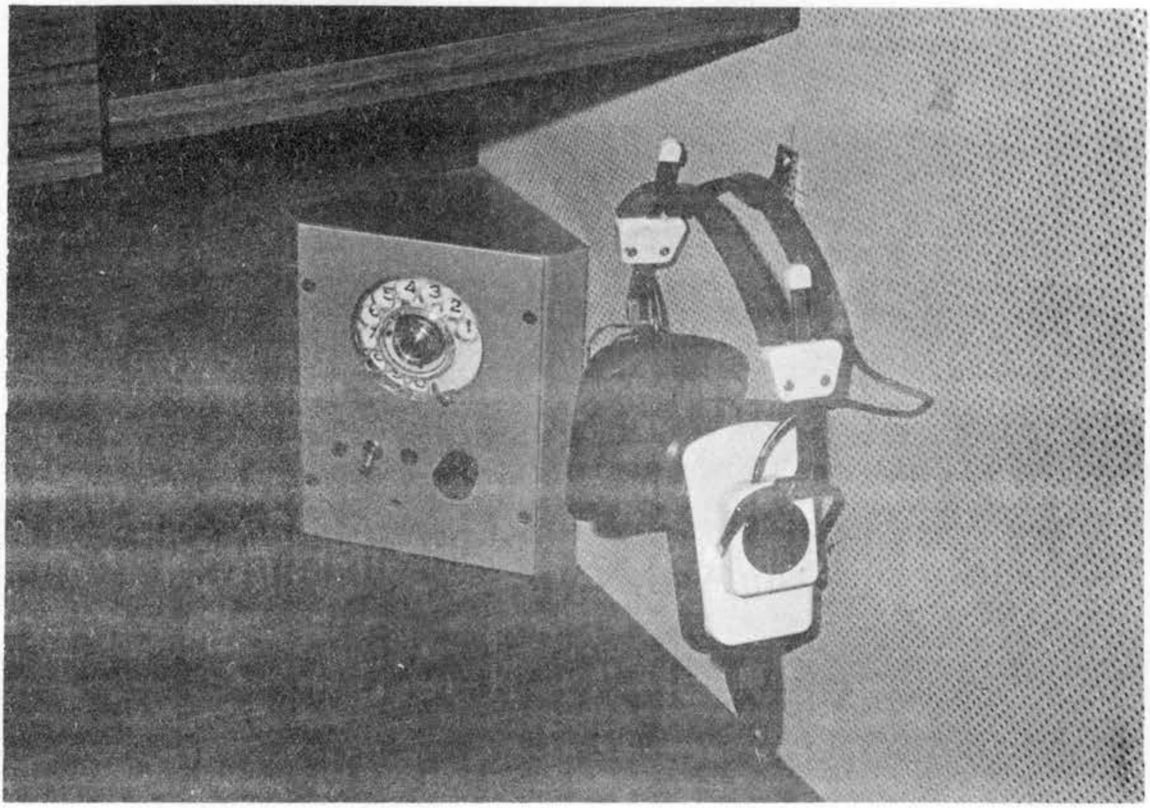


Figure 4. Dial Box and Headsets

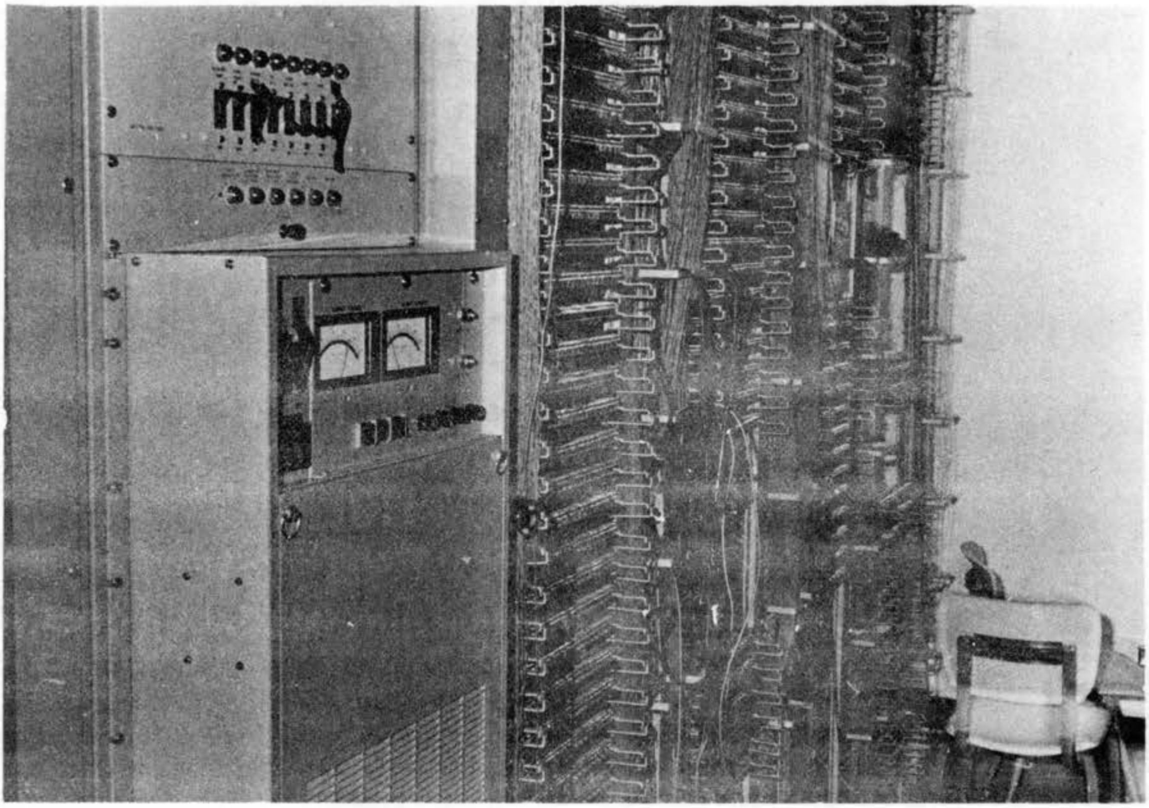


Figure 5. Computer and Telephone Switching Network

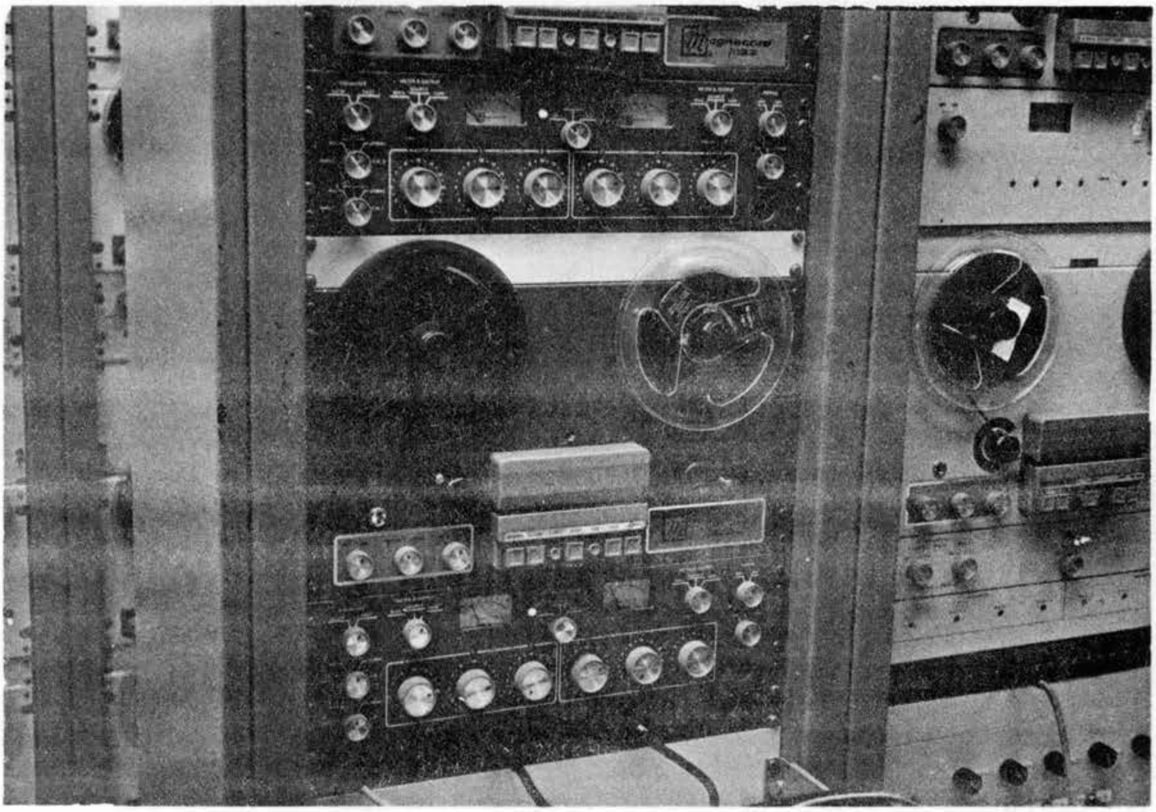


Figure 6. Tape Decks

VITA

3

Larry Jack Alexander

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Doctor of Education

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