# A COMPARATIVE STUDY OF PROGRAMED INSTRUCTION AND VIDEO-TAPED LECTURES IN PUBLIC SPEAKING

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ABSTRACT

A COMPARATIVE STUDY OF PROGRAMED INSTRUCTION AND VIDEO-TAPED LECTURES IN PUBLIC SPEAKING

by Philip P. Amato

The increased enrollment in speech classes, particularly in the basic theory-performance courses, has created a unique problem for speech teachers which demands serious attention. The basic problem is this: the larger the class the less the opportunity for individual attention. This problem is compounded by the inherent limitations of the lecture method in presenting factual material (passive listening, active listening with misunderstanding, etc.) Recent developments in the area of programed instruction indicate its potential utility as a cogent method of presenting the theoretical aspects of speech courses.

The primary purpose of this study was to measure the relative effectiveness of programed instruction and video-taped lectures as methods of presenting public speaking lecture material. A 45 minute lecture on Outlining and Speech Organization was recorded on video tape. Two forms of a 62-frame program were constructed using the identical material as that of the video-taped lecture. One form of the program (constructed response program) consisted of

frames in which the critical words in questions or statements were deleted, and in response to which the student was required to construct a written answer. The other form (reading program) consisted of the same questions and statements as the constructed response program, but with the critical words underlined. In this form the student simply read each frame.

The video-taped lecture and the programs were presented to 223 subjects enrolled in the basic public speaking course at Michigan State University. The subjects were assigned at random to one of seven groups (six experimental and one control). The control and experimental conditions are described below:

TV: Subjects in this condition viewed the video-taped lecture.

CR: Subjects in this condition worked through the constructed response program.

R: Subjects in this condition worked through the reading program.

TVC: Subjects viewed the video-taped lecture and then worked through the constructed response program.

TVR: Subjects viewed the video-taped lecture and then worked through the reading program.

C-R: Subjects first worked through the constructed response program and then the reading program.

C: Subjects in the control group were given the posttest.

Subjects using the programs were instructed to indicate the time they began and finished working on them.

Following the completion of the learning task, subjects in those groups that used the programs were also given an 8-item questionnaire to fill-out anonymously. Three measures were recorded: (1) a posttest score--a measure of amount learned; (2) a time score--the amount of time subjects took to learn; and (3) an attitude measure--the reaction to the learning task.

Three analyses of variance and two Scheffe tests were computed to evaluate the significance of the differences among the posttest means of the seven groups. Critical ratios were computed to test significant differences among time scores. Questionnaire responses were not tested statistically but reported as percentages.

The results of this study tend to indicate that:

1. Programed instruction is a more effective and efficient method of presenting public speaking material than video-taped lectures.

2. Reading programs are as effective as, and far more efficient than, constructed response programs in presenting public speaking material.

3. Combinations of programed instruction and video-taped lectures, while taking much more time, do not increase the total amount of learning beyond that acquired when programs are used alone.

4. Although students feel that programed instruction is a more effective and easier method of learning than video-taped lectures, they do not prefer it as the sole source of instruction.

5. Students have a strong preference for using both programed instruction and video-taped lectures as methods of presenting public speaking material.

This study also includes a brief history of the development of programed instruction; the three most dominant theories of programing; and a review of part of the experimental literature. Implications and the potential utility of programed instruction as an auxiliary teaching device in selected areas of speech education are also discussed.

# A COMPARATIVE STUDY OF PROGRAMED INSTRUCTION AND VIDEO-TAPED LECTURES IN PUBLIC SPEAKING

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TABLE OF CONTENTS

Page

LIST OF TABLES

## LIST OF APPENDICES

# CHAPTER I

# AN OVERVIEW OF THE STUDY

## Introduction

Today, more than ever before, communication and the important role it plays in every day life is seriously being considered and studied. The importance of effective speech, for example, is recognized not only by colleges and universities, but also by business and industry. Approximately one half of the colleges and universities in the United States require that every student take at least one speech course, usually voice and diction or public speaking.[1] Many business and industrial concerns demand or at least encourage executives and supervisors to take a course in business and professional speaking.

The impact of the student population growth, which has already over-taxed primary and secondary educational facilities and manpower, is also beginning to have its effect on speech education. The increase in enrollment of speech classes, particularly in the basic courses, has created a unique problem for speech teachers which demands

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[1] E. C. Buehler and W. A. Linkugel, Speech: A First Course (New York: Harper & Brothers, 1962), 19.

serious attention. In the basic theory-performance type course, such as voice and diction or public speaking, the amount of time each student has for performance is usually proportional to the number of students in the class. As the size of the class grows, the probability of students receiving sufficient time to perform becomes less and less.

In addition to textbooks, there are two dominant methods of presenting factual material in the basic speech course. They are: (1) the classroom lecture-discussion approach; and (2) the lecture hall approach in which all students enrolled in the course listen to the same lecture. Both methods have a number of individual advantages and disadvantages which have been frequently discussed and debated. Regardless of the approach, the problem of student reception still exists. In both situations, one student may be entirely active, another may be entirely passive. Even the most careful organization of material is ineffective when the student is inattentive. Moreover, even though a student may be attentive to the material being presented, he seldom receives immediate information as to the correctness of his response and consequently may form misconceptions. The student is also unable to proceed at his own rate. In fact, because of the mass entrance of students into the classroom, the teacher is often forced to lecture to the average student. The students at the extremes seldom receive the attention required to facilitate

learning; the brighter student is bored while the slower student struggles.

The limitations of the lecture method often force an instructor to sacrifice recitation meetings in order to restate or explain material which the student failed to grasp during the lecture. The more time taken to clarify material covered in the lectures, the less time available for recitation. There is, therefore, a growing need for ways and means of accommodating large numbers of students in speech courses without destroying the small class-individual attention situation which many speech teachers believe is necessary in speech education.

The closed-circuit television presentation of material represents an attempt to cope with the problem of increased enrollment and in many ways has alleviated some of the problems facing the lecturer in the large lecture hall. For example, it has done away with such frequent problems as poor acoustics and lighting which often make it difficult for the students to hear what is being said and see the visual aids being used. Closed-circuit television, however, does not provide each student with individual instruction, and as in any situation where students are not instructed individually, the lecturer is faced with the problem of student reception. This brings on the problems of passive listening or active listening with misunderstanding, and with them the problems of using recitation meetings to clarify

lecture-covered material. Hence, the major problem facing the lecturer still exists. Finally, very few schools have the facilities or budgets for closed-circuit television systems.

Two possible solutions to the problem are: (1) assign a private tutor to each student; and (2) eliminate the lectures and theoretical aspects of the course and use that time for practice and performance. The first solution is impractical from an economic standpoint, the second from an academic standpoint. Without a clear understanding of speech principles the student will profit little from his speaking experiences.

Recently much attention has been focused on the development of teaching machines and programing techniques as a method of self-instruction. Programed instruction is a process of presenting to the student a body of material through small sequential steps or frames in the form of questions or statements. Depending upon the type of program or format, the student may overtly respond to each frame by constructing or selecting a correct answer or he may covertly respond either by mentally composing a correct answer, or by simply reading each frame as a complete statement. In the reading format the correct answers are supplied within the frame, and the student is not required to respond.

The potential utility of this new method of auto-instruction is currently being investigated and mounting

reports of successful experimentation indicate that programed instructional methods are highly effective and efficient. Harm believes that programed instruction may offer a means of achieving the "optimal ratio of theory to practice."[2] According to Harm, programed learning

> appears most suitable for exactly those kinds of material teachers grow weary of explaining term after term but which the student seems unable to get from the text without instructor interpretation.[3]

Since programed learning is an individual-tutor type method based on a one-to-one (program to student) relationship, it represents a means of coping with large numbers of students without the problems of the typical lecture situation. Perhaps it is time for the speech teacher to examine closely these new methods of instruction and determine what possible role they may play in the future of speech education.

## Purpose of This Study

In view of the increase in enrollment of speech classes and the problems facing the lecturer, either in person or on television, it seemed worthwhile to consider programed instruction as an alternative method of presenting lecture material and to subject it to experimentation. Consquently, the primary purpose of this study was to ascertain objectively and quantitatively the relative effectiveness of presenting

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[2]L. A. Harm, "Programed Learning for the Field of Speech," Speech Teacher, 10 (1961), 219.

[3]Ibid.

lecture material through programed instructional devices compared to conventional methods of presentation. While there are many ways of approaching this problem, the experiment conducted as part of this study was designed to investigate methods of presenting public speaking materials and focused on: (1) developing a program on Outlining and Speech Organization; (2) comparing two forms of this program and a televised video-taped lecture on the identical material; (3) comparing combinations of two of these three modes of presentation (video-taped lecture and two forms of a program); and (4) comparing all six modes of presentation, i.e., the three basic modes of presentation and combinations of two of these modes.

A second purpose of this study was to present a brief history of the development of programed instruction, the three most dominant theories of programing, and a review of part of the experimental literature.

A third and final purpose of this study was to consider and discuss the implications and potential utility of programed instruction as an auxiliary teaching device in selected areas of speech education, particularly the basic theory-performance course.

## Limitations

Three major limitations were imposed on this study. First, although programed instruction is a relatively new

field of inquiry, a vast amount of literature has appeared, which makes it difficult to consider its complete depth and scope. This study considered only the major historical developments, the three dominant theories of programing, and a selected portion of the experimental literature.

The second major limitation placed on this study was in the general nature of the experiment conducted. Only one aspect of public speaking was considered--organization and outlining a speech. The programs used were based on only one major programing theory and limited to 62 frames. Only the televised video-taped lecture, and two forms of a program, along with combinations of two of these three basic modes of presentation, were compared. The "in person" lecture hall, "live" television, and classroom lecture-discussion methods of presentation were not considered. The questionnaire used to measure student attitude toward programed instruction was limited in depth and scope and did not readily lend itself to statistical analysis. Hence, only percentages of student responses were reported. Finally, since the students continually applied the information learned in later classroom work, no test of retention over a long period of time was given.

A third major limitation imposed on this study was in the discussion of the implications and potential utility

of programed instruction in speech education. Only selected areas, particularly the basic theory-performance courses, were considered.

## Justification

Because the recent interest in speech training and the increased enrollment in basic speech courses threaten to destroy the small class-individual attention situation, there is merit in studies that seek ways of coping with this growing problem. And since the results of experimental studies have amassed an impressive array of evidence supporting programed instruction as a potentially effective and efficient method of presenting lecture material, there is merit in studies that seek to determine whether these findings are transferable to areas of speech.

To date, there has been little research conducted which has attempted to determine the potential utility and feasibility of programed instruction in speech education. Studies by Hillis[4] and Holland[5] used tape recorders

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[4]J. Hillis, A research project in progress since 1960 which is investigating a tape recorder-workbook type program in applied phonetics at Michigan State University (Department of Speech).

[5]A. Holland, "The Development and Evaluation of Teaching Machine Procedures for Increasing Auditory Discrimination Skill in Children With Articulation Disorders" (unpublished Ph. D. dissertation, Department of Speech, University of Pittsburgh, 1960).

and non-continuous type programs. The experiment reported in this study used a continuous type program and programed booklet as a vehicle of presentation. Finally, there have been no studies reported which compared television ("live" or video tape) and programed instruction as modes of presentation.

## Organization

In alignment with the three major purposes of this study, the organization was divided into three major areas: (1) an overview of programed instruction; (2) an experiment testing the relative effectiveness of methods of presenting public speaking lecture material through televeision and programed instructional devices; and (3) a discussion the implications of programed instruction in speech education.

The chapters of this study follow this general plan of organization. Chapter I endeavors to set forth a basic overview of the study. Chapter II presents a brief picture of the historical development of programed instruction; a discussion of the three dominant theories of programing; and a review of part of the experimental literature. Chapter III consists of a report of the experiment, including: a statement of the problem; a review of the literature related to the problem; a listing of the hypotheses tested; a description of the subjects, materials, and procedure followed; and a discussion of results; and

conclusions drawn from the data. The final chapter, Chapter IV, includes a discussion of the implications and potential utility of programed instruction in selected areas of speech education.

# CHAPTER II

## PROGRAMED INSTRUCTION

Most of the major developments in the field of programed instruction have occurred within the past ten years.[1] The earlier self-teaching devices were conceived as teaching aids in conjunction with standard teaching methods. The first teaching machine, for example, was developed and patented in 1866 and was designed to aid in teaching spelling.[2] Today, programed instruction is generally conceived as a sole source of instruction, i.e., a method of instruction without the aid of other standard teaching devices (textbooks, lecture-discussion, etc.).

### Some Early Developments in Self-Teaching Devices

In 1915, Sidney L. Pressey began a series of studies designed to measure the effectiveness of self-testing devices which provided immediate confirmation of responses. In his early studies Pressey used a mechanical device

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[1]For a comprehensive picture of the history of programed instruction see Teaching Machines and Programed Learning: A Source Book, ed, A. A. Lumsdaine and R. Glaser (Washington, D. C.: National Education Association, 1960), 5-23. This book also contains numerous articles on programing theories, techniques, and experimental studies.

[2]I. Mellan, "Teaching and Educational Inventions," Teaching Machines and Programed Learning: A Source Book, pp. 265-74. This device did not provide immediate feedback concerning the correctness of the student's response.

called the "Drum Tutor"[3] which is about the size of a typewriter and consists of a window which displays a multiple choice item and four keys which represent each of the four alternatives. A sequence of questions (usually 30) is inserted into the machine with the first question visible to the student. The student reads the question and responds by depressing a key. If the response is correct, the next question in the sequence appears in the display window; if incorrect, the machine does not advance the next question and the student must try again. These studies revealed that the "Drum Tutor," in addition to serving as a mechanical tester, produced significant increments in learning.

A more thorough investigation of self-testing devices as potential self-teaching instruments was made by Pressey and his associates using a punchboard type device.[4] The punchboard device consists of two 3" x 5" thin punchboards, the top one of which contains a series of numbered rows of holes. An answer sheet is placed between the two boards; the multiple choice test items are presented on separate reusable sheets. After reading a question the

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[3]S. L. Pressey, "A Simple Device Which Gives Tests and Scores--and Teaches," School and Society, 23 (1926), 373-76.

[4]S. L. Pressey, "Development and Appraisal of Devices Providing Immediate Automatic Scoring of Objective Tests and Concomitant Self-Instruction," Journal of Psychology, 29 (1950), 417-47.

student responds by inserting his pencil into the hole corresponding to the alternative on the test sheet. If his choice is correct, the whole pencil goes through the paper; if incorrect, only the point of the pencil goes through the sheet and the student must try again. These studies also found that in addition to testing, the punch-board device produced significant increments in learning.

These early devices did not receive any widespread acceptance or attention. While successful in producing significant increments in learning they were not programed instructional devices in the true sense of the term. The material presented to the student was not a program but a test based on subject matter taught via standard teaching methods such as lectures, discussion, and textbook readings. The tests were not designed to produce an organized change in learning behavior; on the contrary, the learning that took place was incidental to the testing and principally the result of response feed-back.

The idea of a teaching device designed to serve as a sole source of instruction began to receive considerable attention after 1954. In that year, B. F. Skinner reintroduced the concept of automated instruction in a provocative paper presented during a psychology conference at the University of Pittsburgh.[5] He reported the development

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[5] B. F. Skinner, "The Science of Learning and the Art of Teaching," Harvard Educational Review, 24 (1954), 86-97.

and feasibility of a mechanical device designed to present a continuous discourse program which would serve as a sole source of instruction rather than as a testing device that produced learning as a byproduct. Skinner developed a small box-like device about the size of a portable typewriter. The top surface of the Skinner teaching machine contains a display window through which a question or problem may be seen. The problem is printed on a paper disk and consists of questions or statements in which one or two words are missing. The student reads the problem and responds by writing in the provided answer space to the right of the display window. He then raises a lever and the correct answer is exposed which the student compares with his own answer. After indicating with an appropriate movement of the lever whether his answer was correct or incorrect, the student reads the next item in the program which appears in the display window. At the completion of the program, incorrect items are repeated. Skinner and his associate, James G. Holland, found that the program and teaching device were capable of producing learning without the use of standard teaching methods.[6]

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[6]J. G. Holland, "Teaching Machines; An Application of Principles From the Laboratory," Programed Learning: Theory and Research, ed. W. I. Smith and J. W. Moore (New York: D. Van Nostrand Company, Inc., 1962), pp. 34-48.

Since 1954, self-teaching methodology has developed into what is now commonly referred to as programed instruction. In programed instruction the material to be learned is broken down into a series of small steps. Depending upon the program format and presentation mode, these steps may be written in the form of a multiple choice item or an incomplete question or statement. In either case, the student is required to make an overt response. The presentation process, depending upon the complexity of the device, may prompt or hint, reveal the correct answer immediately after the student responds, branch the student off to a remedial phase of the subject matter, and keep score for the complete series. The vehicle of presentation may range from a machine to a specially designed book.

## Programing and Presentation Devices

Programing Theories.--The power of programed instruction lies not in the presentation device or machine but in the program. At the present time there are three dominant schools of programing from which stem a number of programing techniques or systems. These three programing theories are known as "linear," "intrinsic" or "branching," and "multiple choice."

Linear Programing.--This theory of programing was developed by B. F. Skinner, and the learning model is basically a conditioning model. Of the three theories,

it is the most popular. In 1960, for example, 62 of the 81 programs surveyed were of this type.[7] Much of this popularity, however, seems to stem from the ease with which this type of program can be constructed and presented.

Linear programing is based on the concept of operant conditioning, which differs from classical conditioning. Briefly, operant conditioning postulates that each time a response is reinforced in the presence of a certain cue or stimulus the probability of the recurrence of that response in the presence of the same stimulus is increased. Once a reinforcer (which is contingent upon a response) gains control over a form of behavior, that behavior can parsimoniously be maintained by an intermittent reinforcement schedule.[8]

Through a serious consideration of Thordike's Law of Effect[9] and basic principles of operant conditioning,

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[7]J. W. Rigney and E. B. Fry, Current Teaching-Machine Programs and Programing Techniques, Supplement 3, Audio-Visual Communication Review, 9.

[8]For a more concise picture of Skinner's theory of learning and operant conditioning see E. R. Hilgard, Theories of Learning (New York: Appleton-Century-Crofts, Inc., 1948), 80-109.

[9]According to this law, we tend to repeat those responses which are followed by a rewarding state of affairs and avoid those which are accompanied or followed by an unhappy or annoying state of affairs. E. L. Thorndike, Educational Psychology (New York: Columbia University Press, 1921, II, 4.

Skinner developed a system of programing which employs four major principles: (1) clarity and simplicity; (2) reinforcement; (3) gradual progression; and (4) fading or vanishing.[10]

The principle of clarity and simplicity, according to Skinner, suggests that a good program is one which makes it almost impossible for the student to make an error. The concepts or principles to be learned are atomized, constructed into simple statements, and presented with some degree of redundancy. The linear method usually requires that the student construct his own response; this is usually done by exposing to the student a question or problem which contains a blank(s) for one or two missing words. This method also avoids using multiple choice items so that the learning process is not one of trial and error. In fact, little provision is made for errors since they are considered irrelevant to learning any may hinder its process. Hence linear programs, if properly constructed, are refined to the point where very few errors occur. In addition to the atomization of material, the program employs prompting, cueing, or other suggesting devices.

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[10]R. Glaser, Principles and Problems in the Preparation of Programed Learning Sequences, A Report Prepared Under Cooperative Research for the United States Office of Education (Pittsburgh: University of Pittsburgh, 1960), 4-8.

The second principle of linear programing is reinforcement. According to this principle, a desired change in behavior, defined as learning, can best be brought about by rewarding or reinforcing the desired behavior. The change is acquired as a result of "contingencies of reinforcement."[11] Reinforcement does not follow unless the conditioned response appears; in other words, the reinforcement is contingent upon the response. In traditional arrangements, such as in the classroom,reinforcement might have to wait until homework is corrected or test papers returned. By this time, the reinforcement has lost a good deal of its potency. In contrast, the linear program theorist argues that programed instruction provides immediate feedback, a higher rate of reinforcement, and active student participation in the learning process. This is by far one of the most critical features of this new method of instruction.

The principle of gradual progression is concerned with getting the student from a basic point (initial repertoire) to a higher or complex point (terminal repertoire) through a series of finite steps. In working from the initial to the terminal repertoire, each and every small change in behavior which is in the direction of the terminal repertoire is reinforced. This principle

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[11]Skinner, op. cit., 86.

runs throughout the program and serves to make the student correct as often as possible. (See Table 1.)

TABLE 1

A SET OF FRAMES ILLUSTRATING THE PRINCIPLES OF LINEAR PROGRAMING

| Frame | Answer Blank and Correct Response |
|---|---|
| 1. Plosives are exploding sounds. When we build up pressure in out mouths and suddenly release it we produce a_____ sound. | _____ plosive or exploding |
| 2. In order to make the sound [p] we must bring our lips together build up_____in our mouths, and suddenly release it. | _____ air or pressure |
| 3. The sound [o] is not a _ _ _ _ _ _ _* because there is no pressure built up in the mouth. Try it! | _____ plosive |
| 4. Which sound is not a plosive? [p] [f] [b] [d] | _____ [f] |

*This is one method of "prompting" or "cueing." Each space represents a letter in the correct answer.

The final principle, fading or vanishing, is one which is concerned with the withdrawal of stimulus support. It involves a weaning process which takes the student away from any dependence upon the program (such as the "prompting" techniques used in Table 1) which he may have developed.

Built into the program is a gradual process of removing prompts and cues so that by the time the student has completed the lesson he responds to the material as a stimulus rather than to built-in prompts or cues.

Hence it may be said that the linear program requires at least four basic features. (1) Program items must be relatively small in terms of the amount of information they impart to the learner. (2) Each item must be presented in a logical sequence. (3) The learner must overtly respond to each item. (4) The learner must receive immediate feedback or knowledge of results.

The linear programing model has been the subject of much investigation. In contrast to the requirements stated above, many studies have found, for example, that there is no significant difference in criterion performance between programs requiring overt responses and programs requiring covert responses. A further discussion of experimental findings will be presented in the latter part of this chapter.

Intrinsic Programing.--The second major programing theory was developed by Norman A. Crowder, who views the teaching of human beings as essentially a communication process.[12] This approach to programing makes no

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[12]N. A. Crowder, "Automatic Tutoring by Means of Intrinsic Programing," Automatic Teaching: The State of the Art, ed. E. Galanter (New York: John Wiley and Sons, Inc., 1959), 109-116.

presumptions as to how to set up conditions under which efficient learning takes place and uses feedback to control the communication process. Therefore, the program frames or items in intrinsic programs are not restricted to as rigid a model as that proposed by Skinner. Furthermore, in this type of programing knowledge of results is primarily used to determine whether the communication was successful rather than as a method of reinforcement.

Intrinsic programing is more commonly known as "branching," since it employs a branching procedure which involves shifting the difficulty of the material presented to a lower level when the student may have trouble responding to a particular item. It may also work the other way; that is, the material may be shifted to a higher level when the student is responding very rapidly and correctly. To implement these shifts either a machine or a specially designed ("scrambled") book is required.

In the "scrambled" book format each step of the program is presented on a different page. The material (program steps) is scrambled throughout the book to prevent the student from merely reading through the program. Thus, step one may be on page 1, step two on page 29, and so on. (See Table 2.) The student is given a short discussion of the material to be learned, followed by a multiple choice question designed to test him on the

material just discussed. Each alternative leads the student to a different page in the book (in the machine the pages are usually represented by a frame on a microfilm and alternative selecting is done by pushing appropriate buttons). If the student selects the correct alternative, he is given additional information and a new problem; if he selects a wrong alternative, he is told why he is wrong and referred back to the problem where he selects another alternative. The shifting of material is contingent upon the student's responses and for this reason the intrinsic or branching method is sometimes referred to as "adaptive programing." In Table 2, choosing "factors" on the first try permits the student to bypass two remedial steps. The choosing of a wrong alternative leads the student to a remedial level. Thus, the shifting of material difficulty is dictated by the student's response.

Intrinsic programing has certain obvious advantages in coping with individual differences. Unlike the linear program, every student is not required to read every step. The one main objection to this method is its prodigious use of time and materials. For example, a sequence of fifty questions with only two alternatives would require fifty extra pages in a text or frames in a machine just to carry the wrong answers. In a sequence of fifty questions with the usual four alternatives,one hundred and fifty

TABLE 2

A SET OF FRAMES ILLUSTRATING THE INTRINSIC OR BRANCHING METHOD AS USED IN A SCRAMBLED TEXTBOOK [13]

Page 1

In the multiplication 3 x 4 = 12 is called the product and the numbers 3 and 4 are called the

Page 15 quotients
Page 29 factors
Page 43 powers

[If the student chooses the alternative "powers" he turns to Page 43.]

Page 43

Your answer was: 'powers.'

We'll get to the powers of numbers pretty soon, but we're not there yet. The numbers that are multiplied together to form a product are called 'factors,' not 'powers.' Now return to Page 1 and choose the right answer.

[The student returns to Page 1 and now chooses the word "factors" which directs him to Page 29. Note: If the student chooses "factors" the first time, he bypasses Pages 15 and 43, which are remedial steps.]

Page 29

Your answer was: 'factors.'

You are correct. The numbers which are multiplied together to form a product are called 'factors.' Thus in multiplication '3 x 4 - 12' the numbers 3 and 4 are the factors, 12 is the product.

Is it possible for the same number (same quantity, that is) to be used as a factor more than once in forming a product?

Page 59 Yes
Page 71 No

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[13] Ibid., 15-17.

extra pages or frames would be necessary to accommodate the wrong alternatives. The mechanical devices employing micro-film are capable of large programs of two or three hundred items but these machines are quite expensive. Another factor to be considered in this type of programing is the inherent difficulty in constructing good multiple choice items.

Multiple Choice Programing.--The third type of programing theory was developed by Sidney L. Pressey. As stated earlier, Pressey views the program as an auxiliary teaching device rather than as a sole source of instruction. The steps in the program are cast in the form of multiple choice items, but unlike the intrinsic method a wrong alternative does not direct the student to remedial areas. If he chooses a wrong alternative the student is either instructed to choose another or given the correct answer and instructed to continue along in the program. Thus, in item sequencing this approach is linear. Fry discusses a number of differences between linear and multiple choice programing;[14] the major difference between these two methods of programing is in the types of questions asked and response modes used (multiple choice vs. constructed response). The current trend in "styles of

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[14]E. Fry, "Teaching Machine Dichotomy: Skinner vs. Pressey," Programed Learning: Theory and Research, 81-86.

programing," however, seems to be in the direction of composite programing--particularly the combination of multiple choice and linear methods; the branching or intrinsic method is seldom used.[15]

Programing Techniques.--In addition to the three programing theories and their respective programing techniques, a number of other systems have emerged.[16] In the "Ruleg" system, for example, the subject matter to be programed is classified into two classes of statements--rules and examples.[17] The program frames or items are usually written as either incomplete rules or incomplete examples to which the student must respond by filling-in

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[15]Programs, '62: A Guide to Programed Instructional Materials (New York: The Center for Programed Instruction, Inc., 1962), xi-xii.

[16]The individual theories and techniques of programing are scattered throughout the literature. There are, however, a number of sources which present selected articles by noted theorists and critics, particularly Lumsdaine and Glaser (op. cit.) and Galanter (op. cit.). Summaries of the major programing theories and systems of programing are found in Current Teaching-Machine Programs and Programing Techniques (Rigney and Fry, op. cit.), 14-19, and in Lawrence Stolurow, Teaching by Machine (Washington, D. C. U. S. Department of Health, Education, and Welfare, Office of Education, 1961), 17-50.

[17]J. L. Evans, R. Glaser, and L. E. Homme, The RULEG System for the Construction of Programed Verbal Sequences (Pittsburgh: Department of Psychology, University of Pittsburgh, August 1960). A discussion of this system may also be found in Lumsdaine and Glaser (op. cit., 486-96).

the answers called for in the blank(s). This system of programing follows a linear format. There are at least ten different systems of programing, but they are simply variations of the three major theories.

Presentation Devices.--The two most popular methods of presenting programs are the machine (ranging from a simple hand-operating piece of hardware to computers) and programed textbook. Today, there are over 80 machines on the commercial market and almost as many in the research laboratory.[18] There are also two major types of programed textbooks.

Although they represent different designs and degrees of complexity, these devices contain at least four basic features or functions.[19] (1) Presentation Function: A question or problem is presented to the student in response to which he must construct or indicate an answer. (2) Comparator-Feedback Function: The student is informed whether his response is correct or incorrect. (3) Programing Function: The sequence in which the items are presented is controlled by the program or the student's response

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[18]J. D. Finn and D. G. Perrin, Teaching Machines and Programed Learning: A Survey of the Industry-1962 (Washington, D. C.: Department of Health, Education, and Welfare, Office of Education, 1962), 23. This publication includes a complete directory of machines and programs currently found on the commercial market.

[19]B. F. Skinner, "Teaching Machines," Science, 128 (October, 1958), 969-77.

(as in the intrinsic or branching method). (4) Selective-Pacing Function: The student proceeds at his own rate; the timing of the questions and answers is usually under the control of the student.[20]

There are basically two types of programed textbooks: (1) the linear or constructed response type; and (2) the scrambled book, which was discussed earlier. Both types of books represent two of the three major approaches to programing (linear and intrinsic or branching). In the linear or constructed response book, questions or statements contain one or more blanks which represent the critical word(s) in the frame or item. The student responds by constructing a written answer. Depending upon the textbook format, the student either turns the page (horizontal format) or reads down to the left or right of the next item (vertical format) to ascertain the correctness of his response. After comparing his response to the correct answer in the text, the student reads the next item in the sequence.

## A Review of Selected Experimental Studies

Since 1954 a sizeable number of studies have been conducted to test the effectiveness and efficiency of programed instruction. On the whole, these studies indicate that groups taught by means of programed instruction tend to score significantly better on criterion

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[20] A more detailed treatment of the functions of certain machines may be found in Teaching by Machine (Stolurow, op. cit.), 17-50.

performance measures than groups taught by conventional methods. The criteria generally used in these studies are: (1) time necessary to complete learning task; and (2) achievement tests. The majority of recent studies have investigated the relative merits of different principles of programing, particularly those set down by Skinner in the linear method. The remainder of this chapter is devoted to studies of this nature. It is hoped that such a review of the experimental literature will provide the reader with a clearer picture of programing principles in relationship to their behavior under experimental conditions.

Punchboard Studies.--The early research relating to self-teaching devices was initiated by Pressey and was mainly concerned with the potential utility of multiple choice testing devices ("Drum Tutor," "punchboards"), which provide immediate knowledge of results, as instructional tools to supplement regular classroom instruction. Studies by Pressey,[21] Little,[22] Briggs,[23] Angell,[24]

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[21]Pressey, "Development and Appraisal of Devices Providing Immediate Scoring of Objective Tests and Concomitant Self-Instruction," Journal of Psychology, op. cit., 417-47.

[22]J. K. Little, "Results of Use of Machines for Testing and for Drill Upon Learning Educational Psychology," Journal of Experimental Education, 3 (1934), 45-49.

[23]L. J. Briggs, "The Development and Appraisal of Special Procedures for Superior Students and an Analysis of the Effects of 'Knowledge of Results'," Abstract of Doctoral Dissertations, 58 (1949), 41-49.

[24]G. W. Angell, "Effects of Immediate Knowledge of Quiz Results on Final Examination Scores in Freshman Chemistry," Journal of Educational Research, 42 (1949), 391-94.

Jensen,[25] Jones,[26] and others offer an impressive array of evidence showing that the punchboard type test can produce significant increments in learning and that students using the device score higher on criterion performance than students not using the device. These studies, however, did not attract any widespread use of this method of auto-instruction.

The Program as the Sole Source of Instruction.--Skinner reintroduced the concept of automated instruction in 1954. While the Pressey punchboard approach was interested in the teaching machine as an auxiliary teaching device, Skinner approached it as a possible sole source of instruction. A number of studies were first conducted to test the feasibility of this point of view. Studies by Porter,[27] Home and Glaser,[28] Blyth,[29] along with a number of others, showed that machines can teach on their own and that

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[25]B. T. Jensen, "An Independent Study Laboratory Using a Self-Scoring Test," Journal of Educational Research, 42 (1949), 134-47.

[26]R. S. Jones, "Integration of Instruction With Self-Scoring Measuring Procedures," Abstract of Doctoral Dissertations, 65 (1954), 157-65.

[27]D. Porter, "Some Effects of Year-Long Teaching Machines," Automatic Teaching: The State of The Art, 84-90.

[28]L. E. Homme and R. Glaser, "Relationships Between the Programed Textbook and Teaching Machines," Ibid., 103-7.

[29]J. Blyth, "Teaching Machines and Human Beings," Educational Record, 41 (1960), 116-26.

programed instruction material, using either machines or programed textbooks, produces significantly better criterion performance than non-programed presentation.

Machine Versus Programed Textbook.--Studies comparing the machine and programed textbook modes of presentation indicate that there is no significant difference in achievement between the two modes.[30] Eigen, et al. found that there is no significant difference in mastery between machine, horizontal text, or vertical text.[31] Because of the inherent problems associated with any mechanical device, these studies generally show a significant saving in time within those groups utilizing the programed textbook. The results of these studies suggest that programs may be presented either by machine or programed textbook with the same degree of effectiveness and that the programed textbook is the more efficient of the two modes in terms of time necessary to complete the program. A recent survey shows that 93.4 per cent of the available programs can be obtained in programed textbook format.[32]

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[30]L. S. Goldstein and L. G. Gotkin report and summarize eight studies which have compared machine and programed textbook presentation of self-instructional materials. All of the studies dealt with the Skinner linear-type program. No significant differences between modes emerged and in five studies, significant saving in time was effected with use of the programed textbook. ("A Review of Research: Teaching Machines vs. Programed Textbooks as Presentation Modes," Journal of Programed Instruction, 1 [1962] , 20-36.)

[31]Eigen, et. al., "A Comparison of Three Modes of Presenting a Programed Instruction Sequence, "Journal of Educational Research, 55 (1962), 453-60.

[32]Programs, '62, xiii.

Intrinsic or Branching Versus Linear Programing.--
A number of studies have been concerned with the relative effectiveness and efficiency of these two programing theories. In the linear technique proposed by Skinner, a fixed sequence of items is displayed and the learner is required to go through all the items. The branching method, in contrast, uses a variable sequence of items, allowing the learner to branch to remedial material or bypass to more difficult material.

Coulson and Silberman presented a program on elementary psychology to college students through a simulated teaching machine.[33] The results showed no significant difference on the criterion test scores between the groups using linear and those using branching programs. The branching group, however, learned the material in much less time than the linear group.

In a later study by Silberman, et. al., a logic program was presented to groups of high school students through a computer-based teaching machine.[34] The researchers found that the branching or intrinsic group did no better

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[33]J. E. Coulson and H. F. Silberman, "Effects of Three Variables in a Teaching Machine," Journal of Educational Psychology, 51 (1960), 135-43.

[34]H. F. Silberman, et. al., loc. cit.

on criterion performance than the linear group, nor did it take less time for the branching group to learn the material.

Two later studies by Campbell also failed to show the superiority of one method over the other.[35] Thus the Skinnerian assumption that programs must be presented in linear formats does not seem to hold up under experimentation. On the other hand, there is little evidence suggesting that intrinsic programing is more effective or efficient than linear. It is obvious that more investigation is necessary before further assumptions on either type of programing can be made.

Small Versus Large Steps.--Another Skinnerian and linear programing assumption maintains that the program must contain a large number of small steps. The results of studies comparing small versus large step programs do not appear to support this thesis. Two early studies, one by Coulson and Silberman,[36] another by Evans, Glaser, and Homme,[37] suggest that smaller steps (more items to

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[35]V. N. Campbell, Adjusting Self-Instruction Programs to Individual Differences: Studies in Cueing, Responding, and Bypassing (San Mateo, Calif.: American Institute for Research, 1961).

[36]Coulson and Silberman, loc. cit.

[37]J. L. Evans, R. Glaser, and L. E. Homme, "An Investigation of 'Teaching Machine' Variables Using Learning Programs in Symbolic Logic," Journal of Educational Research, 55 (1962), 433-52.

cover the same subject matter) produce significantly better performance on immediate and delayed criterion tests. On the other hand, recent studies by Shay,[38] Smith and Moore,[39] Briggs, et. al.,[40] have found no statistically significant differences between the small and large groups on criterion performance. However, the inter-study variance in the research parameters in the above mentioned studies, as in most of the experiments reported, makes it difficult to assess the full significance of the experimental findings. For example, the two earlier studies presented programs in elementary psychology and symbolic logic to college students, while the latter studies employed programs in spelling, Roman Numerals, and the structure and function of the U. N., and presented them to elementary school children. The Shay study defined an item step size in terms of the "difficulty of giving the correct answer" and the criterion measure was the number of

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[38]C. B. Shay, "Relationship of Intelligence to Step Size on a Teaching Machine Program," Journal of Educational Research, 52 (1961), 98-103.

[39]Smith and Moore, "Size of Step and Cueing," Programmed Learning: Theory and Research, 202-6.

[40]Briggs, et. al., "Experimental Results Regarding Form of Response, Size of Step, and Individual Differences in Automated Programs," Programed Learning and Computer-Based Instruction, ed. J. E. Coulson (New York: John Wiley and Sons, 1962), 86-98.

errors on the program. In the Smith and Moore study, pictorial and non-pictorial cue programs were used and the difference between a small step and a large step was three frames.[41] In view of these interstudy experimental variations and in light of the contradictory findings, it would seem that further research is required before this programing assumption can be discarded or assumed.

Scrambled Versus Ordered Sequence.--The a priori assumption by Skinner that the optimum program is one in which the items are presented in a logical sequence has also been the focus of recent investigation. In a previous study, according to Roe, Case, and Roe, a student failed to read the instructions in his programed text and worked through the program by reading down each page rather than moving along the horizontal divisions from page to page.[42] In spite of this procedure, the student scored high on the criterion test.

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[41]Goldstein "wonders if a difference in step size of only two or three frames per word can reasonable be expected to produce any significant effects. Also questionable is the assumption that the presence or absence of a pictorial cue presented only once for each new word is sufficient to differentiate between programs. . .Failure to control for 'cheating' could obscure a significant relation between error rate and step size on cueing. An experiment which used 'more difficult' subject matter, had greater range in step size and cueing, and controlled for 'cheating' might give results different from those of this study." ("Recent Research," Programed Instruction, 2 [December, 1962], 6.)

[42]V. K. Roe, H. W. Case, and A. Roe, "Automated Teaching Methods Using Linear Programs," Programed Instruction, 1 (October, 1961), 7.

In 1962 V. K. Roe conducted an experiment to determine whether sequential ordering of frames in a program is better than random ordering of the same items.[43] She used a 71-frame, multiple choice program designed to teach elementary probability. The results indicated that the sequence of items had no significant effect on variables that were measured. The researcher also found that prior mathematical aptitude did have a significant effect on both the error-score and the criterion test score. Although the assumption that sequential ordering of frames in a program is better than random ordering of the same items has been considered axiomatic by many theorists, the above study, along with those of Gavurin and Donahue,[44] and Levin and Baker,[45] does not seem to support this principle. On the other hand, the scrambled format used in these studies may be viewed as a series of ordered sequences in which the student pigeonholes in his mind the frames relating to specific concepts. This idea may be posited on the basis of the small number of frames

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[43] V. K. Roe, "Scrambled vs. Ordered Sequence in Auto-Instructional Programs," Journal of Educational Research, 52 (1961), 98-103.

[44] E. I. Gavurin, and V. M. Donahue, "Logical Sequence and Random Sequence," Automated Teaching Bulletin, 1 (1961), 3-9.

[45] G. R. Levin and B. L. Baker, "Item Scrambling in a Self-Instructional Program," Programed Instruction, 1 (April, 1962), 4.

and concepts generally employed in these studies. It appears that studies employing large numbers of frames and concepts should be conducted before final judgment can be passed on the assumption of ordered sequencing of program frames.

Immediate Versus Delayed Knowledge of Results.--Another Skinnerian assumption and one held by most proponents of programed instruction is that the program must provide the learner with immediate feedback or confirmation of results concerning the correctness of his response to each item. Results of the early "punchboard" studies indicate the necessity for such feedback.

Little found performance measures for groups which received immediate knowledge of results superior to those groups whose responses were scored and returned the next day.[46]

Briggs attempted to verify the effectiveness of knowledge of results.[47] While Little demonstrated the importance of immediate feedback by using a machine and non-programed set of multiple choice items, Briggs used the punchboard device (also employing a non-programed set of multiple choice questions). He found that the

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[46]Little, loc. cit.

[47]Briggs, loc. cit.

punchboard used in the regular manner, i.e., working each item until a correct answer is found, was superior to the punchboard group in which the student was allowed only one try at each item, and was then informed as to the correctness of that one try. Both modes of knowledge of results were superior to the regular test procedure in which no knowledge of results was given.

Angell conducted an experiment to determine the effects of immediate and delayed knowledge of quiz results on three types of learning in freshman chemistry: facts and principles, application of facts and principles in non-quantitative problems, and application of facts and principles in quantitative problems.[48] Students in the experimental group used punchboards on three hour-long quizzes. The control group used machine-scored (IBM) answer sheets and received no information concerning the quiz results until the next recitation section meeting. The criterion of improvement used was scores on the final examination of the course. Angell found that the experimental group did significantly better than the control group at the .01 level.

The necessity for immediate feedback or knowledge of results for non-programed multiple choice items seems to

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[48]Angell, loc. cit.

be well documented. Whether such immediate confirmation of results is critical where the program is the sole source of instruction is an experimental question which has recently received attention.

Meyer presented a 10-lesson program designed to teach Latin prefixes in English words through a programed textbook to 44 eighth grade students.[49] An immediate-knowledge-of-results group was compared to another which received confirmation after a 24-hour delay. Meyer found that the delayed-knowledge-of-results group made almost twice as many errors on the program and scored lower on the criterion test than the group receiving immediate confirmation of responses.

In a study investigating certain programing characteristics, Evans, Glaser, and Homme considered the question of immediate versus delayed feedback in terms of minutes rather than hours or days.[50] The researchers employed a program in symbolic logic in which most items required more than one response. The subjects were not allowed to check their responses until they had completed

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[49]S. R. Meyer, "A Test of the Principles of 'Activity,' 'Immediate Reinforcement,' and 'Guidance' As Instrumented by Skinner's Teaching Machine," Dissertation Abstracts, 20:12 (1960), 4729-30.

[50]Evans, Glaser, and Homme, "An Investigation of 'Teaching Machine' Variables Using Learning Programs in Symbolic Logic," Journal of Educational Research, 55 (1962), 433-52.

all responses to that particular item. This procedure delayed the feedback between response and response confirmation; the delay averaged about two minutes, with a range of thirty seconds to five minutes. The immediate and delayed groups were also compared to a group making no response (items in the form of complete sentences). The results showed that delay of confirmation or knowledge of results from 30 seconds to five minutes resulted in no significant performance decrement. In fact, this study indicated that perhaps the response (and therefore feedback) is not necessary since the no-response group (read complete statements) scored as well on criterion performance as the immediate and delayed feedback groups. A complete discussion of types of responses will be presented later.

A recent study by Ripple used a 134-frame linear programed textbook of the constructed response type to teach the background, basis, and techniques of programed instruction to college students (N=240).[51] Of the various conditions employed, two are relevant to this discussion. In one condition the constructed responses of the subjects were immediately confirmed; in a second condition the subjects responded but received no feedback.

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[51]R. E. Ripple, "A Comparison of the Effectiveness of a Programed Text With Three Other Methods of Presentation," Programed Instruction, 2 (May, 1963), 6.

A 50-item (25 multiple choice and 25 completion items) served as the criterion measure; it was administered two days after training and again ten days later. No significant differences emerged between the two treatments. An interesting sidelight to this study was that the error rate of the group receiving feedback was "conspicuously" less than the groups which did not receive feedback.

Results of other studies also seem to suggest that there is no significant difference between groups with and without knowledge of results.[52] Goldstein points out that the effectiveness of immediate confirmation of results may depend upon the program used, since "some programs, particularly those employing conversational chaining have the answer imbedded in succeeding frames."[53] In such a program, deleting words and giving the answer in separate answer frames has little value. Perhaps obvious program items or frames should not require a response and the subsequent confirmation of results. Results of recent studies investigating overt and covert responding, and reading programs (a linear program without deleted words--

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[52]Smith and Moore, loc. cit. J. F. Feldusen and A. Birt, "A Study of Nine Methods of Presentation of Programed Learning Material," Journal of Educational Research, 55 (1961), 460-71.

[53]Goldstein, "Recent Research," Programed Instruction, 2 (December, 1962), 6.

frames are in the form of complete statements which the student reads) suggest that good conversational chaining programs are capable of teaching without the use of response-making or knowledge of results. A full discussion of the research findings on this subject will be presented in Chapter III.

The Response Mode.--There has been considerable discussion in the literature of the relative merits of the different response modes.[54] Moreover, a considerable body of research has emerged attempting to evaluate the effectiveness and efficiency of these modes. Skinner requires that the student actively respond to an item by constructing a written response. Pressey and Crowder (with modifications) suggest that picking a multiple choice alternative is sufficient. A third type of response is offered by Evans, Glaser, and Homme which requires that the subject mentally compose the response called for in the program item without recording it; this type of responding is called "implicit" or "covert" responding.[55]

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[54]D. Porter, "A Critical Review of a Portion of the Literature on Teaching Devices," Harvard Educational Review, 27 (1957), 126-47. W. Deterline, "Response Mode: Different Effect or Different Purpose?" AID, 1 (September, 1961), 4-5, R. S. Hatch, "More On the Response Mode Controversey," AID, 1 (December, 1961), 4-5.

[55]Evans, Glaser, and Homme, "A Preliminary Investigation of Variations in the Properties of Verbal Sequences of the 'Teaching Machine' Type," Teaching Machines and Programed Learning: A Source Book, 486-96.

Research in the area of responding may be grouped into five areas of investigation: (1) multiple choice versus written or constructed response; (2) overt versus covert response; (3) overt versus reading; (4) covert versus reading; and (5) overt versus covert versus reading. The last three areas will be discussed in Chapter III.

Constructed Versus Multiple Choice.--Of the four studies reported here, two found that constructed response programs produced more learning than multiple choice programs when the criterion measure was a constructed response type test. The other two found no significant difference.

Fry used a non-continuous-discourse type program designed to teach Spanish words and phrases to 150 ninth grade students.[56] Two post-tests, one given immediately after training--the other given two days later, served as criterion measures. Both tests consisted of equal numbers of multiple choice items and constructed response items. Responses to the multiple choice items all approximated the maximum possible score and hence did not reflect any significant difference. On the other hand, the constructed response items showed significant results

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[56]E. Fry, "Teaching Machines: An Investigation of Constructed Versus Multiple-Choice Methods of Response," Automated Teaching Bulletin, 1 (1959), 11-12.

favoring the constructed response mode of training. The results of this study also showed that in the condition where time was allowed to vary, the constructed response program took significantly longer than the multiple choice group.

Coulson and Silberman used a program on elementary psychology and presented it to college students through a simulated teaching machine.[57] They found that the multiple choice response mode took significantly less time than the constructed response mode during training. No significant difference was obtained between response modes on the criterion tests for the branching or intrinsic procedure. When a linear procedure was used, the constructed response mode was superior to the multiple choice mode on a 19-item constructed response test.

Using a 192-frame program on elementary probability, Roe, et. al., compared the constructed response and multiple choice modes of responding.[58] The program was presented through teaching machines allowing students to proceed at their own rate of responding. The researchers found no achievement differences (20-item posttest); but they did find the usual time saving of multiple choice responding over written responding.

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[57] Coulson and Silberman, loc. cit.

[58] A. Roe. et. al., "Automated Teaching Methods Using Linear Programs," Programed Instruction, 1 (May, 1961), 6.

Evans, Glaser, and Homme presented a 72-frame program in symbolic logic to 60 college students.[59] No significant difference was found between the two modes or response on both the immediate and one-week delayed posttests (three 150-item tests). As in the case of the other three studies reported, the multiple choice format required less time to complete the program.

Overt Versus Covert Responding.--Of the three studies reported below, one found a significant difference favoring overt responding while the other two found no significant difference between the two response modes.

Evans, Glaser, and Homme compared overt (written) and covert (implicit) responding using a "Fundamentals of Music" program.[60] The authors found that the covert group took less time to complete the program and did better, though not significantly so, on the posttest.

Cummings and Goldstein, in a more recent study, presented a 119-frame program (Diagnosis of Myocardial Infraction) to 63 college students.[61] Two groups were compared: overt (written) responding and covert

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[59]Evans, Glaser, and Homme, "An Investigation of 'Teaching Machine' Variables Using Learning Programs in Symbolic Logic." Journal of Educational Research, 55 (1962) 433-52.

[60]Evans, Glaser, and Homme, "A Preliminary Investigation of Variations in The Properties of Verbal Sequences of The 'Teaching Machine' Type," Teaching Machines and Programed Learning: A Source Book, 486-96.

[61]A. Cummings, and L. S. Goldstein, "The Effects of Overt and Covert Responding on Two Kinds of Learning Task," Programed Instruction, 2 (April, 1963), 7.

(mentally composing) responding. The results of the immediate and ten-day posttests reveal that the overt group achieved significantly higher scores on the pictoral and verbal sections of the tests, but that the differences for the verbal sections were not as great as the pictoral sections. On the performance criterion, however, the covert group was far superior to the overt group (the overt group required a mean time of 98.8 minutes to complete the program while the covert group required only 50.3 minutes).

Keislar and McNeil used a 432-frame program on kinetic molecular theory and found no differences between overt and covert responding.[62] The subjects, 300 primary grade school children, were assigned to four groups. The two groups of interest to this discussion were taught individually through a teaching-machine device consisting of colored slides and a tape recorder commentary. The overt group was required to answer by pressing a button to indicate choice of alternatives; the covert group watched and listened to the commentary without physically responding. No significant difference emerged between the response modes on paper-and-pencil tests and individual interviews which measured retention and transfer concepts.

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[62]E. R. Keislar, and J. D. McNeil, "A Comparison of Two Response Modes in An Autoinstructional Program With Children in The Primary Grades," Journal of Educational Psychology, 53 (1962), 127-31.

Discussion.--It is rather difficult to summarize and assess the research findings of the studies reported. This is due mainly to the large variance in the research parameters, such as: sample size, program format, research design, conditions, etc. Nevertheless, some tentative conclusions may be drawn from the results of these studies.[63] The first is that both linear and intrinsic programs are equally effective in producing learning and that, in terms of time necessary to learn, the intrinsic or branching program appears to be the more efficient of the two. Secondly, in terms of programing principles, the linear model does not maintain a position of superiority over other systems and techniques. This does not mean that linear programing principles are inferior, but rather that there are a number of methods of developing good programs. Perhaps this accounts for the recent trend in program styles. As noted earlier, the trend is a departure from pure linear or intrinsic styles to composite programs which employ combinations of different programing principles. Finally, it is obvious that more research is necessary to further establish successful methods of programing.

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[63]By and large, these studies generally used a control group taught by conventional teaching methods, usually the lecture-discussion technique. The results offer an impressive array of evidence indicating the superiority of the programed instruction groups.

# CHAPTER III

## THE RELATIVE EFFECTIVENESS OF SIX METHODS OF PRESENTING PUBLIC SPEAKING MATERIAL

The experiment reported in this chapter developed out of: (1) a need for methods of coping with the growing enrollment in speech courses, particularly basic theory-performance courses: and (2) the potential utility of programed instruction as a method of presenting lecture material. The experiment represents an attempt to investigate the relative effectiveness of programed instruction as a method of presenting public speaking material.

### Statement of the Problem

At the present time there is no evidence which justifies the practice of presenting lecture material by means of vide-taped lectures rather than programed instruction. In the area of speech education, there is no evidence which justifies the use of any lecture method over programmed instruction. One of the questions asked in the experiment reported here is whether there is a significant difference in learning and time needed to learn when the same lecture material is presented by televised video-taped lectures or programed instruction. The effective difference between these two methods is that in the video-taped lecture presentation the rate

of material is not controlled by the student, nor is he required to respond actively to the material; in the programed instruction method the student proceeds at his own rate of speed and must either actively respond to the material or read it.

A second question considered in the experiment is whether it is important for the learner to make a response during the learning process. Recent studies in the area of programed instruction have attempted to determine the relative effectiveness of different methods of responding to programed material. The three modes of response generally compared are: (1) constructed response (writing out an answer); (2) multiple choice (choosing an alternative); and (3) implicit or covert response (mentally composing an answer). Some program theorists, for example Skinner, insist that the student must actively respond by constructing a written answer.[1] Results of studies, however, have generally shown that multiple choice and covert responding do not affect the quality of learning. In fact, multiple choice and covert responding generally increase the efficiency of the learning performance.[2] A number of studies comparing

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[1] Supra, Chapter II, 14.

[2] Supra, Chapter II, 34-38.

different response modes often include a "reading group." The subjects in the reading group are instructed to read the same programed material as the response groups but with the answer already written in the blanks. Hence a "reading program" is one in which the student reads without responding. The results of these studies generally show that the reading group is as effective as, and far more efficient than, any other procedure. These findings suggest that student responding may not always be necessary in certain types of programs. This question was also considered in the experiment.

Three other basic questions were considered; two of them generate from the two questions stated above. One considers the question of time needed to learn in the three modes of presentation (video-taped lecture, constructed response program, and reading program); the other is related to student attitude toward these modes, specifically televised taped lectures and programed instruction. The third question stems from all the others and asks whether there is a significant difference in learning, time needed to perform the learning task, and student attitude when combinations of two presentation modes are used; a video-taped lecture and a constructed response program, a video-taped lecture and a reading program, or a constructed response program and a reading program. These questions generate a number of specific hypotheses which will be stated following a review of the literature.

## Review of the Literature

There is a general framework within which the questions stated above can be viewed. Although there have been no studies reported which compared programed instruction and video-taped lectures, the effect of programed instruction on learning achievement and learning efficiency (time needed to learn) can be examined by a review of the literature which compared it to other lecture presentation modes.[3] These studies generally reveal the superiority of the programed instruction method. The present study developed, in part, out of the need for research which compares programed instruction and video-taped lectures as modes of presentation. There have been a number of studies which investigated the relative effectiveness of mode of response and reading programs, and student attitude toward programed instruction. These studies are reported below.

Response Mode Versus Reading Programs.--There have been a number of studies which investigated the relative effectiveness of program groups in which the student was required to respond (overtly or covertly) to program frames, and groups that simply read the program frames as complete sentences (correct responses supplied). The

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[3]Supra, Chapter II, 23-38.

overall results of these studies suggest the potential superiority of the reading program for certain types of material. The comparison of covert responding and reading programs in the experiment reported in this chapter grew out of the results of the research cited below. The twelve studies reported here may be grouped into three areas of investigation: (1) overt versus reading (and listening); (2) covert versus reading; and (3) overt versus covert versus reading.

Overt Responding Versus Reading.--Six studies were conducted comparing these two types of programs. Four indicate no significant difference between the two treatments. A fifth study indicates the superiority of overt responding with groups "below median MA." A sixth study found significant differences favoring overt responding but the type of reading group was not clearly defined. In all cases, the reading groups took significantly less time to complete the program.

Evans, Glaser, and Homme used a 72-frame program in symbolic logic and presented it to sixty undergraduates to study the effects of differences in two overt response modes (written and multiple choice) and reading (the correct answer just below the material but within the frame).[4] The reading group, while taking less time on

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[4]Evans, Glaser, and Homme, An Investigation of 'Teaching Machine' Variables Using Learning Programs in Symbolic Logic, Journal of Educational Research, 55 (1962), 433-52.

the program, took the longest mean time for completion on the three 15-item performance tests. This difference, however, disappeared over the one week retention interval. In no case were significant achievement differences found, either on immediate or delayed posttests.

Silberman, et. al., using a logic program with high school students through a computer-based teaching machine, compared written responding, reading frames in statement form, and reading papargaphs.[5] Results showed that the reading groups took less time to complete the program. No achievement differences among the treatments were found.

Gropper and Lumsdaine presented a programed lesson on body chemistry to 150 high school students through television.[6] The overt group was required to construct responses on a work sheet completing sentences presented on the TV screen, while an identical lesson in which the blanks were already filled-in and which the instructor read twice while the students read the sentences silently was presented to the reading group. An achievement test administered the day after the experiment and again approximately two weeks later served as the criterion

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[5]H. F. Silberman, et. al., "Fixed Sequence Versus Branching Auto-Instructional Methods," Journal of Educational Psychology, 52 (1961), 166-72.

[6]G. L. Gropper and A. A. Lumsdaine, "An Investigation of the Role of Selected Variables in Program TV Instruction, Audio-Visual Communication Review, 9 (November-December, 1961), A48-56.

measure. No significant differences emerged on either the immediate or delayed posttests between the two groups.

Roe, et. al. presented a 192-frame program on elementary probability to 186 freshman engineering students (four ability levels) through programed textbooks (horizontal format).[7] The overt group constructed responses called for by the blanks in each item. In the reading group the blanks were filled-in with the correct answer. A 20-item constructed response test was given immediately after training. The reading group took less time than the students who constructed answers. The students in the lower quartiles did not score as high as the students in the upper quartiles; however, there is no indication that any one of the methods was better for a particular aptitude level, on the basis of either time or achievement performance measures.

Using the same subject matter and type of students as Keislar and McNeil[8] but with vocalization as a form

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[7]Roe, et. al., loc. cit. In the horizontal format each page is divided into a number of panels in which the program frames appear. The learner begins at the top panel of page one, reads the frame, and constructs a response or chooses an alternative. After responding he turns the page and compares his answer with the correct response, which is to the left of the top panel containing frame two. When he gets to the last page, going from page to page using the top panel, he returns to page one and begins reading the second panel on each page. He continues this procedure until he completes the whole program.

[8]Keislar and McNeil, loc. cit.

of overt response, Wittrock presented the kinetic molecular theory program to 80 first grade students through colored slides and tape recorder commentary.[9] For the overt response group the program was structured in completion-item form with the last word of most of the sentences to be supplied audibly by the subject during a five second pause (indicated by an audible tap of a bell) in the taped commentary. After the pauses, the taped commentary presented the correct response. In the reading and listening group the slides and tapes were identical to the ones used by the overt group; the five second pause and instruction for overt responding was omitted. Subjects were divided into two individually matched groups of 40 subjects according to mental age (MA) and, as nearly as possible, according to chronological age (CA), and sex. The subjects were presented the programs in groups of ten or less on eight consecutive school days. Immediately following this group-setting instruction period, a ten minute individual standardized interview, and written (multiple choice) group test was administered. One year later the written, multiple choice test was again given to the subjects. Results show that the reading-listening group (120.2 minutes) took less time than the overt group (165.0 minutes ) to complete the program. On the immediate

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[9]M. C. Wittrock, "Response Mode in the Programing of Kinetic Molecular Theory Concepts," Journal of Educational Psychology, 54 (1953), 89-93.

posttest the variance due to interaction between response mode and MA was statistically significant at the .05 level. The overt response mode was more effective with the below median MA subjects than it was with the above median MA subjects. On the one-year-later retention test, no significant interaction between MA and response mode emerged.

The Ripple study mentioned earlier also compared an overt (written) response group and a reading group.[10] He found that the overt group differed significantly from the reading condition on criterion posttest measures (immediate and delayed). The author concluded that active involvement required by the overt programed condition contributed to the increase of learning. However, as pointed out by Silverman in his review of the study,

> to evaluate this study, one must have answers to certain questions about the reading. . .was the material arranged in discrete frames or was it put in paragraph form? How long did it take the subjects to read the material? Were they allowed to read and reread the material until the time was up?[11]

Covert Versus Reading.--Of the two studies on this topic, one failed to reveal any significant differences between covert responding and reading; the second found that the reading group did significantly better on the posttest.

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[10]Ripple, loc. cit.

[11]R. A. Silverman, "Recent Research," Programed Instruction, 2 (1963), 6.

The Keislar and McNeil study mentioned earlier presented slides and taped commentary to two groups.[12] Both groups received instruction in group setting in which the program and commentary were presented to the subjects in a classroom (12 to 15 subjects at a time). The slides were projected on a large screen (correct answer identified by a green sticker) while the commentary was played on a tape recorder. Subjects in one group received the program in question form as in the teaching machine group; in the other group, all questions were rephrased and presented as statements. No difference in the effect of these classroom presentations on subject mastery was found.[13]

Silberman, et. al. presented a 61-frame logic program to high school students through a computer-based teaching machine.[14] The authors found that the

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[12]Keislar and McNeil. loc. cit.

[13]In comparing these two groups with the two using individual instruction via the teaching machine, a highly significant variance (F) was found (control group included). The two individually taught teaching machine groups differed significantly from the two group-setting instruction groups. The authors concluded that "it appears that individual instruction, whether requiring an overt response or not, was superior to group instruction in which the children observed and listened in a group setting to the same program as an audiostrip film." (Ibid., 130).

[14]Silberman, et. al., loc.cit.

reading group did significantly better than the covert group on the posttest; however, no significant difference in time to complete the program emerged. Both groups took about the same time to work through the program.

Overt Versus Covert Versus Reading.--The four studies below report seven experiments comparing these two response modes with reading groups. Four experiments obtained no significant difference between the treatments. One experiment indicated the superiority of overt respond-ind over covert responding and reading. The results of a sixth experiment favor the reading group at the "lowest difficulty level" and the overt group at the "intermediate difficulty level" (both about the same at the highest level). A seventh experiment found the reading group superior to overt and covert responding modes.

Goldbeck, Campbell, and Llewellyn investigated four conditions: overt (written), covert (mentally composing responses), optional overt (subject may or may not compose a written response), and reading.[15] A 32-frame program on light was presented to 62 eight grade students. On the immediate posttest the authors found

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[15]R. A. Goldbeck, V. M. Campbell, and J. E. Llewellyn, Further Experimental Evidence on Response Modes in Automated Instruction, Technical Report No. 3 (Santa Barbara, California: American Institute for Research, December, 1960).

no significant differences among the means of the four groups; the mean for the reading group was slightly higher. The reading group was also significantly superior in terms of time spent on the criterion test, the reading group took the longest time to complete the items while the covert group required the shortest. This finding is similar to the Evans, Glaser, and Homme reported results concerning time spent on the criterion test.[16]

Silverman and Alter conducted three experiments to compare modes of response.[17] In the first experiment, spoken, written, and written and spoken responding (combined) were compared with one another and a reading group. The total posttest was composed of eight constructed response items and fourteen multiple choice items. As in the Fry[18] and Coulson and Silberman[19] studies, performance on the multiple choice and constructed response portions of the test were considered separately. Results of this study show no significant difference between the experimental groups and unlike previous studies (Fry; Coulson and

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[16]Evans, Glaser, and Homme, loc. cit.

[17]R. Silverman, and M. Alter, "The Response in Programed Instruction," Journal of Programed Instruction, 1 (1962), 55-78.

[18]Fry, loc. cit.

[19]Coulson and Silberman, loc. cit.

Silberman) overt responding was not superior to covert responding on either the constructed or multiple choice subportions of the test. Experiment II compared written responding with reading under conditions of external and self-pacing. Results indicate that neither the main effects nor the interaction were significant on the total test and on the multiple choice subportion of the test the reading group was superior to written responding. Experiment III also compared written responding with reading using a programed text and machine with a program designed to teach binary numbers. Results of this third study reveal no significant difference either in the main effects or the interaction.

Goldbeck and Campbell[20] reported a related finding to Wittrock.[21] The authors used a 35-frame discrete discourse program on "men of history, geography, etc.," with 63 seventh-graders. The three groups studied were: overt (constructed written responses), covert (mentally composing responses), and reading (completed frames with the critical word underlined). The subjects were assigned to three difficulty levels. They worked at their own pace and were given a 35-item, constructed response criterion test at the completion of the program. Results

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[20]R. A. Goldbeck and V. N. Campbell, "The Effects of Response Mode and Response Difficulty on Programed Learning," Journal of Educational Psychology, 53 (1962), 110-18.

[21]Wittrock, loc. cit.

show an interaction between response mode and difficulty level. The overt response groups performed below the covert response groups at the lowest difficulty level and about the same at the high difficulty level. In terms of training time and achievement, the reading groups were most efficient and overt responding least efficient. A second study by the same authors employed a 32-frame continuous discourse program about light.[22] An option mode which permitted the subject to write his response if he was sure of it or omit it if not was also employed. This study failed to reveal significant achievement differences on an immediate posttest between the groups. However, on a ten-week retention test (same as immediate posttest--number of items not reported) the groups did differ significantly with the reading group performing best at the .05 level. On both the immediate and ten-week retention test, the covert group scored lowest. This study differs from others comparing overt, covert, and reading groups. However, it has been severly questioned by Cummings.[23]

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[22]Goldbeck and Campbell, loc. cit.

[23]A. Cummings, "Recent Research," Programed Instruction, 2 (September-October, 1962), 4-6.

A study by Krumboltz and Weisman found that the overt responding mode increased delayed retention.[24] The authors investigated the effects of response mode on three groups: overt (written), covert (mental), and reading. The program, a 177-frame programed textbook, was designed to teach fundamentals of educational test interpretation. Two fifty-item completion tests served as post- and retention tests. The authors found that the written response group took 10 per cent more time than the other two groups. On the first posttest no significant difference on the three groups was found; however, on the two-week retention test, the written response group proved significantly superior to the other two groups. This result is in contrast with the findings reported by Goldbeck and Campbell,[25] and Evans, Glaser, and Homme.[26]

Student Attitude Toward Programed Instruction.--The inclusion of a student questionnaire in the experiment reported in this chapter developed from the results of the studies reported below. At the present time there have

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[24]J. D. Krumboltz and R. G. Weisman, "The Effect of Overt Versus Covert Responding to Programed Instruction on Immediate and Delayed Retention," Journal of Educational Psychology, 56 (1962), 89-92.

[25]Goldbeck and Campbell, loc. cit.

[26]Evans, Glaser, and Homme, loc. cit.

been few studies which have considered the question of student attitude toward programed instruction. Within the six studies reported here, programed instruction is generally compared to the lecture-discussion method. The results of these studies reveal a favorable reaction to programed instruction over other methods of learning.

One of the first surveys concerned with student reaction or attitude toward programed instruction was conducted by Skinner and Holland.[27] They surveyed (using a questionnaire) 187 students who worked through an introductory psychology program as part of a second-level general education course. The program was presented to the students through Skinner teaching machines.[28] Responses to the five questionnaire items reported indicate a positive attitude toward programed instruction. In general, students felt that: (1) the program contributed to a better understanding of the course-textbook; (2) the program taught them more than the text; (3) if the program was not used they would have gotten less out of the course; and (4) if they were to take another introductory course in a science or similar field, programs

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[27]B. F. Skinner and J. G. Holland, "The Use of Teaching Machines in College Instruction," Teaching Machines and Programed Learning: A Source Book, ed. Lumsdaine and Glaser, 159-72.

[28]Supra, Chapter II, 11-12.

should be used for part of the course. In a more recent study,Naumann reported that the attitudinal reactions of the 44 college students who worked through the first third of the Holland-Skinner psychology program were rather favorable and generally supported the corresponding data obtained with students in the Skinner and Holland study.[29]

Feldusen presented a 37-frame linear program (constructed response) on seven basic concepts of programed instruction to 129 college students enrolled in a general psychology course.[30] Immediately after finishing the program the student was given a questionnaire. The questionnaire consisted of both structured and open-end questions (number of items not reported). The questions were general and ranged from how effective the student felt the program was as a teaching device (that is, programs in general), to open-end questions asking for advantages and disadvantages of programed instruction. The results of this survey indicate a highly favorable reaction to self-instructional devices. Ninety-three per cent of the students felt that the program would be more or very much more effective than a textbook; 92.3 per cent also favored a combination of programs, textbooks, and lectures. A number of factors cast

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[29]T. F. Naumann, "Laboratory Experience in Educational Psychology," Journal of Programed Instruction, 1 (1962), 9-18.

[30]J. A. Feldusen, "Reactions of College Students to a Self-Instructional Teaching Device and Programed Instruction," AID, 1 (August, 1961), 37-38.

some doubt on the validity of some of the results of this survey. Many responses to items on the questionnaire were probably prompted by information presented in the program. For example, the program teaches the student the advantages of programed instruction. Later, in the questionnaire, the student is asked to list or discuss the advantages of programed learning. Thus, the responses to these items may be an indication of how well the program taught the student rather than how favorably the student was reacting to programed instruction. Furthermore, on the basis of this limited program (37-frame) the students were asked to generalize their opinions of programed instruction to rather broad areas (comparing it to other methods of learning, how it should be used, etc.).

Geis and Peyser report a two year survey which was conducted at Hamilton College to ascertain, periodically, student reaction to a 7,000-frame program used in an introductory psychology course.[31] Four periodic surveys were conducted between the academic years: 1960-1961, and 1961-1962. An average of 80 students per survey were given questionnaires (number of items not reported). The responses to three questions were reported; two are relevant to this discussion. In response to the open-end

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[31]G. L. Geis and C. S. Peyser, "A Survey of Reactions of College Students to a Program in Introductory Psychology," AID, 2 (January, 1963), 208-10.

questions: "Comment briefly upon this question: Do you think the program material has helped (or hurt) you in this course?" 90 per cent felt that it helped, none felt that it hurt. In response to the question: "Do you think that the time spent on the program might have been spent on some other activity in the course (e.g. lectures, outside reading, etc.)?" 59 per cent said no, 14 per cent said yes, 24 per cent said partly, and 3 per cent said equally. The most common negative reaction to the program was that it was "dull, monotonour, or unchallenging." No questions which attempted to compare the program with another specific mode of presentation were reported.

Hughes and McNamara presented a 719-frame program on the IBM 7070 Data Processing System to 112 computer maintenance trainees.[32] The control groups were taught by conventional classroom methods (lecture-discussion) and the instruction period covered four mornings and totaled 15 hours. The experimental groups were given programed texts and learning time was spread over three days and totaled 11 hours. Students working on the program, however, were not permitted to proceed at their own speed. After completing the posttest, the experimental groups were asked to fillout a questionnaire (8-items) anonymously.

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[32]J. L. Hughes and W. J. McNamara, "A Comparative Study of Programed and Conventional Instruction in Industry," Journal of Applied Psychology, 45 (1961), 225-31.

The results of the experiment showed significant gains in learning and reduction of training time for the experimental groups using programed instruction. Results of the questionnaire indicate that the subjects were highly favorable to programed learning. Of the 70 subjects responding: 87 per cent like programed instruction more than conventional instruction; 83 per cent said that they prefer using it in future training courses; 79 per cent felt that the programed instruction method taught the material much more effectively than the regular classroom method (the other 21 per cent felt that it taught the material "somewhat more" effectively than the regular classroom method); and 60 per cent felt that the programed instruction method required less home study than the regular classroom method. Three items in the questionnaire were of the open-end type and asked for additional reactions to the program. Negative comments were few and were directed to the: (1) amount of repetition and written responses required; (2) absence of an instructor and class discussion; (3) amount of time allotted for the study of materials; and (4) failure of programed textbooks to provide summaries or outlines of topics.

In a more recent study, Hughes measured the effect of change in programed text format and reduction in classroom presentation time (from 11 to 8 hours) on learning achievement and attitude on the same type of subjects

(maintenance engineering trainees).[33] The formats used were constructed response and covert response programs. 199 subjects were used over a period of six months. The results of the 8-item questionnaire indicate an "increased negative trainee reaction to programed instruction as the study progressed, but it did not attain a high level."[34] It is interesting to note that the covert responding groups reacted less negatively to programed instruction than did overt responding groups.

Summary.--To date, no studies comparing programed instruction and video-taped lectures as methods of presenting lecture material have been reported. There have been, however, a number of studies comparing programed instruction and other methods. The results of these studies show that programed instruction is the more effective and efficient mode of presenting lecture material; they also suggest that the same findings may emerge when programed instruction is compared to the video-taped lecture method. The results of studies investigating response modes and reading programs consistently show that the reading program is as effective, and far more efficient, than any

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[33] J. L. Hughes, "Effective of Changes in Programed Text Format and Reduction in Classroom Time on the Achievement and Attitude of Industrial Trainees," Journal of Programed Instruction, 1 (1962), 43-54.

[34] Ibid., 43.

other type of program. Finally, the results of attitude surveys reveal that students respond favorable to programed instruction. It is from the foregoing literature that the experiment reported in this chapter emerged.

## Hypotheses

The questions considered in this experiment generate a number of specific hypotheses. The rationale for each hypothesis is derived from the literature. In stating the hypotheses and in future references the presentation modes are designated by abbreviations. These abbreviations and their respective presentation mode represent the six experimental conditions employed in this study and are presented in Table 3. A seventh condition or group served as a control and is designated as C.

TABLE 3

A BREAKDOWN OF PRESENTATION-MODE ABBREVIATIONS

| Abbreviation | Presentation Mode |
|---|---|
| TV | video-taped lecture |
| CR | constructed response program (Program A) |
| R | reading program (Program B) |
| TVC | video-taped lecture and constructed response program |
| TVR | video-taped lecture and reading program |
| C-R | constructed response program and reading program |

Six null hypotheses were formulated for testing. The first three are concerned with learning achievement (as measured by a posttest); the last three are concerned with the amount of time needed to learn.

$H_1$: There is no significant difference in the amount of learning among the three basic modes of presentation (TV, CR, and R).

$H_2$: There is no significant difference in the amount of learning among combinations of two of the basic modes of presentation (TVC, TVR, and C-R).

$H_3$: There is no significant difference in the amount of learning among the three basic modes of presentation and combinations of two of the basic modes (TV, CR, R, TVC, and C-R).

$H_4$: The mean time needed to complete the constructed response program (Program A) is equal to 45 minutes (time needed to view the video-taped lecture), against the alternative: $\mu_A < 45$ minutes.

$H_5$: The mean time needed to complete the reading program (Program B) is equal to 45 minutes, against the alternative: $\mu_B < 45$ minutes.

$H_6$: The mean time needed to complete the constructed response program (Program A) is equal to the mean time needed to complete the reading program (Program B), against the alternative: $\mu_A \neq \mu_B$.

## Method

Subjects.--A total of 223 undergraduate students were used as subjects in this experiment. The students were members of a one-quarter, 3 credit course in basic public speaking (Speech 101) at Michigan State University. The majority of the subjects were freshmen and sophomores.

Prior to the experiment, the subjects had been exposed to three video-taped lectures (during the one hour weekly lecture period) presented over a closed-circuit television system and three weeks of recitation-section meetings (three hours per week).

Materials.--The materials used in the study included a video-taped lecture, a constructed response linear program, a reading program, a posttest, and a questionnaire.

Video-Taped Lecture.--A 45 minute lecture on the principles and methods of outlining and organizing a speech was recorded on a standard two-inch video-tape. During the experiment the taped lecture was presented over a closed-circuit television system by an Ampex-1000C Video Tape Recorder.

Constructed Response Linear Program.--A 43-frame linear program based on the identical material used in the video-taped lecture was developed and tested. The frames were typed on a 5 x 8-inch index cards with the correct responses on the back. The program was presented to five volunteer undergraduate college students; none of the subjects had any previous public speaking training. Each subject wrote his responses on a separate answer sheet and then compared them with the answers on the back of the card. Subjects were instructed to note any errors in the program or reactions concerning the frames. The error rate was

calculated for each subject. It varied from 4 to 19 per cent, with an average error rate of 11 per cent. The initial program was revised on the basis of this testing and increased to 55 frames. The revised program was presented to seven other subjects, non of whom had any previous public speaking training. The testing procedure was the same as that used with the initial program. At the completion of the program the subjects were given a 25-item completion test based on the more salient points covered in the program. The mean score for the seven subjects was 22. The error rate was less than 6 per cent. It was felt that a low percentage of errors was necessary because of the limited size of the program. The program was again revised and increased to 62 frames.

The revised 62-frame program was stenciled and duplicated in two forms. In the first form, Program A, the critical word(s) in the frame is deleted and the student is required to construct a written response on a separate answer sheet. (Appendix A) The correct answer is located to the left of the succeeding frame. The booklet followed a vertical format[34] and served as the constructed response program.

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[34]The frames proceed vertically from the top to the bottom of each page--frame one is followed by frame two, and so on. The answer to each frame appears in the left or right hand margin of the succeeding frame. The student uses a card or sheet of paper to mask the page--exposing only the frame he is working on. After responding to the frame, he slides the mask down the page to expose the correct answer and the next frame in the sequence.

Reading Program.--In the second form of the revised 62-frame program, Program B, the frames were identical to Program A except that the critical word(s) was underlined rather than deleted. (Appendix B) Hence programs A and B were identical in content structure except that in the latter the student reads each frame without constructing a response (either in writing or mentally). Program B also followed a vertical format but no answer appears in the left hand margin of the succeeding frame because no response is required.

Posttest.--A forty-five item (5 alternative) multiple choice test was constructed to measure factual understanding of outlining and organization in public speaking. (Appendix C) The split-half reliability coefficient (even item scores compared to odd item scores) as computed by the Spearman Brown prophecy formula was .965. (See Appendix F for computational formula.)

Questionnaire.--An eight-item questionnaire was constructed to measure student attitude toward programed instruction when compared to the regular televised lecture. (Appendix D) The questionnaire consisted of five structured and three open-end items based on a questionnaire developed by J. L. Hughes.[35] Each of the five alternative items consisted of a five-point descriptive scale. The open-end items provided for additional positive and negative responses.

Procedure.--Subjects were assigned at random to one of seven groups--six experimental and one control. The experimental conditions for these groups are discussed below.

Experimental Condition I (TV, N=30): Subjects viewed the video-taped lecture (45 minutes). The subjects were not told that they were part of an experiment.

Experimental Condition II (CR, N=37): Subjects in this condition were given a copy of Program A (constructed response) and told that they were part of a study designed to investigate new methods of presenting lecture material.

Experimental Condition III (R, N=32): Subjects were given a copy of Program B (reading) and the same explanation of the experiment as in Condition II.

Experimental Condition IV (TVC, N=31): Subjects first viewed the video-taped lecture. After the lecture each subject was given a copy of Program A and told that the experiment was aprt of a study to determine new methods of presenting lecture material.

Experimental Condition V (TVR, N=31): Subjects first viewed the video-taped lecture. Following the lecture each subject was given a copy of Program B and an explanation of the study.

Experimental Condition VI (C-R, N=32): Subjects were first given a copy of Program A and an explanation of the experiment. After finishing and returning Program A, each subject was given a copy of Program B to work through.

Control Condition (C, N=30): Subjects in this condition were given only the posttest.

On the evening of the regularly scheduled televised lecture period, the seven groups met in seven different rooms. Two television sets were in those rooms where the groups watching the video-taped lecture were located. A faculty supervisor was assigned to each room but restricted as much as possible (turning on the television sets, passing out the programs, etc.). They remained at the front or rear of the room and answered questions as briefly as possible. Subjects working through the programs were instructed to note the time they began and finished working through the program and to hand them in to the instructor as soon as they were through.

Immediately following the learning task (televised lecture, and/or program), each subject was given the post-test. The subjects were told that the results of the test would not affect their grade in any way. No test of retention was given because subjects continually applied the material learned in later classroom work. At the completion of the posttest those groups that worked through either form of the program or both (all groups but TV, and Control) were given the questionnaire.

Three measures were recorded: (1) a posttest score--a measure of amount learned; (2) a time score--the amount of time the subjects took to complete the learning task; and

(3) an attitude measure--a measure of reaction to the learning method.

## Results

Posttest Data.--For greater ease in analyzing the data the number of subjects in each group was reduced to 30. Where the number of individuals in any given group ($n_i$) exceeded 30, $n_i$ - 30 subjects were discarded using a table of random numbers. Hence, of the original 223 subjects, the scores of 13 were discarded. It is doubtful that the retention of scores for these subjects in the computations would have significantly altered the results.

Table 4 presents the posttest-score means and variance for all seven groups. The mean posttest scores for the control and experimental groups ranged from 15.30 to 37.27 out of a possible 45. (See Appendix E for complete listing of raw scores within each group.) The variance for the control and experimental groups ranged from 8.20 to 14.91. The homogeneity of variance among all groups was tested by Hartley's Max-Min test.[36] The resulting F-max ratio was equal to 1.817. The probability of F-max exceeding 3.02, given 7 groups with 30 individuals in each group, was equal to .05. The hypothesis that there is no significant differences among the variances

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[36] H. O. Hartley, "The Maximum F. Ratio as a Short-cut Test for Heterogeneity of Variance," Biometrika, 37 (1950), 308-312.

of the 7 groups ($\alpha$ = .05) was accepted. Therefore, the assumption of homogeneity of variance which underlies the analyses of variance used in this study was probably not violated.

TABLE 4

MEANS AND VARIANCES OF POSTTEST SCORES

| | TV | CR | R | TVC | TVR | C-R | C |
|---|---|---|---|---|---|---|---|
| Mean | 26.60 | 36.70 | 36.53 | 36.67 | 36.70 | 37.27 | 15.30 |
| $S^2$ | 9.08 | 10.98 | 8.33 | 9.40 | 17.15 | 8.20 | 14.91 |

Analyses of Variance.--In order to evaluate the significance of the differences suggested by Table 4, three analyses of variance were undertaken.[37] The significance level of .05 was used in all cases. The results of these analyses are presented in Table 5, 6, and 7. (See Appendix F for computational formula.)

Table 5 represents the test of $H_1$: There is no significant difference in the amount of learning among the three basic modes of presentation (TV, CR, and R). The $F_{2-87}$ needed for significance ($\alpha$ = .05) is equal to approximately 3.10. Therefore, the first hypothesis was rejected at the .05 level of significance.

[37] W. J. Dixon and F. J. Massey, Introduction to Statistical Analysis (New York: McGraw-Hill, Inc., 1957) 145-152.

TABLE 5

ANALYSIS OF VARIANCE FOR GROUPS: TV, CR, AND R

| Source | df | Sum of Squares | Mean Square | F |
|---|---|---|---|---|
| Between groups | 2 | 2007.09 | 1003.55 | 106.08 |
| Within groups | 87 | 822.97 | 9.46 | |
| Total | 89 | 2830.06 | | |

Table 6 represents the test of $H_2$: There is no significant difference in the amount of learning among combinations of two of the basic modes or presentation (TVC, TVR, and C-R). The $F_{2-87}$ needed for significance ($\alpha$ = .05) is equal to approximately 3.10. Therefore, the second hypothesis was accepted.

TABLE 6

ANALYSIS OF VARIANCE FOR GROUPS: TVE, TVR, AND C-R

| Source | df | Sum of Squares | Mean Squares | F |
|---|---|---|---|---|
| Between groups | 2 | 43.39 | 21.75 | 2.14 |
| Within groups | 87 | 884.17 | 10.16 | |
| Total | 89 | 927.66 | | |

Table 7 represents the test of $H_3$: There is no significant difference in the amount of learning among the

three basic modes of presentation, combinations of two of the basic modes, and a control group (TV, CR, R, TVC, TVR, C-R, and C). The $F_{6-203}$ needed for significance ($\alpha = .05$) is equal to approximately 2.14. Therefore, the third hypothesis was rejected at the .05 level of significance.

TABLE 7

ANALYSIS OF VARIANCE FOR ALL SEVEN GROUPS

| Source | df | Sum of Squares | Mean Square | F |
|---|---|---|---|---|
| Between groups | 6 | 12692.19 | 2115.37 | 200.70 |
| Within groups | 203 | 2139.43 | 10.54 | |
| Total | 209 | 14831.62 | | |

Data Snooping.--In order to test for significance of difference among the means of any two groups, the Scheffé test was employed whenever the differences among means were shown to be significant by an analysis of variance. (See Table 5 and 7.) The Scheffé method was used for two reasons: (1) "it is closely linked to the F-test and requires only the F table"; and (2) "the frequently advocated Duncan new multiple range test is currently under suspicion by mathematical statisticians."[38] The results of these tests are presented in Table 8 and 9. (See Appendix F for computational formula.)

[38]Q. McNemar, Psychological Statistics (New York: John Wiley and Sons, Inc., 1949), 286-87.

Table 8 represents the Scheffé test of differences for the three basic modes of response groups (TV, CR, and R). Each cell in this table presents the mean for the column group under consideration minus the mean of the corresponding row group. For example, the cell corresponding to the column CR and row TV, which is equal to 10.10, was found by subtracting the mean of TV (26.60) from the mean of CR (36.70). (See table 4.) According to the results of the Scheffé test, when absolute values in the cells are equal to, or greater than, 6.25 ($\alpha$ =.05), the hypothesis that the two means under consideration are equal should be rejected. These values are indicated by asterisks.

TABLE 8

SCHEFFE TEST OF DIFFERENCES FOR GROUPS: TV, CR, AND R

| Row | Columns TV | CR | R |
|---|---|---|---|
| TV | — | 10.10* | 9.93* |
| CR | | — | -.17 |
| R | | | — |

Table 9 represents the test of difference for all seven groups (TV, CR, R, TVC, TVR, C-R, and C). As in Table 8, the row means have been subtracted from the column means. According to the results of the Scheffé test for these seven groups, absolute values equal to, or greater

than, 9.50 ($\alpha$ = .05), result in the rejection of the hypothesis that the two means being considered are equal. These values are indicated by asterisks.

TABLE 9

SCHEFFE TEST OF DIFFERENCES FOR ALL SEVEN GROUPS

| Row | TV | CR | R | TVC | TVR | C-R | C |
|---|---|---|---|---|---|---|---|
| TV | ___ | 10.10* | 10.07* | 10.07* | 10.10* | 10.67* | -11.30* |
| CR | | ___ | -.17 | -.03 | .00 | .57 | -21.40* |
| R | | | ___ | .14 | .17 | .17 | -21.23* |
| TVC | | | | ___ | .03 | .60 | -21.27* |
| TVR | | | | | ___ | .57 | -21.40* |
| C-R | | | | | | ___ | -21.97* |
| C | | | | | | | ___ |

Time Data.--The time required to complete the learning task in the control and experimental conditions was recorded. In those conditions where more than one task was employed (TVC, TVR, and C-R), separate time scores were also recorded for each task. On each program form, the subject was asked to indicate the time when he began and ended working on the program. These time scores varied from subject to subject and from condition to condition. The time required to view the video-taped lecture was 45 minutes. A breakdown of experimental condition, task, and time needed to learn is presented in Table 10, 11, and 12.

Table 10 presents a listing of total time, mean scores, and variance for groups that worked through Program A (constructed response). The time scores in this table represent only the time needed to work through Program A in the condition in which it was used. Thus, the mean time for working through Program A in condition C-R was 39.83.

TABLE 10

COMPLETION TIME (MINUTES) FOR GROUPS USING PROGRAM A

| Condition | Task | Total Time | Mean Time | $S^2$ |
|---|---|---|---|---|
| CR | A | 1207 | 40.23 | |
| C-R | A | 1195 | 39.83 | |
| TVC | A | 1076 | 35.87 | |
| Total | A | 3478 | 38.64 | 45.87 |

Table 11 presents a listing of total time, mean scores, and variance for groups that worked through Program B (reading).

Table 12 presents a listing of task(s) and total time needed to learn in all six experimental conditions.

The standard deviation of the sample mean for Program A (constructed response) was found to be equal to 4.84 ($\frac{S^2}{N}$), while the corresponding value for Program B (reading) equaled 1.13. $H_4$ (The mean time needed to complete Program A is equal to 45 minutes, against the alternative: $\mu_A < 45$

TABLE 11

COMPLETION TIME (MINUTES) FOR GROUPS USING PROGRAM B

| Condition | Task | Total Time | Mean Time | $S^2$ |
|---|---|---|---|---|
| R | B | 500 | 16.67 | |
| C-R | B | 511 | 17.03 | |
| TVR | B | 398 | 13.26 | |
| Total | B | 1409 | 15.66 | 10.70 |

TABLE 12

COMPLETION TIME (MINUTES) FOR ALL EXPERIMENTAL GROUPS

| Condition | Task | Time | Total Time |
|---|---|---|---|
| TV | TV | 45 | 45 |
| CR | A | 40.23 | 40.23 |
| R | B | 16.67 | 16.67 |
| TVC | TV + A | 45 + 35.87 | 81.21 |
| TVR | TV + B | 45 + 13.26 | 58.26 |
| C-R | A + B | 39.83 + 17.03 | 57.26 |

minutes.) and $H_5$ (The mean time needed to complete Program B is equal to 45 minutes, against the alternative: $\mu_B < 45$ minutes.) were then tested (one-tailed) in the following manner.[39] (See Appendix F for computational procedure.)

[39] Dixon and Massey, op. cit. 81-91.

The mean time needed to complete Program A and that needed to complete Program B were each subtracted from 45 minutes (time needed to view the video-taped lecture). These values were in turn divided by the corresponding sample-mean standard deviations. The resulting values or critical ratios were found to equal 1.32 for Program A and -26.01 for Program B. When a critical ratio is found to be equal to, or less than, -1.65 the hypothesis that $\mu_o$ is equal to a constant should be rejected at the .05 level of significance.

In order to test $H_6$ (The mean time needed to complete Program A is equal to the mean time needed to complete Program B, against the alternative: $\mu_A \neq \mu_B$.) a t-test was employed.[40] (See Appendix F for computational formula.) The value for t was found to equal 23.7. Given 178 ($N_1 + N_2 - 2$) degrees of freedom, when t is found to be equal to, or greater than, approximately 1.97 ($\alpha = .05$), the hypothesis that the two means are equal should be rejected. Therefore, $H_6$ was rejected at the .05 level of significance.

Questionnaire Data.--After completing the posttest, all groups that worked through either Program A or Program B or both, were given an 8-item questionnaire (CR, R, TVC, TVR, and C-R). Although the subject responded to the

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[40] Ibid., 121-22.

questionnaire anonymously, he was asked to specify the form of program he used and the room in which he was located. This provided a means of measuring attitude by treatment. The data were recorded on IBM Punch Cards and grouped by means of an IBM card-sorter machine. Table 13 presents a summary of percentages of questionnaire responses on the first five items. This table includes the responses of the 13 subjects that were discarded.

The last three items on the questionnaire were open-end items and called for additional positive and negative reaction to programed instruction as compared to the regular video-taped lectures. The percentages of responses to these items was 100. The most frequent favorable response (84 per cent) to programed instruction by the CR (constructed response) and R (reading) groups was that it was "repetitious." On the other hand, the most frequent negative response (79 per cent) by the TVC, TVR, and C-R groups was that the program was "too repetitious."

## Discussion

Effect on Learning Achievement.--Following the computation of three analyses of variance, $H_1$ and $H_3$ were rejected, while $H_2$ was accepted. The F of $H_1$ and $H_3$ was found to equal 106.08 and 200.70 respectively which was well beyond the .05 level of significance.

TABLE 13

SUMMARY OF QUESTIONNAIRE RESPONSES FOR GROUPS THAT USED PROGRAMS

| Question and Scale Category* | Percentages of Response CR | R | TVC | TVR | C-R | Total |
|---|---|---|---|---|---|---|
| Compared to regular TV lectures in Speech 101 | | | | | | |
| (1) How well has the program taught you the material? | | | | | | |
| 1. less effective | 8 | 9 | 6 | 13 | 3 | 8 |
| 2. somewhat less | 11 | 9 | 6 | 13 | 0 | 8 |
| 3. about the same | 11 | 13 | 13 | 13 | 16 | 13 |
| 4. somewhat more | 46 | 44 | 52 | 35 | 47 | 45 |
| 5. much more effective | 24 | 25 | 23 | 26 | 34 | 26 |
| (2) How do you like the PI method? | | | | | | |
| 1. much less | 16 | 22 | 6 | 29 | 9 | 18 |
| 2. somewhat less | 32 | 19 | 26 | 23 | 12 | 23 |
| 3. about the same | 11 | 12 | 19 | 12 | 25 | 16 |
| 4. somewhat more | 27 | 28 | 23 | 26 | 38 | 28 |
| 5. much more | 14 | 19 | 16 | 10 | 16 | 15 |
| (3) How difficult was it to learn using PI? | | | | | | |
| 1. much more | 0 | 3 | 3 | 6 | 0 | 2 |
| 2. somewhat more | 19 | 6 | 6 | 13 | 13 | 12 |
| 3. about the same | 24 | 34 | 23 | 29 | 16 | 25 |
| 4. somewhat less | 32 | 35 | 45 | 26 | 31 | 24 |
| 5. much less | 24 | 22 | 23 | 26 | 40 | 27 |

TABLE 13 (Continued)

| Question and Scale Category* | Percentages of Response CR | R | TVC | TVR | C-R | Total |
|---|---|---|---|---|---|---|
| Compared to the regular TV lectures in Speech 101: | | | | | | |
| (4) In the future, would you like to use PI instead of TV? | | | | | | |
| 1. strongly object | 14 | 19 | 22 | 23 | 9 | 18 |
| 2. some objection | 32 | 28 | 29 | 42 | 16 | 29 |
| 3. don't care | 11 | 13 | 13 | 3 | 22 | 12 |
| 4. some preference | 32 | 34 | 23 | 19 | 44 | 31 |
| 5. strongly prefer | 11 | 6 | 13 | 13 | 9 | 10 |
| (5) In the future, would you like to see both PI and TV used? | | | | | | |
| 1. strongly object | 5 | 6 | 10 | 0 | 9 | 4 |
| 2. some objection | 14 | 9 | 7 | 13 | 10 | 10 |
| 3. don't care | 5 | 10 | 6 | 10 | 9 | 8 |
| 4. some preference | 27 | 41 | 48 | 42 | 47 | 41 |
| 5. strongly prefer | 47 | 34 | 29 | 35 | 34 | 37 |

*To save space, the questions and statements in the scale category have not been completely reproduced here. (See Appendix D.)

The results of the Scheffé test of the means involved in $H_1$ (TV, CR, and R) show that the means for the CR (36.70) and R (36.53) groups were significantly higher than the mean score for the TV (26.60) group, while not significantly different from each other.

The results of the Scheffé test mean differences following the analysis of variance of $H_3$ show that the mean scores for all of the experimental groups (TV, CR, R, TVC, TVR, and C-R) were higher than the control group at the .05 level of significance. Among the experimental groups, all those that used programs (CR, R, TVC, TVR, and C-R) emerged significantly higher than the TV group at the .05 level.

The total amount of learning as revealed by the posttest scores indicate that more is learned under conditions of programed instruction than video-taped lectures. These results are in agreement with those studies which compare programed instruction with conventional teaching methods (lecture-discussion, etc.).[41] These findings are also in agreement with those studies comparing constructed response and reading programs which found no significant difference in learning achievement between these two types of programs.[42] Finally, combinations of programed instruction

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[41] Supra, Chapter II, 23-38

[42] Supra, Chapter III, 42-45, 47-49.

with other presentation modes do not reveal a significant increase in total amount of learning beyond that acquired when programs are used alone.

Effect on Time Needed to Learn.--The results of the three tests employed to measure time differences in presentation modes show that the time taken to complete Program B (reading) is significantly less than the time taken to complete Program A (constructed response). In fact, subjects in the R groups took less than half the time (16.67 minutes) to complete Program B than subjects in the CR group (40.23 minutes) took to complete Program A. These results are consistent with studies that investigated these two types of programs and found that the reading groups took significantly less time to complete the program than the groups required to construct a written response.[43] These results also reveal that while it takes significantly less time to complete Program B than it takes to view the video-taped lecture, there is no significant difference between the time needed to complete Program A and the time required to view the video-taped lecture. The lack of time difference between CR and TV was probably due to the time taken to construct written responses in Program A.

Tests of time needed to complete the learning task within combination modes of presentation (TVC, TVR, and C-R)

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[43] Supra, Chapter III, 42-50.

would also reveal that time needed in TVR (video-taped lecture and reading program) and C-R (constructed response program and reading program) is significantly less than in TVC (video-taped lecture and constructed response program), while not significantly different from each other. Although computations for these tests were not actually computed, the results may be inferred from the time scores listed in Table 12.

Effect on Student Attitude.--Differences in attitude toward programed instruction among individuals in the experimental groups using programs were not tested statistically. Because of the limited scope of the questionnaire, it was felt that statistical tests would violate the assumption of unidimensionality underlying any statistical test of responses. Another assumption that might be violated is that of equal intervals between response categories. Thus, questionnaire responses were presented as percentages with each item considered individually.

In spite of the lack of statistical tests, certain observations of the data may be made. In general the majority of the subjects felt that programed instruction was more effective than the regular video-taped lectures, and less difficult to learn. (See items 1 and 3 in Table 13.) On the other hand, in response to the question: "How do you like the PI method?" 41 per cent of the subjects said

that they liked it "much less" or "somewhat less" than the regular television lectures; 43 per cent replied "much more" or "somewhat more;" and 16 per cent said "about the same." Responses to this item are not consistent with the highly favorable reaction to programed instruction found in the attitude surveys mentioned earlier.[44] Responses to item 4 ("In the future, would you like to use PI instead of TV?") are also inconsistent with the high favorable response to such an item in the Hughes and McNamara survey.[45] In response to the question: "In the future, would you like to see both PI and TV used?" 4 per cent of the subjects strongly objected; 10 per cent had some objection: 8 per cent didn't care; 41 per cent had some preference; and 37 per cent strongly preferred a combination of both methods. The results of this item are in agreement with other studies which found a favorable reaction to such a question.[46] Finally, in response to the first five items on the questionnaire, the most positive reaction came from the C-R group which used both forms of the program.

In regards to the open-end items, the most frequent positive and negative response to programed instruction was "repetition." Combination groups (TVC, TVR, and C-R) used

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[44] Supra, 50-54.

[45] Hughes and McNamara, loc. cit.

[46] Supra, 50-54.

this word in responding to the question: "Was there anything about the programed instruction method that you particularly disliked?" Single presentation groups (CR and R), on the other hand, used this word in responding to the question: "Was there anything about the programed instruction method that you particularly liked?" This type of reaction is understandable considering that the combination groups received the same material twice.

## Conclusions

The results of this study suggest the following conclusions:

1. Programed instruction is a more effective and efficient method of presenting public speaking material than video-taped lectures.

2. Reading programs are as effective as, and far more efficient than, constructed response programs in presenting public speaking material.

3. Combinations of programed instruction and television modes of presentation, while taking much more time, do not increase the total amount of learning beyond that aquired when programs are used alone.

4. Although students feel that programed instruction is a more effective and easier method of learning than video-taped lectures, they do not prefer it as the sole source of instruction.

5. Students have a strong preference for using both programed instruction and video-taped lectures as methods of presenting public speaking material.

In any study attmepting to compare programed instruction with conventional methods of instruction, valid general

conclusions are difficult to reach, especially since the results of such comparisons depend upon the skill of the programer and, say, the lecturer. In some cases, studies comparing programed instruction with conventional methods tend to overgeneralize their results. To abandon the video-taped lecture method in favor of programed instruction because of the latter's superiority in this study would be dangerous. Further research is necessary before such a transition would be valid. The limited scope of the experiment (size of program, lack of retention tests, etc.) is not only a reason why the above conclusions must be tempered, but also an indication of the need for further study.

# CHAPTER IV

## THE IMPLICATIONS AND POTENTIAL UTILITY OF PROGRAMED INSTRUCTION IN SPEECH EDUCATION

As stated in the first chapter of this study, the recent interest in speech training and student population growth pose a unique problem in speech education. The basic problem is this: The larger the class the less the opportunity for individual attention, which most speech teachers will readily admit is crucial in speech training. This problem is often compounded by the inherent weaknesses of the lecture method, and programed instruction was suggested as an alternative method of presenting lecture material. Chapter II included an overview of the historical and theoretical developments of programed instruction and a review of part of the experimental literature which suggested the potential utility of this method of instruction as an effective and efficient self-teaching device. Chapter III reported an experiment which was designed to investigate the effectiveness of programed instruction in presenting public speaking materials. If the results of this study could be generalized to other areas of speech the implications of programed instruction in speech education are great. Even without these generalizations the

potential utility of this new method of instruction is still evident and should command serious attention from speech educators.

The Use of P. I. in the Basic Speech Course

The growth of the speech class has had its greatest impact on the basic theory-performance course. In this type of course, be it voice and diction, public speaking, discussion, oral interpretation, etc., there are commonly two basic goals: (1) to provide a certain amount of factual material; and (2) to improve performance skills. Improvement in the first goal lends itself to group lecture and discussion methods, while the second flourishes with practice and individual attention. In the large class (more than twenty) the time allotted to each student is small. Hence, time spent in clarifying and repeating material covered in the lectures is spent at the expense of the student. Some believe that these two goals are incompatible. In discussing voice and diction, Merritt and Shaver state that:

> Many a realistic teacher, unhappy with the dichotomy and pressed for time, feels compelled to resign himself to either a 'content' course or a 'skills' course, to the dismay of colleagues who expect his products to display vocal mastery plus a knowledge of basic phonetics, elementary physics of sound, physiology of the vocal mechanism, and anatomy of the ear.[1]

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[1]F. Merritt and C. L. Shaver, "Teaching Voice and Diction," Speech Methods and Resources, ed. W. W. Braden (New York: Harper & Brothers, 1961), 124-45.

Perhaps these "dismayed colleagues" believe that courses which achieve only one of these goals are academically unsound. Taken separately each goal could easily degenerate a course into either a voice coaching session or one in which a student learns to speak without speaking.

The use of programed instructional devices may represent a solution to this problem. As a self-teaching method, programed instruction is capable of presenting the factual material of the course in an effective and efficient manner. For example, in the experiment reported in Chapter III, the reading program group learned as effectively as the TV and constructed response program groups in less than half the time. Thus, half of the lecture period may be used for programed learning, and the other half for class discussion. The teacher, free from the drudgery of preparing, delivering, and clarifying lectures, could spend his time in individual student consultation, class discussion, and performance training.

## The Use of P. I. in Speech Science and Correction

Of the few studies reported which have attempted to determine the potential utility of programed instruction in speech, all are in the area of speech science and correction. The nature and results of these studies give evidence to the wide range of application this new method possesses.

Holland studied the effectiveness of using teaching machine techniques for increasing auditory discrimination skill.[2] The machine developed for this study was a tape recorder equipped with a special timing device. The auditory problem (single word, pairs of words, or isolated sounds) was presented on programed tapes. The subjects, children with sound discrimination problems, responded by pressing one of three buttons.

> An incorrect response resulted in the tape recorder immediately rewinding a sufficient distance and replaying that problem; while on correct responses the tape recorder simply continued to play, uninterrupted.[3]

The study employed three programs: one designed to teach discrimination of isolated sounds, another single words, and another pairs of words. In the program on isolated sounds, for example,

> the child learned to make a series of finer and finer auditory discriminations, first discriminating [s] in isolation from other speech sounds; second, discrimination of the sound in more complex contexts; third, identifying the position of [s] within a word; fourth, discriminating correct from incorrect sound production.[4]

The programs, which proved to be quite effective, included all the principles of programed instruction, and suggest the possible use in speech correction.

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[2] A. L. Holland, loc. cit.

[3] Ibid., 17.

[4] Ibid., 19.

Filby and Edwards recently conducted an experiment designed to test and teach form discrimination to aphasics.[5] The subject was seated in a dark room containing a frosted glass window which served as a screen on which the visual stimuli were projected fron an adjoining room.

> Immediately below the screen was horizontally mounted a 4" x 6" x 18" rectangular metal box, with two lighted buttons protruding from the surface toward the S, one on the left and the other on the right. The other three sides of the screen were ringed by a string of colored lights mounted behind frosted glass. A one-second flash of the colored lights surrounding the screen served as the reinforcement during the experiment.[6]

The visual stimuli were exposed on the screen and the subject was required to press the button on the side corresponding to the side on which the matching stimulus was presented.

The subjects (12) were pretrained (without verbal instructions) to make "matching to sample" responses. Once trained, the subject was advanced to a 118-item form discrimination program which utilized this response. Ten subjects with no known brain damage served as the control.

The results of this study show that of the twelve aphasics ("including very severely impaired aphasics") ten were able to successfully complete the pretraining program. On the 118-item program, the aphasics did not commit significantly more errors than the subjects in the nonbrain-damaged control group.

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[5] Y. Filby and A. E. Edwards, "An Application of Automated-Teaching Methods to Test and Teach Form Discrimination to Aphasics," Journal of Programed Instruction, 2 (1963) 25-33.

[6] Ibid., 27.

> This unexpectedly low error rate on the part of the aphasics was felt to be due to the optimal conditions provided by the automated teaching situation, i.e., self-pacing, immediate feedback (reinforcement), gradual progression in the difficulty of the items, and the requirement for the S to make a correct response before proceeding to the next item.[7]

The results of this study suggest another area in which programed instructional methods may be successfully employed.

At Michigan State University, James Hillis is currently investigating the potential utility of using a tape recording-workbook type program designed to teach applied phonetics. The program employs both programed instruction and language laboratory principles. The workbook presents the initial stimuli (the printed phonetic symbols) to which the student responds by saying to himself the auditory event. He can check his response immediately against the correct response which is presented auditorally via the tape recorder. The workbook is also designed to teach transcription skills. To allow for individual differences, the program is constructed in such a way that segments may be bypassed by students who are able to master the material rapidly.

Another area that appears to lend itself to programed instructional methods is vocal anatomy. At the present time there are a number of programs on anatomy and physiology on the commercial market.[8]

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[7] Ibid., 25.

[8] Programs, '62, 305-13. Finn and Perrin, op. cit., 61.

## The Use of P. I. in Other Areas of Speech

There are a number of courses in speech with subject matter highly suitable for programing. These include: debate, parliamentary procedure, principles of stage lighting, radio control room procedure, etc. A number of programs in these areas have already been developed and published. Prouse and Alcock have developed an 1800-frame programed textbook (constructed response and multiple choice) in the principles of debate for high school and college students.[9] Lehman has developed a 344-page branching program in parliamentary procedure.[10]

## The Need for Future Research

At the present time programed instruction in speech education represents a method without a philosophy of application. Because of its potential utility in this area, research should be conducted to determine how it can best be employed. Examples of possible application, particularly those studies conducted in the area of speech science and correction, are highly encouraging. The results of the experiment reported in Chapter III are also encouraging, expecially since they suggest a possible solution to the

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[9]P. Prouse and W. T. Alcock, Principles of Debate (Albuquerque, New Mexico: General Programed Teaching Corporation, 1962).

[10]W. Lehman, Parliamentary Procedure (New York: Doubleday and Company, Inc., 1962).

problems facing the basic theory-performance courses. But these results are also limited since the study was solely concerned with one aspect of public speaking, one method of programing, etc.

The need for further research is quite evident, and the areas of investigation are many. Below are listed just a few of the major questions which need to be investigated before the acceptance and use of programed instruction can become widespread in speech education.

1. How effective is programed instruction in presenting lecture material over a long period of time; for example, the complete length of the course? How effective is it in comparison to other presentation methods?

2. How well do students retain material learned by programed instruction over a long period of time? How effective is it in comparison to other teaching methods?

3. What type of program (linear, multiple choice, branching) is best suited to speech materials?

4. Are programs more effective as sole sources of instruction or as auxiliary teaching aids?

5. How do students react to programed instruction over a long period of use?

These questions are broad and each suggests a number of areas which need to be investigated. The researcher can greatly benefit from research conducted in other areas. Results of these studies are proof of the potential utility of programed instruction in speech education, but they do not provide the answers as to how it can best be employed. These answers can only come from research conducted within the field of speech and using speech programs.

## The Future of P. I. in Speech Education

Programed instruction appears to be here to stay. Programs have been in use in schools for the past several years and all indications point to their continued use. Because of the limited number of studies which have been conducted to determine its effectiveness in teaching speech, it is almost impossible to predict what role programed instruction will play in the future of speech education. That question can be attempted only after more research. If the results of experimentation in other areas can be generalized to speech areas, the implication for the future of speech education are many. Programs will be able to present the factual materials of a course and provide the teacher with time to devote to performance training. In areas of content-structured courses more time would be available for discussion and practical application. The teacher, free from the preparation of lectures can devote more time to developing more efficient methods of instruction. He can plan programs and exercises designed to meet the individual needs of each student. The results of studies conducted in the area of speech science and correction indicate a wide range of possible uses of programed instruction in both student training and practical application.

In the ideal situation, the teacher will construct his own programs and, of course, this takes time. But program writing is not an esoteric science which requires years of

intensive training; on the contrary, it consists of relatively few principles which can be easily learned. In fact, there are a number of programed books designed to teach programing techniques and principles.[11] The speech teacher is the most qualified person to program speech materials since he is an expert on the subject matter. And if it does nothing else, programing performs a great service to education, for it forces the programer to define what it is he is attempting to teach, or more specifically, what it is he wishes his students to learn.

## Conclusion

Auxiliary teaching devices are not new to speech education; audio and visual aids have long served to alleviate some of the problems facing the classroom teacher. The tape recorder, for example, has been of inestimable value to the speech teacher. Unfortunately, the words "teaching machine" and "programed instruction," are often associated with Orwellian concepts of dehumanization and stereotyped learning. Many educaters are reluctant to explore objectively the potentials of programed instruction because they do not understand its end. Programed instruction is not an attempt to sterilize learning or eliminate the classroom instructor; nor does it present itself

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[11] Programs, '62, 279-82.

as a panacea for all educational problems. It merely represents a realistic method of increasing the capacity of education. And if improving the quality of the educational experience is one of the ultimate goals of speech education, it must maintain a constant willingness to examine, test, and evaluate methods and devices, such as programed instruction, if it ever hopes to achieve that goal.

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APPENDIX A

PROGRAM A

FORM A

TO THE STUDENT

This is a self-teaching device ("program") designed to present the basic terms, principles and concepts of Speech Organization. The information about Speech Organization will be presented to you in small steps. Each step ("frame"), unless otherwise indicated, requires you to write down one or more answers on the material presented. After you respond to the frame, you will receive immediate confirmation as to the correctness of your response (answer). Thus, as you go through the program, you will be presented the material on Speech Organization and also immediate feedback indicating your understanding or misunderstanding of the terms, principles and concepts. You will find it easy to learn about Speech Organization with this device if you follow instructions carefully.

Instructions:

1. Arrangement of the program:--The frames proceed vertically from the top to the bottom of the page--frame one is followed by frame two, and so on. The answer to each frame appears in the left-hand margin besides the succeeding frame (i.e., to the left of the next frame in the squence). Use a card or sheet of paper to mask

or cover the page--exposing only the frame you are working on. Read the frame carefully before writing your answer(s) on the provided answer sheet. After you have responded to the frame, slide the mask down the page to expose the correct answer along with the next frame. If your answer is incorrect mark an "X" beside it. If your answer is correct continue on to the next frame.

2. Conventions used in the program:--

   a. One blank (_____) indicates that one word is missing and must be supplied; two blanks (_____ _____) indicate two words; and three blanks (_____ _____ _____) indicate that three words are missing and must be supplied.

   b. Asteriks (***) are used to indicate that several words, or a sentence is missing and must be supplied.

   c. Cues or hints are sometimes supplied. For example: (s____) means that the answer begins with an "s." Short, one-spaced blanks (-----) indicate the number of missing letters in the word.

   d. Try to keep in mind, while going through this program, that you are not taking a test but rather that you are learning about Speech

Organization. If at times it seems as though the material is repetitious this is only so because the program is attempting to reinforce terms, principles or concepts in your mind. Finally, when responding to the blanks in the frames, try not to look back at your other answers on the answer sheet.

Now turn the page and begin

PLEASE DO NOT MAKE ANY MARKINGS ON THIS PROGRAM!!

NOTE: Be sure to mask the page and expose only the frame you are working on. Do not slide the mask down until you have written down your answer.

PART ONE: Organization and Outline

1. The first question that may pop up in your mind is: "Why must I organize my speech?" For our purposes here let us say that there are two reasons why we organize our speeches: (a) in order to make sense; and (b) to satisfy the desire for unity which we all have within us, including members of an audience.

   Copy down the underlined words before going on.

---

1. Did you copy down the underlined words:

2. In a disorganized speech, the arrangement of the material prompts us to say that the speech not only lacks unity but also makes little s____.

---

2. sense

3. To put it another way, we may say that a disorganized speech generally lacks 1. u____ and thus makes little 2._____.

---

3. 1. unity
   2. sense

4. Thus, to answer the question: "Why organize?" we say that we organize our speeches***. (Write down the missing phrases or sentences.)

| | |
|---|---|
| 4. to make sense and satisfy the desire and unity. | 5. Many people confuse the terms "ORGANIZATION" and "OUTLINE." They are related but not the same thing. Thus we say that while Organization and Outline are not the same thing, they are, nevertheless r_____. |
| 5. related | 6. The ORGANIZATION of speech refers to the pattern of development or the arrangement of the speech. If we develop or arrange our speech in "such-and-such" a way, we mean that our speech is_____in "such-and-such" a way. |
| 6. organized | 7. The OUTLINE of a speech serves as the instrument or vehicle by which o____ is achieved. |
| 7. organization | 8. The pattern of development or arrangement of a _____ is referred to as the organization. |

| | |
|---|---|
| 8. speech | 9. Organization is the ***. |
| 9. pattern of development or arrangement of a speech. | 10. Organization (is/is not) the same thing as the Outline. |
| 10. is not | 11. While the Organization is the pattern of development or arrangement of a speech, the instrument or vehicle by which this is achieved is the _ _ _ _ _ _ _. |
| 11. outline | 12. Organization is the 1. _____ of _____or arrangement of the speech, while the 2._____ is the instrument or vehicle by which organization is achieved. |
| 12. 1. pattern of development<br>2. outline | 13. Organization and Outlines (are/are not) related. |
| 13. are | 14. Review Frame:--The purpose of this review is to help you find out how much you have learned. Read and answer each question carefully. Do not check your answers until you have completed the frame!<br>1. We organize a speech for two reasons. What are they? |

2. Organization and Outlines (are/are not) the same thing.
3. Organization and Outlines (are/are not) related.
4. What is organization?
5. What is an outline?

---

14. Review Frame:

1. to make sense and satisfy the desire for unity.
2. are not
3. are
4. pattern of development or arrangement of a speech.
5. the instrument or vehicle by which organization is achieved.

PART TWO: The Principles of Organization

Let us now focus our attention on the principles of organization. We know that organization is the pattern of development or arrangement of a speech and the outline is the instrument or vehicle by which organization is achieved. In this portion of the program we shall consider the three principles basic to all speech organization. They are: (a) the Purpose Sentence; (b) the Development of the Purpose Sentence; and (c) the Relationship of the Development to the Purpose Sentence. Let us first consider the Purpose Sentence.

Go on to the next frame.
Do not pass "Go" ! !
Do not collect $200!!

---

A. The Purpose Sentence:

In the following frames we shall be concerned with three basic questions: (a) What is a Purpose Sentence? (b) What does it do? (c) What is its significance? Very briefly we can say this: (a) The Purpose Sentence is the first principle basic to all speech organization and the sum total

of what the speaker plans to do in his speech. (b) A Purpose Sentence is a declarative sentence formulating an idea, a feeling, an opinion, a judgment or a matter of inquiry. (c) The significance of the Purpose Sentence is that it helps the speaker to remember what it is he wishes to do in the speech.

Go on to the next frame.

---

15. The first principle basic to all speech organization is the _____ _____.

---

15. purpose sentence

16. A purpose sentence attempts to sum up the speaker's plans and so we say that the 1. _____ _____ is the 2. _____ total of what the speaker intends to do in his speech.

---

16. 1. purpose sentence
2. sum

17. The definition of a purpose sentence is as follows: "A purpose sentence is a declarative sentence formulating an idea a feeling, an opinion, a judgment, or a matter of inquiry."

Copy this definition before going on to the next frame.

17. Did you copy the definition?

18. declarative

18. A purpose sentence declares something; thus we say that a purpose sentence is a _____sentence.

19. purpose sentence

19. Some people refer to the purpose sentence as the "topic," "gut," or "lead" sentence. However, in this course, we refer to the sentence which sums up the speaker's plans as the _____ _____.

20. declarative

20. A purpose sentence is a _____ sentence formulating an idea, a feeling, an opinion, a judgment or a matter of inquiry.

21. The significance of the purpose sentence is that it helps the speaker to remember what it is he plans to do in his speech. If the purpose sentence does not help the speaker remember what it is he plans to do, it has no _____.

21. significance

22. Review Frame:--Read and answer each question carefully. Do not check your answers until you have completed the frame.

1. The purpose sentence is the _____ of what the speaker intends to do in his speech.

2. The purpose sentence is the first principle basic to all speech_____.

3. The purpose sentence is a_____sentence formulating an idea, a feeling, an opinion, a judgment or a matter of inquiry.

4. The significance of the purpose sentence is that it ***.

---

22. Review Frame:

1. sum total
2. organization
3. declarative
4. helps you to remember what it is you want to do in the speech.

B. The Development of The Purpose Sentence

23. The second principle basic to all speech organization is called the Development. Conversely, the _____ is the second principle basic to all speech organization.

---

23. development

24. The Development is the sum total of all those things (evidence, quotes, statistics, reasoning, etc.) which support and develop the _____ _____.

| | |
|---|---|
| 24. purpose sentence | 25. We call those things which support and develop the purpose sentence the "materials of speaking." Thus, the Development of the speech is the sum total of all the _____ _____ _____. |
| 25. materials of speaking | 26. The Development is the 1. _____ _____of speaking which support and develop the 2._____ _____. |
| 26. 1. sum total<br>2. purpose sentence | 27. Quotes, statistics, personal proof and reasoning are used to support the purpose sentence and are thus called _____ _____ _____. |
| 27. materials of speaking | 28. While the purpose sentence is the sum total of what the speaker intends to do in his speech, the sum total of all those things which he uses to support and develop his purpose sentence is called the _____. |
| 28. development | 29. Since the_____includes everything which supports and develops the purpose sentence, it is sometimes referred to as the "guts" of the speech. |

| | |
|---|---|
| 29. development | 30. The development is the second principle basic to all speech_____. |
| 30. organization | 31. The Development is sometimes referred to as the "_____" of the speech. |
| 31. "guts" | 32. All those things which go into making up the Development and serve to support and develop the 1._____ _____ are called the 2._____ _____. |
| 32. 1. purpose sentence<br>2. materials of speaking | C. The Relationship of The Development of The Purpose Sentence<br>40. The third principle basic to all speech_____is called the Relationship. |
| 33. orgainzation | 34. This third principle of organization is concerned with the Relationship between the 1. p____ s____ and the 2. d____. |

34. 1. purpose sentence
2. development

35. The principle of Relationship is more of a concept than a principle; nevertheless it is an easy one to remember. The principle requires that the Development always be subordinate to the _____ _____.

35. purpose sentence

36. When we say that the Development must always be subordinate to the purpose Sentence we mean that the Development (which is the sum total of all the materials of speaking) must always support the_____ _____.

36. purpose sentence

37. This point about the Development always being subordinate to the Purpose Sentence is an important one since very often the reason why many speeches are disorganized stems from the fact that much of the materials of speaking

in the Development have very little direct relation to the Purpose Sentence. We often refer to this as "going off on a tangent." And speeches that go off on a tangent tend to be

_ _ _ _ _ _ _ _ _ _ _ _.

37. disorganized

38. Review Frame:--Let's see where we stand on the three principles basic to all speech organization. Do not check your answers until you answer all the questions.

1. What are the three principles of speech organization?

2. Which principle is the sum total of all the materials of speaking?

3. Which principle sums up what the speech is about?

4. What is the relationship between the Purpose Sentence and the Development?

5. What do we call all those things which serve to support and develop the Purpose Sentence?

38. Review Frame:

1. Purpose Sentence, Development and Relationship (any order)
2. Development
3. Purpose Sentence
4. The Development is always subordinate to the Purpose Sentence
5. materials of speaking

PART THREE: Patterns of Development or Speech Patterns

So far we have talked about the differences between Organization and Outlines, and the three principles basic to all Speech Organization. In our discussion of Organization, we referred to it as the pattern of development or arrangement of the speech. There are two basic patterns of development in speech; that is, there are two ways that you can put a speech together. We call these two patterns: (a) the DEDUCTIVE pattern; and (b) the INDUCTIVE pattern. There are a great number of speech patterns but they all stem from these two basic patterns. Note: Regardless of the pattern used, the Development is always subordinate to the Purpose Sentence. In the Deductive pattern the Purpose Sentence comes first and the Development follows. Conversely, in the Inductive Pattern the Development comes first and the Purpose Sentence follows. Finally, combinations of the two patterns may be used.

Go on to the next frame.

---

39. There are 1._____basic patterns of development in speech: (a) the Deductive pattern and (b) the 2._____ pattern.

39. 1. two
2. inductive

40. If there are two basic patterns in which a speech may be developed, then there are two basic ways of supporting or developing a_____ _____.

40. Purpose Sentence

41. The two basic patterns of development are: 1._____ and 2._____.

41. 1. Deductive
2. Inductive
(either order)

42. The DEDUCTIVE pattern of development is the most common; it is clear, concise, straightforward but often dull. On the other hand, the _____ pattern of development is interesting but yet difficult to handle and hard for the audience to follow.

42. Inductive

43. The most common pattern of development is the 1._____ it is clear, concise, straightforward but often 2._____.

| | |
|---|---|
| 43. 1. Deductive<br>2. Dull | 44. The pattern of development which is more interesting than the Deductive but difficult handle and hard for the audience to follow is the _____pattern. |
| 44. Inductive | 45. In the Deductive pattern, the organization proceeds from the Purpose Sentence to the Development. In other words, in the Deductive pattern, we state the 1._____ _____first and then proceed to the 2._____ |
| 45. 1. purpose sentence<br>2. development | 46. In the Inductive pattern of development, the organization is the reverse of the Deductive pattern; that is, it proceeds from the 1._____ to the 2._____ _____. |

46. 1. development
2. purpose sentence

47. It must be remembered that in both the Deductive and Inductive patterns of development, the Development is always s____to the Purpose Sentence.

47. subordinate

48. When we say that regardless of the speech plan used the Development must always be subordinate to the Purpose Sentence, we mean that the Development must always serve to 1.____and 2.____ the Purpose Sentence.

48. 1. support
2. develop
(either order)

49. Now let us look at an example of the DEDUCTIVE pattern of development.

Purpose Sentence: The process of sheep shearing actually consists of two major steps, each of which may be accomplished in several ways.

Development: I. Immobilizing the Sheep
A. Glue the sheep down
B. Chloroform the sheep.
C. Thumb-tack the Sheep.

II. Shearing the Sheep.
A. Zig-zag, don't know where the heck I'm going method.
B. Plough right in, let-the-wool-fall-where-it-may method.
C. Huggin' and a chalkin' method.

NOTICE in this example of the Deductive pattern of development how the Purpose Sentence is stated first and then developed.

Thus, as we said earlier, in the Deductive pattern of development, the 1._____ _____ is followed by the 2._____.

---

49. 1. purpose sentence
2. development

50. You will also notice in the previous frame that the Relationship between the Purpose Sentence and the Development show that the Purpose Sentence is superior to the Development. This, of course, is in keeping with the principle of Relationship which requires that the ***.

50. development always be subordinate to the purpose sentence or purpose sentence must always be superior to the development. (either one is correct)

51. Here is an example of the INDUCTIVE pattern of development.

Development: I. The process of shearing a sheep involves first the problem of immobilizing him.
A. Some advocate gluing the sheep down.
B. Others insist upon chloroforming the sheep.
C. In Australia he is usually thumb tacked.

II. The actual shearing process is done in several ways.
A. Zig-zag, don't know where the heck I'm going method.
B. Plough right in, let-the-wool-fall-where-it-may method.
C. Huggin' and a chalkin' method.

Purpose Sentence: Thus we can see that there exists no universally accepted method of shearing sheep.

NOTICE again that regardless of the pattern of development used, the Purpose Sentence is still superior to the Development.

| | |
|---|---|
| | In the Inductive pattern of development, the 1._____ is followed by the 2._____ _____. |
| 51. 1. development<br>2. purpose sentence | 52. Finally, as we said before, you may use a combination of the two basic patterns of development. For example, you may want to have some development before stating your purpose sentence and then return to your development. In any event, regardless of the pattern used, the Development is <u>always</u> 1.<u>s</u> _ _ _ _ _ _ _ _ _ _ _ to the 2._____ _____. |
| 52. 1. subordinate<br>2. purpose sentence | 53. Thus we can say that there are two basic _____ _____ _____: the Deductive pattern and the Inductive pattern. |

| | |
|---|---|
| 53. patterns of development | 54. Regardless of the pattern of development used, the 1._____ is always subordinate to the 2._____ _____. |
| 54. 1. development<br>2. purpose sentence | 55. The pattern of development in which the Purpose Sentence preceeds the Development is known as the _____pattern. |
| 55. Deductive | 56. The pattern of development in which the Development preceeds the Purpose Sentence is known as the_____pattern. |
| 56. Inductive | 57. One thing that should be pointed out is that the Purpose Sentence does not have to be stated in your speech (it must, however, be included in your outline). This is especially true when you face a hostile audience or when your purpose sentence might alienate a group. In this case, your development would serve to infer or suggest |

the purpose of the speech.

For these reasons we say that while it is necessary to state your purpose sentence in your outline, you do not have to _____ it in your speech.

57. state

58. Review Frame: Before going on to the last few frames of the program, let us review the more salient points of speech patterns or patterns of development.

1. How many basic patterns of development are there?
2. What pattern of development has the Purpose Sentence preceeding the Development?
3. What pattern of development has the Development preceeding the Purpose Sentence?
4. What does the principle of Relationship require, regardless of the pattern of development used?
5. Is the Development always subordinate to the Purpose Sentence? (yes or no)
6. What are the two basic patterns of development?
7. Which pattern of development is more interesting?
8. Which pattern of development is more common?

9. Does the Purpose Sentence have to be stated in the speech?

10. Does the Purpose Sentence have to be included in the outline? (yes or no)

58. Review Frame:

1. two
2. deductive
3. inductive
4. the development must always be subordinate to the purpose sentence.
5. yes
6. deductive, inductive
7. inductive
8. deductive
9. no
10. yes

59. While the Organization and the Outline of a speech are related, they are not the same thing. The Organization, as we pointed out earlier, is the pattern of development, and the Outline is the instrument or vehicle by which organization is achieved. The pattern of development by itself does not constitute an Outline (we refer to the Outline as the "full speech plan"). A full speech plan contains, not only a pattern of development, but also an Introduction, Body, and _____. (It is that "thing" you hand in to your instructor.)

| | |
|---|---|
| 59. conclusion | 60. The pattern of development used in a speech is only part of the full speech plan. We call this full speech plan, by which organization is achieved, the _____. |
| 60. outline | 61. While Organization and Outline are related they are _____ the same thing. |
| 61. not | 62. Organization is the 1. _____ _____ _____ or arrangement of a speech, while the Outline is the 2_____ or 3_____ by which organization is achieved. |
| 62. 1. pattern of development<br>2. instrument<br>3. vehicle<br>(either order for 2 and 3) | 63. Even though at times the program seemed redundant, inane, and tedious, one would have to admit that it was lots of f _ n. (Hint: the missing letter is the 21st letter of the alphabet and rhymes with what cow say.)<br>Turn the page and sigh |

# APPENDIX B

## PROGRAM B

FORM B

To The Student

This is a self-teaching device ("program") designed to present the basic terms, principles and concepts of Speech Organization. The information about Speech Organization will be presented to you in small steps. Each step ("frame") contains bits of information leading to an understanding of a whole concept, principle, or term. It is important that you read each frame in order, since the material is organized in a logical sequence. Read each frame carefully until you feel that you understand its contents and pay particular attention to the underlined words. When you feel that you have mastered the frame move on to the next one. The frames proceed vertically from the top to the bottom of each page--frame one is followed by frame two, and so on. If at times it seems as though the material is repetitious this is only so because the program is attempting to reinforce key aspects of the term, principle, or concept being considered. You will find it easy to learn about Speech Organization with this device if you follow the above instructions.

PLEASE DO NOT MAKE ANY MARKINGS ON THIS PROGRAM

PART ONE: Organization and Outline

1. The first question that may pop up in your mind is: "Why must I organize my speech?" For our purposes here let us say that there are two reasons why we organize our speeches: (a) in order to make sense; and (b) to satisfy the desire for unity which we all have within us, including members of an audience.

---

2. In a disorganized speech, the arrangement of the material prompts us to say that the speech not only lacks unity but also makes little sense.

---

3. To put it another way, we may say that a disorganized speech generally lacks unity and thus makes little sense.

---

4. Thus, to answer the question: "Why organize?" we say that we organize our speeches to make sense and satisfy the desire for unity.

---

5. Many people confuse the terms "ORGANIZATION" and "OUTLINE." They are related but not the same thing. Thus we say that while Organization and Outline are not the same thing, they are, nevertheless related.

# APPENDIX C

# POSTTEST

INSTRUCTIONS: Each of the following statements or questions is followed by a choice of five answers. Read the question carefully. When you have decided which answer is correct, blacken the corresponding space on the provided answer sheet. BEFORE YOU BEGIN, BE SURE TO SUPPLY THE INFORMATION REQUESTED ON THE ANSWER SHEET (all that is required is your name, age, sex, and grade; i.e., Freshman, Soph., Jr., or Senior).

1. To make sense and satisfy the desire for unity are two reasons why we:
   1. outline our speeches
   2. organize our speeches
   3. state the purpose sentence in the introduction
   4. summarize
   5. use transitions

2. The speech pattern in which the purpose sentence is followed by the development is:
   1. informative
   2. persuasive
   3. spatial
   4. deductive
   5. inductive

3. The principle of relationship is concerned with:
   1. transitions from the introduction, to the body, to the conclusion.
   2. transitions from primary to subordinate points.
   3. the purpose sentence and development.
   4. the introduction and purpose sentence.
   5. the introduction, body, and conclusion.

4. The significance of the purpose sentence is:
   1. it formulates the ideas of the speech
   2. it helps the speaker to remember what it is he wants to do in the speech
   3. it provides the audience with a guide to the speaker's arguments
   4. it tells the audience what the speech is about
   5. it introduces the speech

5. Which of the following is not a pattern of development:
   1. inductive
   2. deductive
   3. topical
   4. outline
   5. spatial

6. The second principle basic to all speech organization is:
   1. outline
   2. pattern of development
   3. purpose sentence
   4. relationship
   5. development

7. The speech plan should be constructed:
   1. before the speaker prepares his speech
   2. as the speaker prepares his speech
   3. after the speaker prepares his speech
   4. after preparation but before practicing
   5. while constructing the outline

8. Where does the purpose sentence normally come in the speech plan?
   1. at the beginning
   2. in the middle
   3. near the end
   4. at the beginning and near the end
   5. there is no "normal" location

9. The part of speech organization which is always superior, regardless of location in the speech plan is the:
   1. relationship
   2. purpose sentence
   3. introduction
   4. development
   5. conclusion

10. The relationship between the purpose sentence and the development requires that:
   1. the purpose sentence be subordinate to the development
   2. the development be subordinate to the purpose sentence
   3. the development preceeds the purpose sentence
   4. the purpose sentence preceeds the development
   5. the purpose sentence serves as a lead-in to the development

11. The pattern of development is:
   1. the way we arrange the materials of speaking
   2. the body of the speech
   3. the reasoning plan of the speech
   4. the transition from the purpose sentence to the development
   5. the transition from point to point

12. Regardless of the speech pattern used:
    1. the purpose sentence must be included
    2. the purpose sentence must be stated
    3. the purpose sentence must preceed the development
    4. the purpose sentence must always be subordinate to the development
    5. the development must always be subordinate to the purpose sentence

13. The instrument or vehicle by which organization is achieved is:
    1. the topic order
    2. the topical plan
    3. the outline
    4. the development
    5. the purpose sentence

14. All patterns of development stem from:
    1. organization, outline, and speech pattern
    2. inductive, deductive speech patterns
    3. topical, spatial speech patterns
    4. informative, persuasive speech patterns
    5. time, spatial, and causal speech patterns

15. In preparing a speech it is suggested that you first:
    1. prepare the body
    2. prepare the purpose sentence
    3. prepare the conclusion
    4. prepare the introduction
    5. prepare the development

16. We refer to all those things used to support the purpose sentence as:
    1. topical arguments
    2. major arguments
    3. body of the speech
    4. development
    5. materials of speaking

17. The purpose sentence of a speech is:
    1. the sum total of what the speaker intends to talk about
    2. the sum total of the materials of development
    3. the last sentence stated in the introduction
    4. the first argument to be presented
    5. the "guts" of the speech

18. Disorganized speeches often occur because:
    1. the purpose sentence is stated in the introduction
    2. the purpose sentence is stated in the conclusion
    3. the wrong pattern of development is used
    4. the development is not subordinate to the purpose sentence
    5. the development is subordinate to the purpose sentence

19. Speech plans of narration, description, causation, and suggestion are:
    1. variations of the basic speech plans
    2. variations of the deductive speech plans
    3. variations of the induction speech plans
    4. basic types of speech plans
    5. informative speech plans

20. The two basic patterns of development in a speech are:
    1. narrative and descriptive
    2. persuasive and informative
    3. deductive and inductive
    4. narrative and causal
    5. topical and spatial

21. The more interesting but difficult type of speech pattern is:
    1. inductive
    2. deductive
    3. spatial
    4. informative
    5. persuasive

22. The organization and outline of a speech are:
    1. parts of the process of invention
    2. names for the process of development or arrangement of a speech
    3. essentially the same
    4. not the same at all
    5. different but related

23. In delivering a speech before a hostile audience the purpose sentence:
    1. must be stated
    2. must be stated in the introduction
    3. does not have to be stated
    4. should be stated in the conclusion
    5. should be stated in the introduction and conclusion

24. The speech pattern in which the development is followed by the purpose sentence is:
    1. informative
    2. persuasive
    3. deductive
    4. inductive
    5. spatial

25. Organization means:
    1. the pattern of development or arrangement of a speech
    2. the instrument or vehicle which the speaker uses to build his speech
    3. the position of major arguments
    4. introduction, body, and conclusion of a speech
    5. outlining the speech

26. We sometimes refer to the development as:
    1. the "guts" of the speech
    2. the "overall organization" of the speech
    3. the "melting-pot" of arguments
    4. the "sign post" of major ideas
    5. the "second purpose sentence"

27. The primary concern of the development of the speech is:
    1. to support the purpose sentence
    2. to formulate the main points of the speech
    3. to give unity to organization
    4. to give focus to the organization
    5. to direct the audience's attention to key arguments

28. The technical term for the statement that formulates an idea, a feeling, an opinion, a judgment, or a matter of inquiry is called:
    1. introduction
    2. development
    3. minor proposition
    4. major proposition
    5. purpose sentence

29. The first principle basic to all speech organization is:
    1. outline
    2. pattern of development
    3. purpose sentence
    4. relationship
    5. development

30. The purpose sentence is normally:
    1. a question
    2. a clause or phrase
    3. a declarative sentence
    4. a paraphrase
    5. an interjection

31. The pattern of development which is simple, straightforward and clear is:
    1. informative
    2. persuasive
    3. deductive
    4. inductive
    5. causal

32. Statistics, quotes, facts, personal proof, and reasoning are all part of:
    1. formal evidence
    2. materials of speaking
    3. inductive speech patterns
    4. inductive reasoning and proofs
    5. deductive reasoning and proofs

33. The pattern of development:
    1. constitutues an outline
    2. does not constitute an outline
    3. often constitutes an outline
    4. seldom constitutes an outline
    5. may be a substitute for an outline

34. "topic," "gut," "lead-in" are all terms used in refering to the:
    1. pattern of development
    2. materials of speaking
    3. purpose sentence
    4. introduction
    5. reasoning

35. A speech pattern which has a purpose sentence followed by the development, which in turn is followed by a restatement of the purpose sentence is:
    1. topical sequence
    2. causal sequence
    3. inductive sequence
    4. deductive sequence
    5. none of the above

36. The most common type of speech pattern used is:
    1. topical
    2. spatial
    3. deductive
    4. inductive
    5. causal

37. The speech pattern that tends to be dull is:
    1. topical
    2. persuasive
    3. spatial
    4. deductive
    5. inductive

38. In order for a speech to be meaningful it must:
    1. have an outline
    2. have a purpose sentence
    3. have motive appeals
    4. be organized
    5. be summarized

39. The sum total of the materials of speaking is:
    1. the introduction
    2. the conclusion
    3. the organization
    4. the development
    5. the outline

40. The pattern of development is synonymous with:
    1. arrangement of materials of speaking
    2. introduction, body, and conclusion
    3. speech plan
    4. purpose sentence
    5. reasoning from point to point

41. A useful device which aids in the development of a subject and one which provides the speaker with a means of testing his analysis is:
    1. an outline
    2. organization
    3. pattern of development
    4. periodic summary
    5. final summary

42. The third principle basic to all speech organization is:
    1. outline
    2. pattern of development
    3. arrangement of ideas
    4. purpose sentence
    5. relationship

43. The full speech plan refers to:
    1. purpose sentence, development, relationship
    2. materials of speaking
    3. pattern of development
    4. organization
    5. outline

44. In writing out an outline the purpose sentence:
    1. must be included
    2. does not have to be included
    3. must be included in the introduction
    4. must be included in the introduction and conclusion
    5. should be included in the introduction and conclusion

45. Organization refers to:
    1. the pattern of development
    2. the order of presentation
    3. the structure of arguments
    4. the position of ideas
    5. the arrangement of outline conventions

# APPENDIX D

# QUESTIONNAIRE

Class Standing: _____ Sex: _____
Freshman, Soph., Jr., or Senior — M or F

Form of Program Used: _____ Room: _____
Specify A or B or A+B

Instructions: Please respond to each of the following questions by placing an "x" before one of the alternatives in each question.

COMPARED TO THE REGULAR TELEVISION LECTURES USED IN SPEECH 101:

1. How well has the program taught you the material covered:
   ____ less effective than t.v.
   ____ somewhat less effective than t.v.
   ____ about the same as t.v.
   ____ somewhat more effective than t.v.
   ____ much more effective than t.v.

2. How do you like the PI (programed instruction) method?
   ____ like PI much less than t.v.
   ____ like PI somewhat less than t.v.
   ____ like PI and t.v. method about the same
   ____ like PI somewhat more than t.v.
   ____ like PI much more than t.v.

3. How difficult was it to learn using the programed instruction (PI) method?
   ____ PI much more difficult than t.v.
   ____ PI somewhat more difficult than t.v.
   ____ No difference in difficulty between t.v. lecture and PI
   ____ PI somewhat less difficult than t.v.
   ____ PI much less difficult than t.v.

4. In the future, would you like to see the program instruction (PI) method used in place of the regular t.v. lecture?
   ____ strongly object to using PI in place of the t.v. lecture
   ____ would have some objection to using PI in place of t.v. lecture
   ____ don't care which method is used
   ____ have some preference for using PI in place of the t.v. lecture
   ____ strongly prefer using PI in place of the t.v. lecture

5. In the future, would you like to see both programed instruction (PI) and television used as part of the Monday lecture--say 35 minutes of television and 15 minutes of programed instruction?

____ strongly object to using PI and t.v. together
____ would have some objection to using PI and t.v. together
____ don't care
____ have some preference for using PI and t.v. together
____ strongly prefer using PI and t.v. together

6. Was there anything about the programed instruction method that you particularly liked? (Specify specific form (A or B) if you used both.)

7. Was there anything about the programed instruction method that you particularly disliked? (Specify specific form (A or B) if you used both.)

8. Use the space below to make any other comments you wish regarding the programed instruction method.

# APPENDIX E

## POSTTEST RAW SCORE DATA

TABLE 14

POSTTEST SCORES, TOTALS, MEANS, VARIANCES, AND STANDARD DEVIATIONS FOR THE CONTROL AND EXPERIMENTAL GROUPS

| Totals | TV | CR | R | TVC | TVR | C-R | C |
|---|---|---|---|---|---|---|---|
| | 32 | 42 | 42 | 42 | 44 | 44 | 21 |
| | 32 | 42 | 41 | 42 | 42 | 41 | 21 |
| | 31 | 41 | 40 | 41 | 42 | 41 | 21 |
| | 31 | 41 | 40 | 41 | 41 | 41 | 21 |
| | 30 | 40 | 39 | 40 | 40 | 40 | 21 |
| | 30 | 40 | 39 | 40 | 40 | 40 | 20 |
| | 30 | 39 | 39 | 40 | 40 | 40 | 18 |
| | 30 | 39 | 39 | 40 | 40 | 40 | 18 |
| | 28 | 39 | 39 | 40 | 39 | 39 | 18 |
| | 28 | 39 | 38 | 38 | 39 | 39 | 17 |
| | 28 | 39 | 38 | 38 | 39 | 38 | 17 |
| | 27 | 38 | 38 | 37 | 39 | 38 | 17 |
| | 27 | 38 | 38 | 37 | 38 | 38 | 16 |
| | 26 | 37 | 38 | 36 | 38 | 38 | 16 |
| | 26 | 37 | 37 | 36 | 38 | 37 | 16 |
| | 26 | 37 | 36 | 36 | 37 | 37 | 15 |
| | 26 | 37 | 36 | 36 | 36 | 37 | 14 |
| | 25 | 36 | 36 | 35 | 35 | 37 | 14 |
| | 25 | 36 | 36 | 35 | 35 | 36 | 14 |
| | 25 | 36 | 36 | 35 | 35 | 36 | 14 |
| | 25 | 35 | 34 | 35 | 35 | 35 | 13 |
| | 24 | 34 | 34 | 34 | 34 | 35 | 13 |
| | 24 | 34 | 34 | 34 | 33 | 35 | 12 |
| | 24 | 34 | 34 | 34 | 33 | 35 | 12 |
| | 24 | 33 | 33 | 34 | 32 | 34 | 12 |
| | 24 | 33 | 33 | 34 | 32 | 34 | 11 |
| | 23 | 32 | 33 | 33 | 32 | 34 | 10 |
| | 23 | 31 | 32 | 33 | 32 | 34 | 9 |
| | 22 | 31 | 32 | 32 | 31 | 33 | 9 |
| | 22 | 31 | 32 | 32 | 30 | 32 | 9 |
| X | 798 | 1101 | 1096 | 1100 | 1101 | 1118 | 459 |
| $X^2$ | 21490 | 40725 | 40282 | 40606 | 40817 | 41902 | 7455 |
| M | 26.60 | 36.70 | 36.53 | 36.67 | 37.70 | 37.27 | 15.30 |
| $S^2$ | 9.075 | 10.975 | 8.326 | 9.402 | 14.148 | 8.202 | 14.906 |
| SD | 3.012 | 3.312 | 2.885 | 3.066 | 3.761 | 2.863 | 3.860 |

# APPENDIX F

## COMPUTATIONAL FORMULAS

## ANALYSIS OF VARIANCE[1]

Given: $X_{ij}$ represents the "$j^{th}$" individual in the "$i^{th}$" column, the computational formulas are as follows:

Analysis of Variance Table

| Source | df | Sum of Squares | Estimate of |
|---|---|---|---|
| Between Means | K-1 | $\sum \frac{Xi.}{n_i} - \frac{X^2..}{N}$ | $\sigma^2 + n\sigma_m^2$ |
| Within | N-K | Total - Between | $\sigma^2$ |
| Total | N-1 | $\sum\sum X_{ij}^2 - \frac{X..^2}{N}$ | |

The above formulas were used for the computation of all three analyses of variance.

[1]W. J. Dixon and F. J. Massey, Introduction to Statistical Analysis (New York: McGraw-Hill Book Co., Inc., 1957), 149.

## SCHEFFÉ TEST[2]

The difference between $\bar{X}_i + \bar{X}_i$ needed for significance is given by the following equation:

$$\frac{D}{S_D} = K \quad \text{or} \quad D = K \cdot S_D$$

(1) $$S_D^2 = S_W^2 \left( \frac{1}{m_i} + \frac{1}{m_j} \right)$$

Where: $S_W^2$ = within sum of squares

$m_i$ = number of individuals in "$i^{th}$" group

$m_j$ = number of individuals in "$j^{th}$" group

$S_D = \sqrt{S_D^2}$

(2) $$K = \sqrt{(G - 1) \cdot (F_{G-1,\ N-G}\ \alpha)}$$

Where: $G$ = number of groups

$F_{G-1,\ N-G}$ = F required for the $\alpha$ level of significance for $n_1 = G - 1 + n_2 = \sum m_g$ - G degrees of freedom

(3) $$D = K \cdot S_D$$

Where: $D$ = difference between group means needed for significance

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[2]Q. McNemar, Psychological Statistics (New York: John Wiley and Sons, Inc., 1949), 286-87.

## ONE-TAILED TEST[3]

Given: H: $\mu_o = C$

H: $\mu_o \quad C$

If C.R. $\leq Z_{1-1/2\,\alpha}$ then reject H

Where:

(1) $Z_{1-1/2\,\alpha}$ may be found from any table of the cumulative normal distribution

(2) $CR = \dfrac{\bar{X} - C}{S^2}$

Where: $\bar{X}$ = sample mean

C = hypothesized mean (a constant)

$S^2 = \dfrac{N\Sigma X^2 - (\Sigma X)^2}{\sqrt{N} \quad (N - 1)}$

---

[3]Dixon and Massey, op. cit., 81-91.

## t-test[4]

Given: H: $\mu_1 = \mu_2$

H: $\mu_1 \neq \mu_2$

If $[t] \leq t_{1-1/2\alpha}(N_1 + N_2 - 2)$, then reject H

$t_{1-1/2\alpha}(N_1 + N_2 - 2)$ = value of t at level of significance with $N_1 = N_2 - 2$ degrees of freedom as found from any standard t-table

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S_p \sqrt{1/N_1 + 1/N_2}}$$

Where:

$\bar{X}_1$ = sample mean of first group

$\bar{X}_2$ = sample mean of second group

$$S_p^2 = \frac{\sum X_{1i}^2 - \frac{(\sum X_{1i})^2}{N_1} + \sum X_{2i}^2 - \frac{(\sum X_{2i})^2}{N_2}}{N_1 + N_2 - 2}$$

$$S_p = \sqrt{S_p^2}$$

$N_1$ = number of individuals in first group

$N_2$ = number of individuals in second group

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[4] Ibid., 121-22.

## SPEARMAN-BROWN (SPLIT HALF)[5]

The Spearman-Brown prophecy formula is given by the formula:

$$r_{22} = \frac{2\, r_{ij}}{1 + r_{ij}}$$

Where:

$$r_{ij} = \frac{N \Sigma XY - \Sigma X \Sigma Y}{\sqrt{(N \Sigma X^2 - (\Sigma X)^2 \quad (N \Sigma Y^2 - (\Sigma Y)^2)}}$$

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[5]V. H. Noll, Introduction to Educational Measurement (Boston: Houghton Mifflin Co., 1957), 70-71.

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