A STUDY OF PROGRAMMED INSTRUCTION AND ITS APPLICATION TO BOUND BUTTONHOLES

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CHAPTER I

INTRODUCTION

The critical need for improvements in American education has been voiced by numerous individuals within the past decade. Both educators and legislators are becoming aware that many of the problems that confront domestic education today are due to an unfavorable teacher-to-student ratio. Reports from the National Education Association indicated a teacher-to-student ratio to be approximately one-to-thirty. The unfavorable teacher-to-student ratio and varied reports that the educational system of the Soviet Union is advancing more rapidly than the educational system of the United States have caused educators to give considerable thought and effort toward improvement of the teaching methods in education.

Approximately fifteen years ago, followers of educational research and industrial training began to observe a new educational technique. The novel method of learning that drew attention had emerged from teaching processes evolving since the days of early Greek civilization. In the last few years, psychologists have made new application of the Socratic method, which is the crux of the programmed learning movement. To those whose mission it is to direct others to knowledge, the potentiality of programmed learning is much too promising to be ignored.

Programmed instruction is the one educational supplement modeled most closely after the teacher. By providing each student with a type of private tutor, programmed instruction offers great hope for relieving the growing pressure of the teacher shortage and increasing the benefits derived from obtaining knowledge.

Programmed instruction is based on the psychological principle of reinforced learning, whereby a reward is provided for desired behavior so that the behavior tends to recur. Also basic to the theory of programmed instruction is the tutorial or Socratic method of teaching by questions. Other elements necessary to the functioning of programmed instruction include an active response by the student to the material being presented in the form of writing, speaking, selecting, or other overt behaviors. The material presented is arranged in order of difficulty so that the obstacle between any two steps is typically small. It is assumed that progression from the simple to the complex prepares the student for success with the more difficult items which are to follow.

One of the key features of programmed instruction is immediate feedback or appraisal of the learner so that the learner knows immediately whether the correct response has been made. Knowing that the proper response has been made immediately tends to 'reinforce' learning, to encourage retention, and to give the learner confidence. In addition to making repetition of an act more probable, reinforcement increases a student's activity, heightens the student's interest, and quickens the pace of learning.

The new development, programmed instruction, aimed at providing aid to the teaching profession requires careful evaluation by persons interested in the improvement of methods in education. Programmed instruction centers on the individual learner and allows each student to work at an individual rate. This feature permits the slow student to pace learning at a suitable speed, while the rapid learner is also able to cover the program and advance to more difficult information.

Research and study should be incorporated into the production of a program so that the student's error rate may be kept low. The fewer the errors, the lower the chances of learning incorrect information. The correct response is rewarded with the correct answer, thus reinforcing the learning situation. The reinforcement of a correct response in the shortest possible interval is an important asset of the self-instructional device.

A survey of classroom teaching revealed that the average student is actively engaged or interested in classroom activity only 20 per cent of the time. (5). Programmed materials, which require continuous active response from the student, provide motivation for the learner thus eliminating passivity and inertia.

The tutorial patience of the self-instructional device is useful in a number of fields, including the instruction of the handicapped and the emotionally disturbed child. Programmed instruction is particularly useful in certain other well-defined areas, such as memorization of facts, nomenclatures, procedures, and mastering of simple concepts and principles which usually require many hours of a teacher's time. It is both inefficient and wasteful to force teachers to spend time on drills, recitation, "canned" lectures, and objective examinations. The teacher can be relieved of the job of drill-master and performer of other mechanical tasks and can apply the time and ability to more creative teaching and more effective analysis of a student's problems, weaknesses, and strengths.

Toward the close of the 1950's the number of studies pertaining to programmed learning increased. John Blyth, (8) for example, summarized an experience in teaching logic on a programmed basis at Hamilton College in the following:

> We wasted no class time on routine checking or drill. In the classroom we could presuppose a common background of experience. We could usually count on a working command of basic concepts and principles. There was a great increase in interest and improvement in morale.

Against such a background of student preparation, Blyth reported greater achievement, higher grades, fewer failures, and a decrease in the actual time spent in class by his students.

The rapid world changes require that the homemaking curriculum be continuously revised if it is to be increasingly challenging and functional. Revision of educational techniques should be based upon sound research in the field of home economics. At the present time few programs have been developed in areas related to home economics. If home economists in the field of education would endeavor to become better acquainted with the techniques of programmed instruction, then wiser decisions might be made upon the value of programmed learning in home economics. By writing and testing short programs in the classroom, home economics teachers could increase understanding of programmed learning devices and strengthen their ability to wisely select any published programs that might come on the market in the area of home economics.

Statement of the Problem, Purposes, and Limitations

The major problem in the study was an investigation of the possibilities of programmed instruction as may be applied to the teaching of clothing in home economics. The purpose underlying the study was to find definite information that would be used in the following sub-problems:

1) To strengthen the understanding of the application of programmed instruction as a supplementary method in education, thus increase the ability to know how and when to use programmed instruction.

2) To explore the advantages and disadvantages through investigation of the literature related to programmed instruction.

3) To analyze the procedures involved in the preparation and administration of a short unit program in clothing education, so as to enable the writer to prepare and administer a program.

4) To develop a sample program on the construction of bound buttonholes for home economics students enrolled at the secondary level.

Thus, the study was limited because it was exploratory in nature and therefore not expected to give definite answers to the many problems of programming. The method of using mainly library research was a limiting factor. Library research was used to give depth and broaden understanding within the general problem.

Facts presented in the study should enable the investigator to more thoroughly understand the place programmed instruction has in today's education and the procedures by which the method can be used most effectively.

Methodology

The methodology in the study was the utilization of library resources in 1) the exploration of previous studies concerning programmed instruction, 2) the study of research records and trial test of psychologists and educators already examining the field of programmed learning, 3) the investigation of programs that have been developed, and tested, and the suggested steps of procedure recorded by the researchers, and, 4) the inquiry into the advantages and disadvantages of programmed instruction, recorded by researchers in order to form a comparison as pertains to education in general and to home economics in particular.

The study of written programs was followed by applying a combination of programming to the construction of bound bottonholes. The sample program was developed by the writer and tested by 1) three home economics teachers and revised, 2) presented as a pilot study to two Clothing I classes, then revised, 3) given as a class assignment to 145 students in Clothing II and III classes in two different high schools, and 4) offered as a possible step forward for the use of programmed instruction in home economics education. Further discussion will be given to methodology in Chapter III.

Assumptions

These assumptions are basic to the study:

1) Programmed learning is a method in education based upon the stimulus-response theory and the psychological principle of reinforcement in learning.
2) Each person is a separate entity with different hereditary and environmental backgrounds, and with different inborn abilities.
3) Homemaking education should be based upon democratic principles and provide equal opportunities for a person to develop to his optimum capacity at the rate best suited to that individual.
4) Students learn through actively participating in the learning situation.
5) American education exhibits urgent needs for continuous improvement.

6) To date, there has been little programmed instruction in home economics. (Letters in the Appendix support this assumption.)

Definition of Terms

1) Branching is a type of programming which has built-in alternate sequences of items.

2) Conversational chaining refers to the technique of having each item of a program lead into the next one by placing bits of information learned in one item into the next.

3) Cue and prompt are used interchangeably to mean any bit of information added to a program item to make it easier for the student to make the correct response.

4) Error is an incorrect or non-appropriate answer to a specific item in the program.

5) Fading is the technique in which the number of cues or prompts is diminished as the program progresses.

6) Intrinsic programming refers to a type of programming which employs the branching techinque where all possible sequences of item presentation are built into the program rather than being controlled by an outside agency.

7) Item and frame are used interchangeably to indicate the smallest single unit of a program consisting of a single piece of information which usually requires response of some sort.

8) Linear programs are also called straight-line, non-branching, or Skinnerian programs. The sequence of items is fixed, unalterable and identical for each sequence.

9) An overt response is any response that involves a physical activity

on the part of the student.

10) Program is the course material which has been broken down into small, easily digestible bits and arranged in a sequence to lead the student to a fundamental understanding of concepts basic to the course.

11) Programmed instruction is generally considered to comprise any means, devices or materials whereby teacher or tutor functions are replaced, or provided by a wholly or partially automated sequence of instructional segments that is prepared in advance and is capable of instructing effectively when presented without direct intervention or modification by a teacher.

12) A programmer is generally, a curriculum specialist who subdivides the material to be learned into the sequential steps for later use with the mechanical method of presenting the program.

13) Programming is the process of arranging materials to be learned in a series of small steps designed to lead a student, through self-instruction, from what the student knows to the unknown of new and more complex knowledge and principles.

14) The programmed textbook is a program that does not utilize an auxiliary device for the presentation of the information.

15) Reinforcement is any stimulus which increases the probability that the immediately preceding response will occur again under similar circumstances.

16) A scrambled textbook is based upon the branching programs.

17) Step means the increment in subject matter level to be learned with each succeeding item or frame in the program.

18) Step size indicates the increased amount of difficulty in subject matter within each step in the program.

19) A <u>teaching machine</u> is a device for presenting programmed materials.

20) <u>Vanishing</u> refers to the gradual withdrawal of prompts from the programmed items.

CHAPTER II

REVIEW OF LITERATURE

As changes occur in living conditions and in societal demands upon individuals, so must the school curriculum change. Curriculum development and improvement is a continuous process which involves long-range planning and foresight. (1).

Presently, educators are on the threshold of an exciting and revolutionary period, in which the scientific study of man will be put to work in man's best interests. Education must play a part and accept the fact that a revision of educational practices is possible and inevitable. (2).

The world-wide demand for education is rapidly surpassing available educational resources. New ways to improve efficiency of the educational process are needed. While many areas of human endeavor have benefited by modern technology, education has remained relatively unchanged for centuries. Technical skills available in today's society make possible implementation of certain psychological principles which have a profound effect upon learning. Teaching machines represent an attempt to improve the efficiency of education by applying certain psychological principles to do the teaching process. (3).

Programming is regarded often as a recent development because practical application to education has become apparent only in the past few years. To maintain that programming is a twentieth-century accomplishment is to ignore the emergence of the present form from processes that have evolved down through the ages and to forget the contributions of scholars dating back more than 2000 years. (4).

One of the earliest programmers was Socrates, who developed a program for geometry, which was recorded by Plato in the dialogue, Meno. Socrates' habit was to guide his followers to knowledge by conducting the students conversationally along a path from fact to fact and insight to insight. The similarity between Socratic method and the contemporary use of programming is easy to observe.

Closer to present times has come the tutorial method. The continuous exchange of questions and answers between the tutor and the student, the unfolding of information and explanations, and the constant selection of new material on the basis of the student's mastery of what has gone before is a forerunner of programmed instruction. (4).

Self-instruction devices to aid teaching are, also, by no means a modern invention. The first truly mechanical, self-instructional device put to widespread use was designed to teach a proper trigger squeeze to United States Army recruits in 1918. (5).

In 1926, Sidney L. Pressey, an Ohio State University psychologist, made public the pioneer studies on the first recognized teaching machine. Pressey's model originally was conceived as a testing machine that presented a series of questions to a student and informed the student immediately whether the reply was right or wrong. (4). Later Pressey discovered that the device also had definite instructional capabilities. Pressey stated the following:

> The average teacher is woefully burdened by routines of drill and information fixing. It would seem highly desirable to lift

from her shoulders as much as possible of this burden and make her free for those inspirational and thought-stimulating activities which are, presumably, the real function of the teacher. (6).

The movement in behalf of programming devices, however, lost impetus in the early stages, perhaps because 1) no provision was made for systematic programming of materials to be used in machines, and 2) the onset of the depression and the impact of it on social conditions and education offered an unfavorable environment for an "industrial revolution" in the nation's schools.

By 1954, however, conditions in the world had changed. Greater knowledge in the science of behavior, especially about the analysis of learning behavior, and a demand for education in an unprecedented scale that strained every educational resource, created a vastly different set of circumstances. In the more favorable conditions two Harvard psychologists, B. F. Skinner and James G. Holland, devised programmed instructional methods which have served the current generation as the basis for excursions into programmed learning. (4).

Teaching machines and related self-instructional devices have attracted increasingly wide attention in the past few years as a new media of instruction. The interest has created a demand for a convenient and comprehensive source of information on what has been happening and what has been written in the rapidly expanding field of programming.

Educators and psychologists, in increasing numbers, have been seeking information about activities in the field of programmed learning. Such effort has encountered considerable difficulty because of the relative inaccessability of much of the material. (7).

Since the Industrial Revolution a continuing complaint has been heard to the effect that the use of machines led to the debasement and the materialism of American civilization. The word "machine" has thereby acquired a heavy emotional burden. The same burden is now rapidly piling upon words such as "automation." Thus the phrase "automation of education with teaching machines" represents such an emotional reaction for some people that intelligent inquiry into the merits of teaching machines is blocked. (8).

The purpose of a program is to shape a series of responses into a complex act. By reinforcement of the specific actions or responses that lead most directly to the learning desired, the educational objective can be achieved. The program begins with questions about information that is familiar to the student and through a sequence of such questions gradually leads the student to new usages, concepts and insights. The student does not merely memorize facts, but is led to formulate perceptions, step by step. Upon formulating such laws, rules, and principles, the student is immediately led to use and apply the principles in different contexts until thorough comprehension of the meanings has been achieved. (5).

A basic purpose of programming is to provide the student with a method by which study can be done at an individual rate, according to the student's capability. The goal of education for the present and the future is to extend to each student optimum means by which to obtain knowledge. Through strengthening of an overall understanding of programmed instruction such a goal might more nearly be accomplished. A basic comprehension of the programming technique is possible by investigation of relevant literature.

Kenneth Komoski, the Director of the Center for Programmed Instruction, made the following statement in an address given at the 25th Annual Educational Conference in October, 1960:

> Two thousand years ago the world's first public school administrator, a gentlemen by the name of Quintillian, wrote what might be called a handbook for teachers. In it he has one bit of advice which will serve as an excellent starting point for a discussion of programmed instruction and its potential uses. Qunitillian's advice is this: 'Do not neglect the individual student. He should be questioned and praised. He should strive for victory, yes, but it must be arranged that he gains it. In this way let us draw forth his powers with both praise and rewards.'
>
> The goal of education in this country should be to give each individual the opportunity of developing himself to the fullest potential. In order to achieve such a goal we in this country should not be content until we have developed a practical method of making it possible for each child to learn as much as he possibly can at his own individual pace.

A great deal of research into learning theory has culminated in the development of programming techniques and materials. The most active proponents of programmed learning do not suggest that programming will be an end to all problems in education, but do suggest that programmed instruction is a good direction in which to proceed. (5).

"A student using a teaching machine is like a student who has a private tutor to guide him forward, step by step," says Theodore Waller. In brief, the teaching machine makes possible the achievement of two goals that were long mutually exclusive: the democratic ideal of educating a great mass of people, and the Socratic ideal of tutorial instruction. (9).

The basis of the teaching-machine movement is three fundamental concepts of behavioral psychology: stimulus, response, and reinforcement. According to this theory, learning is most efficient and more enjoyable when programmed into a series of questions and answers. When a student reads a small unit of information, answers a question, and the answer is immediately confirmed, new knowledge is quickly imbedded in the mind. Such a process is much stronger than reading a chapter, taking a test at the end of a week, and waiting a day or longer to find out the grade. The sooner answers are confirmed, the better learning is reinforced. (9).

The more rapid the feedback, the more effectively learning is reinforced and retained. To obtain learning, the right answers must be reinforced immediately. (5). In addition to making repetition of an act more probable, reinforcement increases a student's activity, quickens his pace, and heightens his interest in learning. The importance of the immediate feedback was formulated years ago by Thorndike as the "law of effect." According to the law, an action which leads to a satisfactory result tends to be repeated. In the contemporary terminology of B. F. Skinner, of Harvard University, immediate reinforcement or reward is important in the learning process. (7).

For each item the machine supplies the student with certain information or clues that aids the student in responding accurately. The clue is known as the stimulus. The remaining portion, which requires the participation of the student, is known as the response. To complete a step, the student fills in the blank space contained in the item and checks his answer against the machine's correct answer. The items are so planned and interconnected as to increase in difficulty as the student advances to higher degrees of knowledge and greater skill. (4).

The arrangement of information in small steps of "frames" allows each student to take utmost advantage of his ability. In most classrooms today the slow student is forced to digest the same amount of information in the same amount of time as the fast student. If the slower student wants to stay with the class, difficult material must be skipped and many undigested facts left behind. The slow learner is thus less and less equipped to deal with new subjects as the year progresses. Conversely, the fast student held in the same lock step, is apt to lose interest because progression is too slow. When the steps are small, the bright student is encouraged to move quickly. The less brilliant student may advance more slowly, but is given the chance to comprehend everything and be adequately prepared for new information. (9).

In brief the duties of the teaching machine is to present a learning program for the student which presents material arranged in a series of small, gradual steps designed to move the student from a familiar background into a complex of new principles, concepts, and understandings; engages in stimulus presentation of the items in the program; elicits the required response on the part of the student; supplies immediate feedback to the student as to the adequacy and correctness of a response; and offers reinforcement on the basis of the feedback. (4).

The following is a statement on self-instructional materials and devices released by a joint committee of the American Educational Research Association, the American Psychological Association, and the Department of Audio-Visual Instruction of the National Education Association:

> The use of self-instructional programed learning materials in teaching machines and similar devices represents a potential contribution of great importance to American education. But this contribution can best be realized only if users have information with which to evaluate self-instructional materials. (10).

In the recent survey of more than 30 research studies on programmed learning, Jack Quackenbush found evidence that the generalizations about the effectiveness of the method have been supported in classroom applications.

Students pursuing programs, for instance, scored higher on standardized achievement tests than the students taught by conventional classroom methods. Variations in the individual rates of learning through programmed units were confirmed. Students were making more progress than might have been expected and mastering material that ordinarily might have been considered beyond the students' level of comprehension. (4).

Although such studies are encouraging, in the interest of objectivity, most of the reported experiences concerned a limited number of students, often from a relatively select category, using a simple program in one subject matter, and usually for a limited period of time. To generalize too much from the findings would be unwise, but their value certainly cannot be ignored. Significantly, the students evinced only a minimum of unfavorable reaction to programmed learning in all the studies Quackenbush surveyed. However, some students did indicate boredom and a few students were disappointed at not encountering greater difficulty due to the simplicity of the material. The first problem obviously calls for better programming. The second points to the need for a more imaginative development of the program sequences so that the student's learning ability will be challenged. (4).

The view taken by the conservative Carnegie Corporation in the 1960 annual report was:

> The programmed learning devices do represent an interesting and significant approach to instruction. They are almost certain to take their place among the important aids to learning in a modern educational system. (9).

Existing results of tests run in the classroom with programmed materials indicate that such materials and devices, properly employed, considerably increase learning speed and retention, and reduce the age level at which advanced content may be presented. Complex concepts may be made relatively easy to absorb in programmed form and so may be introduced at a lower age level. (5).

Kenneth Komoski believes programmed instruction to be a "remarkably effective teacher-training tool." Komoski stated:

> Almost with out exception teachers agree that the experience of programming even one lesson taught them more about their own teaching and instruction in general, than any other teacher-training they had had. There are many reasons for this, such as new detailed analysis of familiar material, analysis of methods and approaches and the practical experience of seeing students trying to learn through programs.

For these reasons, Komoski concluded that teachers' colleges might well investigate the possibilities of programming as an effective means to teacher-training. (5).

The seriousness of America's teacher shortage has led to wide range of action on methods for supplementing the individual teacher in some manner. Programmed learning is not a solution to the shortage of capable teachers nor an answer to an inadequate school budget. Programming may offer some relief to educational problems, but it can help only in the same ways as other advances in teaching have helped. The program supplies the student with the basic information of a given subject. While the student thus acquired a foundation in a subject to be ready for the far more important consideration of causes, relationships, and applications, the teacher will be released to undertake more creative assignments. Since students will progress at their own varied rates the task of the teacher will become more complex and even more vital. (4).

As a result of programmed learning, redefinition of the role of the teacher may become necessary. The teacher should be able to devote more time to worthwhile discussions with the students, to realistic solving of problems with the students, to more adaptations of the material to the individual, and to personal needs of various life situations. The demand for more creative, imaginative effort should make teaching even more dynamic and satisfying as a profession. It could easily result in great enhancement of the learning process. With the aid of the learning program, the teacher can devote a much larger part of the time to counseling, guiding, assisting, and stimulating the individual learners. In reflecting on these possibilities, Harry Broudy has commented:

> If the teacher is a source of non-standardized insights; if the teacher is creative enough to produce a highly personal reaction to the world and to the subjects he teaches, then he is a valuable asset and not a machine at all.

The implication is clear. If certain classroom tasks can be accomplished by a machine, then the tasks should be done by the machine, and not by the human being. The human being, the classroom teacher, should do those things the machine cannot do. In the process, teacher, learner, and education will all benefit. (4).

The application of programmed instruction may change the role of the teacher, but programming will not make the teacher unnecessary. Today the elementary school teacher spends most of the time emphasizing simple rules which can be programmed with relative ease. When these fundamentals have been incorporated into programs, much of the drudgery of the teacher's job will be eliminated. Teachers will then be free to help individuals with their particular problems and interests. Thus the teacher's principle task may be changed from that of instructor to tutor or counselor. A clothing construction teacher gives a great deal of time to basic information on sewing techniques. Programmed instruction could handle the teaching of skills and thus allow time for the teacher to expand the activity in the classroom which is so important in clothing education. In general, teachers employing programmed instruction will be required to have a more thorough understanding of the materials being taught than is currently necessary. (11).

Ultimately then, the teacher's job will probably be more difficult than at the moment. A more thorough knowledge will be required in a wider range of subjects. Not only will clever students be covering more subjects than presently; all students will achieve a better understanding of the material being taught, and will thus be likely to ask more complex questions. (11).

Dr. Skinner, writing for Science, explains:

> Will machines replace the teacher? On the contrary, they are capital equipment to be used by teachers to save time and labor. In assigning certain mechanizable functions to the machines, the teacher emerges in his proper role as an indispensable human being. He may teach more students than heretofore, which is inevitable if the worldwide demand for education is to be satisfied, but he will do so in fewer hours and with fewer burdensome chores. In return for this greater productivity, the teacher can hope to improve his economic condition. (2).

Lewis Eigen said:

> A greater number of thoroughly trained teachers will be needed than ever before. Programs are limited in what they can teach. Good teachers will be needed to write, correct, administer programs and then go beyond them. (6).

An important point is that teachers have to be convinced that programmed learning is a good technique or programming will never work. In a study conducted by Encyclopaedia Britannica Films at Roanoke, findings were that when teachers were hostile to machines, the students did poorly. Students seemed to recognize a lack of enthusiasm on the part of the instructor. Because of such findings, it would be inadvisable to introduce programmed instruction into any school system where the teachers were not prepared in advance.

Dr. Clifford Rall, superintendent of schools in Port Chester, New York, has given considerable thought to the same problem: "I never use a teacher in programmed instruction unless she is sympathetic to this method of teaching." (9).

At this stage, the prospects for general acceptance of programmed learning are good. Fine's (9) survey of some 50 teachers who were using macnines or self-tutoring books, reported only 10 per cent of the teachers were opposed to the new technique, 10 per cent were undecided about programming, and 80 per cent favored it wholeheartedly. Fine found that most teachers lost their antagonism to machines once they had used teaching machines.

A consideration with respect to the learner and the learning program is that there is a substantial redefinition of the student's role in the learning process. Not only is there active interaction between the student and the sequence, but student achievement is essentially the measure of the program's utility. Programmed learning constitutes a powerful new instrument to discern how successful and unsuccessful students behave, and to recommend how to make students more successful by providing better guides to the objective. (4).

In addition to redefining the student's role in the learning process, programming will open new opportunities for exploration. As potentials of programming are achieved students will no longer be limited by the standard perimeter of the learning environment. The student who attends a high school where statistics are not taught can now obtain an insight and skill of a higher order than might be realistically acquired from reading a textbook on his own initiative. Programmed learning through careful sequencing, active involvement, and reinforcement makes the learner a partner to the development of the individual's future, thereby ending the existence of a passive subject to be acted upon. Programmed learning in this sense, could become a vital device in the exercise of individual study, which most educators recognize as being at the heart of any basic changes in the system.

Perhaps the day will come when the individual progress of the student through a series of educational experiences adjusted to his capabilities and capacities will be the distinctive mark of American education. Effective practice of programmed instruction could play a large part in bringing about such a development. Teaching by means of programs is still in the early stage of exploration. (4).

Methods of Programming

So far, there are two main philosophies of programming according to differences in belief about the purpose of the response which has led to the development of two styles. They are: 1) linear and 2) branching. Each type has advantages and disadvantages; neither type could be specified as the "best" type. Both types can be used either with or without a teaching machine. It is advisable that educators become acquainted with both forms of programming in order to discern under what conditions to use each form.

Linear Programming

In a linear program all students read every frame in identical sequence. A type of linear program is that advocated by Dr. B. F. Skinner, which requires a constructed response. (12). Any question which leaves a blank to be filled in requires a constructed response. Two reasons are given for preferring a constructed response: recall is more efficient in the learning process than recognition, and the act of responding tends to cause learning. (2).

The linear type program consists of a series of frames containing small bits of information. Each frame constitutes only one short step in the total sequence. Short steps enable the student to make the correct response. Correct answers are rewarding to the student while errors are discouraging. The student is given the answer immediately after making a response.

Another type of linear program was devised by Dr. Sidney Pressey. Pressey's multiple-choice linear program is based partly on two factors. 1) The Law of Frequency: The student may sometimes get a wrong answer, but in each frame he ultimately gets a correct answer. By chance the student will get more correct than incorrect answers. 2) The Law of Regency: No matter how many wrong answers a student may try in response to a question, the correct answer is always the last one and is more likely to be remembered because it comes closest to the reinforcement. (12).

The short step is characteristic of all linear programs for two reasons. If the act of responding tends to cause learning, each step must be short enough so that the student is very likely to answer correctly. The second reason is that too many mistakes are discouraging, whereas correct answers are rewarding to the student. (12).

Branching Programming

The branching concept is a method of programming, developed by Mr. Norman Crowder. Branching looks something like the Pressey multiple-choice type, but with a big difference; the alternatives lead somewhere. A brief bit of information is given; then two or three statements are made. Each statement is followed by a page number. If the statement chosen is the correct one, the information on the other pages listed may be omitted. Therefore, the student with a good background can finish more quickly than the student who needs additional work. (12).

Crowder-type programming provides a continuous review and insures the mastering of points before the student proceeds to new material. To accomplish this, Crowder employs a technique known as branching. The student who selects a series of incorrect answers will be referred by the program to a remedial sequence of steps which will give fresh approaches to the explanations of the material the student is trying to understand. After the material is mastered the student will be led back to the main-line of the program.

Since errors or misconceptions are corrected before the learner proceeds, the step size can be larger and the main-line of the program may proceed more rapidly than in the linear program. There is the possibility of having the main-line items proceed in large, fairly difficult steps with shorter, easier stages moving side by side with the main-line items. (12).

As the student gets farther along in the linear program the steps may increase in size. Verbal stimuli may be supplemented by visual stimuli such as graphs, often leading the student to do more analysis and application of the theories that have been learned.

A difficult process in programming is determining the sequence and relation of an item to another item. The programmer must strive to make the items relate to and lead into each other. The most common method is called conversational chaining originated by John Barlow, Earlham College, Self-Instruction research project. Conversational chaining involves taking information from the previous step and beginning the next step with it. This makes the materials interesting to the student as well as constantly reminding the student of previously absorbed information. (5).

The very requirement of interlocking the items necessitates a certain amount of repetition in each item in order to tie it rationally to its predecessor, and in addition, to make the program as a whole proceed with continuity of thought. Conversational chaining is a good paradigm for newcomers to choose. (4).

There is a growing conviction among many persons in the field that the types of programming techniques employed should be determined by the course material being taught and the level of the student taking the course. A branching, large-step program, for example, would be virtually useless in teaching any rote skill such as the multiplication tables. Small steps would be a bore and an insult to the intelligence of a student in a higher discipline such as English literature. (5).

Limited experiments by the Systems Development Corporation have shown that the use of multiple-choice responses and the subsequent possibility of error do not constitute sufficient negative reinforcement to statistically affect the learning process one way or another. Other experiments have been run showing that smaller-step programs lead to higher grades on final examinations, but take more time to complete. None of these experiments involved large enough groups of students to be considered conclusive. Recently, however, Skinner has modified his views to the extent of granting that step-size should be relative to the subject matter being taught.

Two studies have been made by Systems Development Corporations and the University of Pittsburgh concerning overt responses. Reports indicated that students who merely thought of the answers without writing anything learned faster and retained more than students who actually wrote the answers. Another study made by the same group yielded no differences between the methods of responding. (5). The main object of having any response at all is not to test, but to ensure the attention and active participation of the student, as well as to have a record of the progress showing where the student had difficulty.

Dr. James Holland, also of Harvard, suggested that the most important factor in programmed learning is the continuous active attention of the student. If the student is highly motivated, the student will pay attention and read the items carefully anyway. It will make no difference if a pupil makes constructed responses, multiple-choice responses or no overt responses at all. The decision as to which response method to use should probably be based on the subject being taught and the age level of the student. In the spelling of words, making constructed responses would be preferable. In a psychology program the student may only be required to remember pieces of information and rules, and multiple-choice response would be just as efficacious and less time consuming. (5). The wording of the questions and the context set by the sequence of questions are usually adequate to indicate the type of answer required.

Howard Kendler made the following statement:

> There is no psychological principle of which I am aware that would oppose the use of teaching machines. Conversely, there are several principles that would suggest that the teaching machine would be an effective and efficient educational tool. Ultimately we have to develop better theories of behavior, particularly those of transfer and symbolic processes, in order to make the best use of teaching machines. Although it might be non-strategic to consider these theoretical problems immediately, I

think it would be more nonstrategic to deny their existence. (14).

Research in Programmed Instruction

The three publications, Programmed Instruction--Today and Tomorrow, by Wilbur Schramm; Prospectives in Programming, is an edited cahier of the three 1962 summer institutes in programmed instruction conducted by the Center of Programmed Instruction; and "The New Educational Technology" in the November, 1962, issue of the American Behavioral Scientist, while presenting divergent viewpoints and different aspects of the wide range of information about the field of programmed instruction, have a common denominator: Agreement that programming has made the educational community recognize more clearly the importance of identifying specific terminal behaviors and the value of testing and revising instructional materials on the basis of analyzed student response. (15).

The rapid growth of programmed instruction and the problems associated with its growth led the Carnegie Corporation of New York to award a grant to the Educational Testing Service for a study of standards for evaluating programs. A result of the study is a guide to the schoolman for use in selecting programmed instructional materials. The guide contains a check-list procedure for use in making decisions about programmed instruction. The purpose is to determine the suitability of the program for the schoolman's purpose. All problems will not be solved by such an aid, but some definite guidance is provided for today's decisions about programmed learning materials. (16).

Seemly research in the use of programmed instruction has affected nearly every part of the American educational structure. From elementary students to adult trainees, from college classrooms to Air Force installations, experiments have probed the potentialities of programmed learning, but the research is only beginning. Much more research has to come before programmed learning can be adequately evaluated. Nevertheless, even now, despite the insufficiency of experimental data, the developing scene of programmed learning may be examined with interest. (4).

About fifty years ago, in 1912, the famous psychologist, Edward L. Thorndike, in his book, "Education," outlined a blueprint for programmed learning devices:

> A human being should not be wasted in doing what forty sheets of paper or two phonographs can do. If, by a miracle of mechanical ingenuity, a book could be so arranged that only to him who had done what was directed on page one would page two become visible, and so on, much that now requires personal instruction could be managed by print. The improvement of printed directions, statements of facts, exercise books and the like is as important as the improvement of the powers of teachers themselves to diagnose the condition of pupils and to guide their activities by personal means. Just because personal teaching is precious and can do what books and apparatus cannot, it should be saved for its peculiar work. The best teacher uses books and appliances as well as his own insight, sympathy, and magnetism. (9).

Not long ago the famous educator Frank C. Laubach gave similar counsel in the autobiography, "Thirty Years with the Silent Billion." "We must prove to the student that he can learn easily, quickly, and delightfully, no matter how old he is," Laubach wrote. "Every step must be so short that an ordinary man can take it easily." (9).

This is an almost exact description of what happens when a student works through a modern programmed textbook. The student reads, answers a question, and only when the answer is verified does the student proceed to the next item. The student's attention is constantly rewarded. (9).

There are many ways to gauge programmed learning. One method is measuring the reduction in study time. At Collegiate School for boys in New York City students finished a mathematics course in half the time required for a control group to complete the course. Freshmen at Hamilton College went through a program of logic in one-third less time than normal, and the grade average rose remarkedly. At Ohio University students finished a course in 20 per cent less time after the subject was programmed as a Crowder "scrambled" book. At Bellevue Public Schools, Washington, seventh grade youngsters taking an algebra course usually given to eighth or ninth graders finished a semester of study in two months. In addition to saving time, teaching machines generally encourage students to do better work. (9).

The qualities of programmed learning which are advantageous for bright, average or slow students are also an advantage for the student who is physically or mentally retarded or emotionally disturbed. The retarded student is allowed to go along at his own rate and not be abused because he is unable to keep up with a "class." The emotionally disturbed or retarded child may simply need more time for work and the teaching machine will be patient. Speed is not the equivalent of intelligence, although many classrooms operate on such a basis. (9).

In the Blue Ridge mountain county of Roanoke, Virginia, pupils in the eighth grade of the local schools completed in a single term a full year of algebra, normally reserved for the first year of high school in other parts of the country. Only one child in the entire Roanoke school system failed to perform satisfactorily on a standardized algebra examination. (4).

The diverse achievements are neither accidents nor as unrelated as a casual reading might suggest. In each instance classroom teachers have been utilizing the techniques of programmed learning, a method of pedagogy that increases the learning rate and proficiency of pupils and students. The results of the studies and similar successful experiences are not conclusive, but they have alerted educators at all levels and in many areas to knowledge of a new educational potential. Although such trials do not represent finely controlled experiments, the trial-testing does contain enough promise to produce interest in programmed learning. (4).

For many years Dr. T. W. Blyth of Hamilton College has been teaching a course in logic. Dr. Blyth finds that giving the class programmed instruction to take home saves time which was formerly wasted on routine checking or drill. Instead of holding classes for three hours a week the class now meets for only two hours and still covers more material than previously with conventional methods. Also the new technique enables pinpointing a student's problems very quickly by checking the answers on the program. (9).

According to Fine (9) the failing rate in a medical technology class at Point Park Junior College, Pittsburgh, had dropped from twelve per cent to three per cent after teaching machines were introduced. The percentage of A and B students rose from fifty to eighty-five, and the students completed the course in 30 hours rather than the usual 120 hours.

The need for research on improved teaching techniques is voiced by Dr. Howard F. Fehr of the Columbia University mathematics department:

> Any 17th century mathematician reappearing upon the earth today could enter most classrooms in our traditional high school and without any preparation, teach the present curriculum, so far it is behind the times.

This view was stated by The Standard Research Institute in a recent study on "Impacts of a Teaching Machine":

> Programmed instruction, via a teaching machine, although still in the experimental stage may well prove a revolutionary route to better quality and lower costs in training and education. The outlook for teaching machines is speculative but highly promising. Although too early to predict in detail the manner and extent to which the concept of programmed instruction is to be adopted, clearly there are many applications to teaching machines and programmed texts of various types and the potential markets are both large and diverse. (9).

In summary, these are the conclusions Fine (9) reached after interviews with students participating in programmed instructed classes:

1) Most students prefer teaching machines to the methods of the conventional classroom.

2) Students would rather have the machine and the human teacher than either the machine or the teacher alone.

3) Students feel that a human teacher is especially important in discussion subjects such as social studies, philosophy, creative writing, and history; in brief, the non-tool subjects.

4) Students think the teaching machine needs to be improved to allow for review.

5) Students respond enthusiastically to immediate reinforcement.

6) Students believe the step-by-step framing technique improves learning.

7) Students like the principle of errorless learning.

8) Students like being able to study at an individual pace and accept the opportunity as a challenge.

9) Students believe programmed learning is especially suited to the bright student and the student who is below average.

10) The students made a very definite response in favor of the new learning psychology and against the aversive psychology of the traditional classroom.

The New York Board of Education has instituted a teacher training program in the use of self-instructional devices and has freed two members of the teaching staff to write programs. (5).

Other educational systems followed the schools and colleges into the new fields of programmed learning. Industrial training specialists concerned with educating adults found ways to apply learning programs to meet industrial problems. Bell Telephone Laboratories, the Polaroid Corporation, Corning Glass Works, and the Hughes Aircraft Company have begun programming in company classrooms. International Business Machines and the Eastman Koadak Company already have studied the efficiency of programming as a new industrial training method. (4).

Eastman Kodak prepared and tested a 70-item course for the employees on how to read the punchings on IBM data cards. The company was amazed to find that in a very short time the employees mastered a technique which had previously resisted the best of teaching efforts.

Encyclopaedia Britannica Films is currently field testing a whole range of mathematics programs of the Skinner-type in various parts of the country. A linear English program published by Harcourt-Brace is being used in a number of schools. Results show that students using Skinnerian programs eventually reach an equal level of comprehension of the subject matter presented in the program. The time required may vary with the student's intellectual capacity; but, according to Foltz's theory the slow student with enough time will equal the faster class-mates in comprehension. (5).

A harbinger of the coming change is the program for U. S. census-takers now being developed by Dr. Klaus. In 1960 it took 16 hours to train each of the 160,000 men and women for the population census. Dr. Klaus estimated the new programmed correspondence course will do the job in half the time with a big financial saving for the government. (9).

Today there are at least forty to fifty companies producing various types of automated self-instructional devices, twenty or more writing and publishing programmed textbooks, and at least an equal number who have announced research is in progress with the intent of entering the field of programmed instruction. (5).

Advantages and Disadvantages of Programmed Learning

Various segments of programmed instruction have been criticized by educators. Arthur Lumsdaine, Research Advisor for Education Media to the American Institute for Research, pointed out four major question areas concerning programmed learning. Lumsdaine stated that by breaking down the various aspects of the following question, a basis could be formed for identifying most of the differences to be found among existing programs. (17). The questions pertain to the following:

1) The size of steps in a program.
2) The content of prompts or manner of cueing.
3) The content of the feedback that is given.
4) The logic of program sequence.

Programmed instruction has presented problems which the behaviorial theorist hopefully will solve, but which nevertheless, currently concerns the schoolman since indications are that behavior theory is not adequate, nor is the method of programming sufficiently firm. The characteristics of effective programs cannot be specified in advance. Likewise, the effectiveness of a text and an achievement examination cannot be specified in advance. There is no set of objective characteristics which can be reliably used to judge quality when quality is determined by student achievement. Such disadvantages do not prevent preparation of programs. Program evaluation like the evaluation of tests, texts, and teaching aids is an empirical process. (16).

Criticism of programmed instruction is often due to insufficient information and misunderstanding of programmed instruction. One of the most vociferous criticisms is the idea that teaching machines will replace teachers. Programmed instruction is to serve as a supplement for the teacher and free the teacher for more creative presentation of the subject and solving of individual problems.

Machines cannot supply the warmth, understanding, and personal interest a human teacher extends to the students. More teachers will be needed to fill the increased demand for more counselors and programming specialists. (4).

Another criticism is the cost of programmed instruction. Teaching machines range from $20 to $500 each, plus the expenditure of the programmed material, maintenance costs, and some provision for storage. Many schools are questioning the improved results in relation to expense. However, as greater quantities of programmed material are produced, unit cost will decrease. Every school board must weigh immediate expense against eventual returns. The cost of education is ultimately not half so crucial as the service performed. Education strengthens democracy just as national defense preserves democracy; both are beyond mere questions of budget balancing. A curious fact is that man is forever moving ahead, but looking backward. (9).

Criticisms are most commonly cited in the form of advantages and disadvantages of programmed learning.

<u>Disadvantages</u>

Many people have indicated that the use of programmed instruction, in which each new concept is broken down into small parts, may eliminate creativity in the learning process and foster generations of unimaginative students. Educators to whom the speed of automated teaching is a matter of concern point out that the intellectually superior high school graduates for whom the learning process has been accelerated by machines may be too young to adjust well to society. Increased learning speed could also greatly increase the number of students equipped for higher education, thus accentuate the present strain on the capacity of our nation's colleges.

Some persons have said the experience of never making a mistake in school could mean psychological disaster once a student made a mistake outside of school. (11). Fortunately such views are more alarming than accurate. If programmed instruction is applied with discretion, it can be the course of major benefits for the students. Imagination and ability to deal with society can be enhanced rather than reduced. Experiments conducted so far indicate that use of programmed instruction allows the student to absorb material more thoroughly and more rapidly than possible with conventional methods. More class time can be made available for more creative work. (11).

A disadvantage of available programmed material is that programs now emerging from various laboratories are simply a rehash of existing textbooks. This is a serious failing of programmed learning today, a failing despite the assurance of Harvard's Dean Keppel: "Our concern is that high quality be at the core of the teaching machine curriculum rather than any effort to show that we can save time." (9).

Another problem is the incompetency of programmers now at work around the country. Some are unqualified or insufficiently trained.

One public official responsible for educational policies voiced the fear that programming devices "threaten to destroy diversity and place pupils in molds." However, the present educational system is marked by conformity and regimentation. Programmed instruction should have the opposite effect to that of placing students in identical molds. The only equalizing effect that programmed instruction presumably will have is the education of everyone to a basic minimal level. (10).

Some teachers are concerned over the possibility of students cheating when using programmed material, by looking ahead at the answers. Green (10) believes that a student who knows that cheating defeats the entire purpose of programmed instruction will be less likely to cheat. After all, the only person cheated is the student. A student will become fatigued after working for a long time in such a textbook. The temptation to cut a corner does exist. Moreover, as the student idly scans a page of frames in a programmed textbook, the student often spots an item ahead that can be answered. The tendency to answer the question is great. The feeling of getting ahead provides reinforcement.

The teaching machine potentially gives more adequate control over the sequence of the learning process than does the programmed textbook. The additional control may not be particularly important, but until more evidence is available, the assumption that control is unimportant should not be made.

Criticisms have been made of machines. Existing machines sometimes break down. The teaching machines are not standardized. A program that fits one machine does not fit another. (10).

Some mislead persons call programming an audio-visual aid and some persons call programmed learning a test. Programmed learning is <u>not</u> an audio-visual aid. Most audio-visual aids are either response or stimulus devices, whereas programmed learning is an effort to complete the total educational model: Stimulus, response, and reinforcement. Programmed learning is not a test. Programmed learning is a teaching method, not a testing method. Programmed material seeks to supply understanding; testing, on the other hand, measures that understanding. The simple developing of items, as in a test does not provide the organized, orderly sequence for self-instruction that is a primary principle of the programming approach. To construct a test and call the test a program places all the burden for learning on the student, whereas an effective program assumes the major portion of that responsibility, enabling any normal student to master the content. (4).

A problem raised by the students was that the machine did not allow for review of the work. The problem is gradually being resolved. The Min-Max II, for example, makes provision for the student to take out frames that have been used if the student wants to review some of the questions or subject matter that have already gone before. The problem does not exist in most of the non-machine programmed instruction materials now being used, points out Dr. Maurice Mitchell. Children can go forward or backward at their own pace and without feeling guilty. It really does not matter since students are not graded on day-to-day work. Students are graded at the end of each week or semester, or by some other arrangement made with the teacher. (9).

Sometimes boredom seems to increase as the student works through a program, however, there is not evidence that the loss of fascination does away with the effectiveness of the teaching device.

One problem will be an exaggeration of the problem of age grouping versus ability grouping. The bright student is now faced with the prospects of staying with a group that is chronologically of the same generation or of moving into an older age group whose abilities, knowledge, and sophistication are commensurate with his own. On the positive side, the self-pacing feature of the technique enables a student to make up missed materials efficiently and with little expenditure of time. (10).

Dr. Skinner comments:

> The necessary techniques for a renaissance in education are now. The necessary equipment can be produced. We have the skills, the brains, and the know-how to meet the challenge. Nothing stands in the way, but cultural inertia. (9).

Without a doubt, the biggest challenge to the acceptance of programmed instruction will be to enlist the cooperation of the majority of the teachers. In Fine's (9) conversation with teachers many were hostile to programmed learning. The simplest expression of the hostility was an unwillingness to change career-long methods of teaching. Like everybody else, teachers are creatures of habit.

The teacher cannot move forward unless backed by the administrator. Administrators and educational groups that represent the teaching progression have shown an amazing desire to take part in the movement: amazing, because as a rule these authorities are the last to accept technological advances; amazing also because several problems and dilemmas have now emerged at the administrative level of programmed learning. (9).

However, some school administrators express reservations, as does Dr. George N. Wells, school superintendent in Bloomington, Illinois. "We are not as enthusiastic about teaching machines, as some people seem to be. We expect to use this new device as an aid and nothing more." (9).

An important pitfall arises with present practices used in the adoption of programs. A prevalent practice is to consider the use of a program only to do an undesired job. Programs are admirably suited to such a type of application, but the problem is in the image that the practice produces. It would be unfortunate if the limited amount of available program-preparation talent were to go into remedial and rote instruction. Programming can be effective when applied to conceptual materials and used to promote cognitive development. Programmed instruction should not be given mere back-door acceptance in the schools. The practice is self-defeating and likely to stifle a struggling infant technology that should be given acceptance and encouragement. (16).

Many criticisms of teaching machines are based on insufficient information, which is based in turn on a lack of adequate research. But if most examples of resistance to the new technique can be traced to inconclusive research, so can many instances of undue optimism.

A threat to programmed instruction is that the technique will be over-sold. Perhaps programming cannot meet all claims that are made. Persons who expect too much are bound for disappointment. The disappointment might become a reaction against programming that could cause total rejection in the long run. (10). Improved research and availability of results would help diminish such a problem. A few of the methodological errors that plague educational research are: the small sample, failure to use random assignments, exposure too brief to produce a change, and use of unreliable criterion measures of questionable validity. (18).

Advantages

Many educators believe that the advantages outweigh the disadvantages.

Professors John Blyth and John Jacobson programmed a freshman course in logic which was tested at Hamilton College. Blyth and Jacobson prepared a report in which they discussed and summed up the use of programmed instruction in the classroom. "We found many advantages and no disadvantages." (5).

1) There was no wasted class time on routine checking or drill.
2) There was no wasted class time on unprepared students. We knew in advance exactly who had done the work on the programs and who had not. We believe that evidence of work on programmed material should become a ticket of admission to class.
3) Examinations of student work on the program enabled us to prepare for a class period with prior knowledge of the points that needed further clarification.
4) In the classroom work we could presuppose a common background or experience with a large number of relevant examples encountered in the program.
5) We wasted no time trying to locate and correct misconceptions students had mastered through unchecked practice.
6) We could usually count on a working command of basic concepts and principles. Class time could therefore be devoted to further development of the concept and their applications to new areas.
7) Classroom efficiency was increased by at least a third. Instead of a standard three hours a week we met two hours a week, yet we were able to cover more material more thoroughly than ever before.
8) Individual differences were not entirely removed. But the range was greatly reduced with every student moving closer to mastery. I had at least three students in a section of twenty who, in my judgment, would have failed the course in the preceding year. They passed with a very safe margin.
9). Many fewer private conferences with individual students were needed. In the conferences that were needed it was possible to diagnose the difficulty very quickly by analyzing the student's answers to the programmed materials. More often than not such conferences led to revisions in the program in the hope of avoiding such troubles for other students.

One of the greatest and most sustained economies may lie in the amount of time it takes to educate any one student. National education now costs $20 billion a year $500 a year for each child and

12 years per child. If a child could go through school in 9, 10, 11 years, millions of dollars could be saved. (9).

Fine (9) listed these contributions of programmed instruction:

1) Responsiveness to individual differences. Machines will enable almost all students to learn at a rate commensurate with their intelligence.
2) A feed-back system of reinforcements and rewards which encourages almost all students to do their best.
3) An antidote to the aversive psychology of most present day classrooms. Programmed learning is enjoyable.
4) Special values in machines for gifted students and remedial instruction, as well as for those who are physically or mentally retarded or emotionally disturbed.
5) A vast improvement in the teaching of tool subjects like science, mathematics and language, and a significant if lesser, improvement in subjects like history and literature.
6) A reduction in the amount of routine teaching drudgery, drill and paper work that now takes up so much of a teacher's time, and a consequent release of time for individual problems, groups discussions, conferences, and curriculum development, thus enhancing the teacher's prestige.
7) A tremendous boost to education outside of the classroom: in underdeveloped countries, rural areas, industry, the armed forces, and home study courses.
8) Teaching techniques will improve, since the teachers will get the scientific and educational approach to learning.
9) The rate of learning will be increased. Surveys and experiments in the field so far indicate that students bright, average, or dull, learn faster on a teaching machine than in the conventional classroom.

Foltz (5) mentioned the ensuing advantages:

1) In certain situations human instructors are not available. Small, isolated school districts without the funds or personnel to offer courses in certain subjects would be able to offer the courses in programmed form.
2) Many teaching devices are virtually cheat-proof. Scoring is done item by item, diagnostically, thus reducing the necessity of testing and allowing a teacher to determine the exact problems of each student. Knowing the trouble spots, the teacher may correct them by a modification of the program.
3) The tutorial patience of the self-instructional device is very useful in a number of fields, including the instruction of handicapped and emotionally disturbed children.
4) There are times when the course material is so complex that teachers do not have the time or methods to teach it effectively. The self-instructional device presents a program in which the complexity of the material has been simplified through the introduction of small, more easily assimilated bits of information.

5) A good programmed text can give feedback much more simply but just as effectively as a machine. Moreover, with a text a student can work anywhere, anytime, without waiting for a machine to become available.

Thus, programmed instruction has a clearly delineated place in education. Programmed instruction is a practical method of individual instruction. There are many who, with some reason, fear the introduction of any type of automated teaching of individual thought. Programmed instruction is not a means of further removing education from intelligent human control, but rather the use of scientific analysis to bring education under intelligent human control.

Porter (3) emphasized an advantage of programmed materials over the conventional textbook. The teaching machine programmer, can discover good and poor portions of the test by examining student responses to particular items, and can rewrite the items on the basis of such information. The programmer is forced to think in terms of the responses students will make to specific items and analyze carefully the exact behavior trying to be taught and how such a behavior relates to previous learning history of the student and the aid in future performance. If certain facts or relationships are to be taught, then the programmer must provide the student with items designed to elicit responses appropriate to these learnings.

Lysaught (4) added to the list of advantages. A program could be used as part of the learner's homework, both to review the work previously covered by traditional instruction and to prepare for the next lessons. Short unit programs on basic clothing construction is a possibility for use in this manner.

A significant benefit of the programmed learning is the demands of a selection of concrete goals before the construction of a program is undertaken. If the generalizations about programmed learning are at all valid, corroborating evidence ought to emerge from research into classroom use of programmed material.

All of the advantages are not evident in all situations. Each program should be critically evaluated in relation to the situation in which the program is to be used. Only after the advantages have been weighed against the disadvantages can a wise decision governing the use of programmed material be made. (4).

The Application of Programmed Instruction

Teaching Devices

Successful transfer of training from the teaching device to the "real" problems is the ultimate criterion of the effectiveness of a teaching device. So far the greatest value of teaching machines appears to lie in "tool" subjects.

Machines can grapple with facts, but are limited in teaching imagination, emotional or artistic sensitivity, or the intellectual insight which relates widely different ideas. Perhaps history, philosophy, and other non-tool subjects could be taught by separating the functions of human and mechanical teachers. Machines would handle the simpler ideas and basic facts, such as dates, events, and rules; the human teacher would relate the facts and give the facts meaning. Until this is done, however, teaching machines will have greatest influence on the more factual subjects. (9).

One disadvantage of the machine as a teaching device is the higher cost than of a programmed text or book. Unlike the textbook, however, a machine can be used over and over with only minor wear. Programmed text must be replaced as the books wear out or sooner if the answers are written into the text.

The programmed text has merits in that the text is less awkward than a machine and takes up less room on a student's desk. Moreover, a programmed book can be taken home. An advantage most machines have over programmed texts is a built-in grading device. Machines keep a record of a student's right and wrong answers, and the record is available to the teacher as soon as the course is finished. Another possible disadvantage of programmed books is that students occasionally take shortcuts and peek at answers. While books have not yet been made cheat-proof, machines prevent the student from looking ahead before writing the answer, and the answer, once written, cannot be erased or changed. Dr. Homme believes cheating will not be a problem. If a student is graded on the basis of a weekly, monthly or semester test, the student will gain nothing by cutting corners during periods of study. (9).

There is no absolute answer on the choice of teaching machines or programmed text. But even the most heated opponent of devices will admit that certain situations demand the use of teaching machines. (5).

There is the matter of attitude toward the use of a teaching machine on the part of both the instructor and the learner. Some reactions are positive: reports favor programmed materials presented by machine as "more absorbing" and "more demanding." Other reactions are negative to the machine while favorable to the program content. To some extent, the latter attitude may be attributed to mechanical and design deficiencies in early machine models. (4).

The educational objective, the subject matter, and the level of the student should determine the type of program employed, which in turn should determine the type of device. (5).

To some persons teaching machines seem to be nothing more than testing devices. Although teaching machines could be used for testing purposes, both the machines and the associated educational content are designed especially for teaching. While a teaching machine program contains a carefully arranged series of problems with prompts designed to lead a student gradually to a perfect performance, a test provides only minimal prompts in the questions asked. The purpose of a test is to evaluate, not teach. (3).

If the program is to be used in conjunction with a specific machine, there are two main points to be considered: the machine's theoretical effectiveness as an instructor and the machine's practical use, particularly in classroom situations. If the programmed materials are in programmed text format the design should facilitate use of the information for reference purposes. The programmed text should contain a detailed table of contents and an index.

Use of Programming in Varied Areas

By answering current American school educational needs in many respects, programmed instruction has received wide acclaim. Programmed instruction gains added stature by a promise of helping to solve other problems perhaps less monumental, but undeniably important. Adult education, training in the military, training in industry and education, and training in developing countries should also be considered. For Americans who have completed formal schooling and want to continue their education, programmed instruction can be a great help. (11).

Deficiencies in preparation could be more easily remedied by programmed instruction. The child who missed fractions because of the measles need no longer lack "aptitude for mathematics." The graduate student who lacks certain needed subjects need not defer graduate career while taking time off to make up needed subjects. Such supplementary education could be undertaken concurrently with the formal courses of study. More time might be released for the pursuit of independent research at all levels. An important advantage lies in the therapeutic effect on education resulting from such a change in technique. Many learning difficulties are emotional rather than intellectual. Reducing the incidence of these could have incalculable advantages. (5).

Schools are often short of teachers, guidance counselors, and supervisors to handle the heavy influx of after-hours adult classes. Teaching machines could take up the slack. Ten million American adults who cannot read or write beyond the fourth-grade level never go to after-hours school. Some are illiterate, unable to write their names or make sense of the daily newspaper. These people do not lack intelligence nearly so much as they lack an opportunity to learn. Teaching machines may be the answer to education for the illiterate adults. (9). Another 67 million adult Americans did not finish high school. Of these, 44 million failed to reach the ninth grade. The number of drop-outs grows higher every year. Fine (9) states that the United States is obligated to provide every citizen at least a high school education.

Adults out of school often lack the proper motivation to learn. Teaching machines have a freshness and an unorthodox manner that create enthusiasm. Moreover, programmed learning makes use of the natural human desire for rewards, creates motivation, makes learning easy, and cuts study time. Each of these qualities is tailored for the education of adults. There are a number of ways that teaching machines can be introduced into adult education: through direct company-to-home sales of programmed books and machines; through programmed correspondence courses; through programmed study at home and through library sources. (9).

Moving away from education in the formal aspects, home-oriented activities such as gardening, chess, and contract bridge are ideal for programming. Programmed learning has a future outside as well as inside the basic school system. (9). One of the biggest beneficiaries of programmed learning may well be the immense and varied group of people who study part-time. Approximately ten million American adults are taking extension courses of some form. (9).

There are more people in the world than ever before, and a far greater number of the people want an education. The demand cannot be met simply by building more schools and training more teachers. Education must become more efficient. Curricula should be revised and simplified, and textbooks and classrooms techniques improved. (7).

Use of Programming in Business and Industry

Although research in the field of programmed instruction is incomplete and many vital questions are still unanswered, quite a few commercial firms have seized upon the new medium. Companies are faced with maintaining permanent staffs of highly specialized instructors to train new employees and old employees moving on to new jobs. Programmed instruction may offer a simpler, cheaper, and more effective solution of training personnel. (11).

The increased demand for training, improved skills, and better education in industry has stimulated some business organizations to explore the possibilities of programmed learning with the aid of devices which include automated teaching machines. (17). Domestic education can profit by research findings of business, with special attention focused upon the basic principles of programming.

Professor Harold S. Clark of Teachers College at Columbia University estimates that industrial training accounts for two-thirds of the money spent on the entire educational system in the United States every year. Industry has found that basic job skills such as manipulation of tools, blueprint reading, names of parts, shop mathematics, radio code instruction, shorthand, and typing can be programmed. Programmed learning is especially useful for industries which have a rapid technological change. (9).

David J. Padwa, president of Basic Systems, Inc., a leading company in the field of programming, states how different industries have put programmed instruction to work, noting that programming can do a job not only in manual skills for industry, but in service skills for workers, whose tasks may bring the workers into daily contact with the public. (19).

Dow Chemical has worked with Basic Systems, Inc., to set up a course to teach the salesmen how to improve listening ability. Now, courses for listening are offered for workers in drug, automotive, insurance, and utility industries.

American Telephone and Telegraph put a programmed listening course into effect to help workers learn to analyze complaints on telephone service, called in by customers. The course improved customer relation and helped save the company money by cutting down the number of repair calls to one visit. (19).

DuPont estimated that programmed teaching increased the amount the trainees learned by about 25 per cent and reduced class time by about the same percentage. International Business Machines used programmed instruction in a data processing course and found that the trainees had a mean score of 95.1 on the final test and took only 11 hours to complete the course. Trainees taught by the lecture-discussion method took 15 hours to complete the course and had a mean score of 86.2 on the final test. (20).

The January 25, 1963, issue of Printer's Ink entered into the discussion on programmed instruction with a rather lengthy article on the "new business tool." Seldom has any new "tool" caught the preference of business as quickly as has programmed instruction. More than 200 firms have had programs custom-tailored on business skills.

Harold L. Moon, unit manager of programmed instruction, training materials and information services, McGraw Book Company, says he considers use of the programming technique in 75 per cent of their training problems and recommends programming about 50 per cent of the time. This decision depends upon many factors: the kind and number of people to be trained, what the trainees will do, where the training is to take place, the availability of instructors, the availability of space, and the budget. (21). Programmed instruction is enjoying rapid growth in business applications. Moon estimates 20 per cent of major American corporations are experimenting or using programming in training programs. (21).

The March, 1963, issue of Stores relates a conclusion formed at a personnel group convention on the subject of programmed instruction. A general appraisal was given by James White, training director of

Jordan Marsh. Perhaps the most suitable subject for programmed learning lends itself to clear definitions and measurements, a subject in which there is easy transition from programmed situation to actual performance. Barbara Rimbach, training director of the Gilchrist Company, Boston, finds that programmed learning is an asset to stores with several branches by getting merchandising information to the branches quickly and easily. (22).

The cost factor was a main topic in the discussion at the personnel group convention. A suggestion was made concerning the possibility of starting an industry-wide programming plan. The same procedure is possible in the school systems. Another possibility would be to have suppliers program retail training material on their own products. (22). If such an idea is carried through, clothing classes would benefit from textiles companies, pattern companies, and even sewing machine companies supplying schools with programs on directions and suggestions concerning the company's product.

Marketing Management Inc., a Chicago sales training-programming firm, has programmed for such leading companies as: Quaker Oats, Abbott Laboratories, Lever Brothers, Zenith Radio, Shell Oil, General Tire and Rubber, and Bell and Howell. There is little doubt that the use of programmed instruction techniques, in business in general and sales training in particular, will grow. The growth, however, will be shaped by practical considerations and experience. (21).

Most retailers commenting upon programming stated this fact: Programmed instruction should be placed alongside all other training techniques and should be used when it will do the job better than any other technique available. (21).

Textbook publishing houses have not ignored the possibility of the contribution to programmed instruction. McGraw-Hill, giant of the publishing industry, has moved aggressively into programmed instruction. Currently, the most active division of McGraw-Hill is the textbook division which already has the credit of the publication of the most extensively tested and used program now in existence, the Holland-Skinner Psychology course. McGraw-Hill has hired as consulting editors, Professor James Holland of Harvard and Dr. Stuart Marguilies of the Center for Programed Instruction, Inc., to insure that programs published will be of high quality. Other negotiations have been transacted with Eastman Kodak concerning the publication of McGraw-Hill programs on microfilm and the publication in text format of employee training programs developed by Eastman Kodak. (11).

The greatest drawback to programmed learning in industry has been the scarcity of programs. More experiments are being conducted with teaching machines in the armed forces than in any other area, not excluding industry and formal education. Almost two decades before the present interest in programmed learning, the services recognized and exploited the benefits of allowing students to learn at different speeds. Because the military services are able to spend hugh sums of money, most of the large-scale testing of machines has taken place among military personnel. One thing is certain; the armed forces are already giving the teaching-machine movement the biggest financial boost. (9).

Programming in General

The technique of programming is developing rapidly. New approaches are continually being devised. Researchers have just begun to explore the possibilities of programming techniques. Certain problems can be anticipated. The problems may be categorized as problems of programming, problems of production and the economics associated with problems of school administration, problems of effectiveness, and problems created for the student. (10).

Insofar as problems of school administration are concerned, the most immediate effect of widespread adoption of programming techniques will be in the area of curriculum planning. Moore has demonstrated that three-year-old children can be taught to read and write using specially constructed typewriters. Komoski and Eigen have demonstrated that children in the primary grades can successfully be taught logic. The greatest problem is not the challenge but the tremendous amount of work that will necessarily be involved in reconstructing the educational system. Not only the practical structure, but also the basic concepts of the educational system will be revised by such events. (10).

A conservative, balanced and entirely reasonable summary was given by Dr. Thomas C. Pullen Jr., superintendent of Maryland's department of education:

> The chief value that comes from movements of this kind is that they stimulate thinking and re-evaluation. Of course, in some cases these things merely confirm us in our reactionary positions, but so long as there is stimulation there is hope. The great danger of all these movements is that they give lay people the idea that there is the one and true way to learning. We must bear in mind the truth of what Aristotle told Alexander, 'There is not a royal road to learning.' There are as many roads to learning as there are individuals, and the job of the teacher is to discover the way that is best and most effective for each student. (9).

Dr. Edward Teller stressed the point of the need to teach the young people more knowledge in less time as a major national objective. In this regard the American system may fail as contrasted with the Soviet system. The Soviet system makes clear the importance of a higher stage of learning. The individual's entire pattern of existence depends upon the degree to which the person makes use of the opportunities for education. (10). The United States should keep up with Russian educational standards and the standards of other nations as well, for the sake of American preservation, strength, and character. (11).

If programmed learning accomplished nothing more than putting the spotlight on the behaviors of teaching and learning, the efforts of the individual teacher or training specialist in developing programmed materials would be amply repaid. (4).

Procedures in Preparation, Administration, and Evaluation of a Program

The educational program of the school is concerned with the changes which occur in the individual. The school should provide experiences which meet the needs of youth and the demands of society. The Oklahoma Secondary School Curriculum Improvement Commission describes the school's position in bringing about changes in individual behavior in relation to teaching methods:

> Any change occurring in a boy or girl after hereditary factors are fixed and their limitations imposed results from the environment. Environment may greatly affect hereditary characteristics, distorting and limiting them or providing for the fullest development within fixed limitations. Classroom methods, subject matter content, and teaching materials are merely means for accomplishing the end for which the schools exist. From all the subject matter, textbooks, and courses of study, the school (the teacher in particular) must shift and select learning experiences which will best meet youth and societal needs. (1).

Thus, the school has a real responsibility for helping to bring about behavior changes in the individuals whom the school serves. (1). An educational method capable of handling some of the responsibility is programmed instruction.

Many persons concerned with the lack of progress that is currently being exhibited in the field of education in programmed instruction are pointing to the classroom teacher as controlling the fate of programmed instruction. The school teacher is viewed as having a number of skills which can be utilized in the preparation of programmed materials for the classroom. The teacher is experienced in the art of explaining; knows the language level at which students operate; is a subject-matter specialist in at least one field; and through training and experience, has developed an understanding of the functioning of the learning process. (24).

For educators who plan to work with programs it is essential to know how to put programs together. This is equally true whether a teacher intends to write programs, to select programs that are available in commercial markets, to use programmed materials as part of a course, or to obtain a broader progressional understanding of the learning processes. Programming experience contributes to a teacher's professional growth. (4).

Lack of a body of communicable principles from which to guide the program writer is at present one of the most serious draw-backs to the production of programs. However, persons working in the field of programming are beginning to formulate principles and procedures which are proving to be consistent. Additional help in the form of printed programs on the techniques of programming are available at modest cost. An example is a publication entitled, A Programed Primar on Programing, which is available from the Center for Programed Instruction at a cost of one dollar. (39). Possibly the most complete set of instructions for programming available today is a six page article prepared by Ernest Z. Rothkopf. (23). The article,"A Do-It-Yourself Kit for Programmed Instruction," was especially designed with the classroom teacher in mind.

The preliminary organization of a program involves three requirements: the making of assumptions about the learners, the declaration of objectives or goals, and the selection of a program paradigm. The programmer organizes the subject matter, constructs the steplike programmed sequences, checks the efficiency of trying out the frames on learners, and revises each step on the basis of the findings. Finally, there comes the post-programming phase and further testing. Criteria are analyzed, student achievement is evaluated and revisions are made as necessitated. (4).

Lysaught (4) innumerates the steps in programming:

1) Selection
2) Definitions and assumptions
3) Objectives
4) Paradigm or model
5) Ordering
6) Construction of items
7) Initial testing
8) Evaluation
9) Revision
10) Selection

The essential point is that after a unit has been chosen and assumptions have been made about the students to whom the program will apply, the programmer must then develop in a rather formal manner the goals to be achieved by the program. Two kinds of objectives concern the programmer, immediate objectives and long-range objectives. Immediate objectives usually are stated as something concrete to be learned, while the long-range objectives are the development of the learner and the systematic use of the subject matter as in transfer ability. (4).

In preparing teaching materials for current research at Harvard several programming techniques are being utilized: The content to be taught is broken down into a large number of small steps, successive steps in the lesson are "prompted" by preceding items or by hints provided explicitly for the purpose, and prompts and hints are gradually removed. (7).

The programmer should submit the programmed sequence to a few of the learners who conform to the assumptions as soon as a few items are completed. The resulting data will assist the programmer to discover items that are confusing, too advanced, repetitious, or in contrast. This pilot testing may reveal portions of the program which move too rapidly, erroneous assumptions about student's backgrounds and gaps in the program. A clustering of incorrect responses indicates that an item may be constructed at too high a level of difficulty for the student to master. Another cause for student error is lack of clarity in the item. Question the item to establish if there are too many responses called for in an item, so many blanks that the item loses understandability and logical development, confusion as to what response the student is expected to make, logic of item, and relevance of the required response. Incorrect responses at the early stage of a program sequence may be indicative of a lack of cueing and prompting to focus student attention effectively on the important parts of the subject matter. (4). The frames may have to be re-written many times before the frames constitute an acceptable program. A danger to be avoided in reviewing and rewriting frames is to reduce errors simply by inserting more cues into the items. This will mean fewer errors. However, the post-test might show that unfortunately no learning took place because no learning procedure had been developed. An ideal frame consists of three components:

1) A response which was selected beforehand.
2) A context, or new setting in which the response will occur.
3) Sufficient cues to produce the desired response.

A frame may include enrichment material for motivation or to increase interest. (25).

Two factors of editorial significance are accuracy and relevance of the material, and the style and vocabulary of the unit and interest of the content. (4). The person who writes a good program must know the subject matter, and discuss it imaginatively. The good programmer is interested in the subject matter and finds the subject personally stimulating and rewarding. Such a programmer is close enough to the student to be able to see the student learn and is not so bound by traditional concepts of human behavior that learning cannot take place by observation of how conditioning or learning really occurs. The programmer should also learn what reinforcement looks like in actual practice. (10).

Programming takes time. The rigorous analysis of subject matter and teaching method is not a swift, broad activity. Lysaught (4) lists six criteria predominate in programming: 1) programmer's field of study, 2) the ease of treatment, 3) length, 4) depressed level of learning, 5) logical order of material, and 6) the exclusiveness of special student needs.

Some of the literature suggests that programs should be used basically as substitutes for the conventional method of teaching. Yet there are difficulties to be considered. In the early stages of testing, administrators might be wise in gradually introducing the use of programmed materials for specific purposes, short of entirely superseding current instruction. A teacher would do well to program short units to complement, enrich, remedy, and review other instruction. Most experimental use in programmed learning has occurred in the classroom during the regular period of instruction for the particular subject matter. An advantage is the availability of the teacher for individual assistance should the learner run into difficulty or have a question about an extension of the programmed material. (4).

Most devices are not maintenance-free and schools should be careful in being committed to a high initial investment in devices until the devices have proven of definite value. Since at present not even the device manufacturers have been able to prove that using a device is appreciably more effective than using a programmed textbook, it might be well to begin with textbooks for the initial experiment. Once the method of instruction has been proven in the school, administrators should begin considering the long range economic and theoretical advantages of devices. (5).

A school board can economize when ordering machines. Since machines can be used at different times of the day by different students; machines for which there is the greatest variety of programs should be purchased. (9).

When field testing a program students should be given instructions for working with the program. Instructions may be given orally, but it is preferable to commit instructions to writing so that other teachers in using the program may be able to pass all the necessary information to the learners. In completing the customary response sheets, students should be encouraged to write comments or questions after each response as to whether the items were confusing, difficult, repetitious, or particularly helpful. Also, students should be questioned immediately about their reactions and the subject matter in order to obtain a general approximation of the program's effectiveness. (4).

The problem of evaluating the results follows the trial-test. Suggested criteria are the same as used for any other type of instruction. That is the amount of information the students learned, amount of retention, transfer ability, the time required to work on the material, and professional supervision that was required.

In evaluating a program the programmer must be sure to separate the content, the technique of programming, and the philosophy of approach. Content must be examined to see if the material is worthwhile. The technique must be examined to determine if the content is being well taught. Lewis Eigen cautions that sometimes both content and technique will be satisfactory, but the philosophy of approach will be "rote" philosophy, instead of leading the students to the discovery of relationships. A good program should stimulate the student to creative thinking and judgment. If the student does not learn well from a program there is something wrong with the program. (5).

There were two main criteria for judging a program, established at the Collegiate School Conference on Programed Instruction in New York, September, 1960. "First the program ought to reflect an adequate and current understanding of the subject matter and, second, the program ought to use the techniques of programming to best advantage." (4).

The program and the person who devises the program bear the major responsibility for the student's success. Lysaught (4) listed a number of common characteristics a successful program should embody:

1. Assumptions stated clearly in writing.

2. Explicitly stated objectives.
3. Logical sequences of small steps.
4. Active responding.
5. Immediate feedback of information.
6. Individual rate.
7. Constant evaluation.

Results to be sought from use of the programs are accomplishment of the writer's objectives, growth in the student's ability to discuss and apply concepts, transfer learnings and apply them to situations not covered by a program, and increase in the positive feeling or attitude of the student toward the subject matter based on the effects of reinforcement and success of learning. (4)

In summary, program evaluation has two main objectives. One is to determine whether the program teaches. The other objective is to determine how well the program does the job. The evaluation of the program with individual students during the construction is the method of choice for attaining the first objective. The field test may also attain the first objective and may be useful in casting the program in the final form. The field test is inevitably involved in attaining the second objective. (10).

Programming in Home Economics

Leading authorities in home economics education agree with the concept of Williamson and Lyle: (26) "To be successful, homemaking education must adapt to the particular group it is to serve." Such a point of view requires that activities of the homemaking curriculum be planned to meet the needs of each individual in the best possible manner. Constant and deliberate research on teaching procedures in home economics is a valuable phase of homemaking education.

Analysis of publications containing descriptions of programs now available through commercial firms revealed a wide array of programs which ranged in difficulty, subject, length, and price. There are practically no programs available at this time in the area of home economics. Twelve of the leading companies that publish programs were contacted and seven letters were received, each confirming this statement. (Appendix A). In fact, the profession has indicated little interest through home economists' publications on the field of programmed instruction. A professional publication in home economics carried a three page article dealing with very general aspects of factors involved in programmed learning. (27) There are few fields in which programmed instruction might not be profitably applied. Home economics and its many subject areas could successfully approach the utilization of programmed learning in improving the quality of instruction. Lack of information would certainly indicate a lag of acceptance, interest, and research in incorporating the programmed technique into the home economics field. There appears little to lose in investigating the possibilities and, at least, attempting to apply programmed instruction to certain areas of home economics.

Technological and social changes of the past decade have brought an influx of new textiles, new processes for caring for garments, and new developments in techniques for constructing garments. In the high school and college clothing classes, this "necessitates emphasis being placed upon all three: basic clothing construction, textiles, and clothing selection and care." (28) With an increasing amount of information necessary to the clothing student, educators in the field should be concerned with methods which offer the quickest and easiest means of teaching and getting information to students in a meaningful way.

One attempt in preparing programmed material for use in the clothing construction laboratory has been undertaken by McCalls Pattern Company. A sixteen page list of educational material which McCalls Educational Department terms a 'programmed' course in sewing was presented in the February, 1963, edition of Forecast for Home Economists. The attempt produced a set of educational materials in leaflet form which will carry the clothing student in orderly fashion through the steps of: Selecting a Becoming Pattern Design; Selecting a Becoming Fabric; Planning for Wardrobe Needs; Choosing an Appropriate Project; Selecting the Correct Pattern Size; Understanding a Pattern; and Learning to Sew. None of the materials included in the 'program' required an immediate overt response from the student, although the student was instructed to 'study the illusions,' 'select the design that will be most becoming,' 'make it in a variety of fabrics,' and follow other related activities. McCalls suggested that the clothing instructor set up a resource center to facilitate programmed instruction in the clothing laboratory, by arranging one corner of the room so that texts, leaflets, and filmstrips can be used independently by students. (29).

In the Journal of Home Economics, December, 1961, Mrs. Ethelwyn Cornelius, director of homemaking in the Ithaca (New York) public schools and instructor in home economics education at the New York State College of Home Economics at Cornell University, reported on programming clothing construction techniques. Mrs. Cornelius described the experiment as follows:

> The material to be used was prepared in simple step-by-step

language and recorded on a tape. Step-by-step illustrative material, of actual fabric, was mounted on flip chart pages to coordinate with the machine's recording. Material prepared so far included stay-stitching, hem construction, neckline finishes, skirt waistbands, and sleeves with gussets. At the end of each recording, a brief written evaluation was asked of the pupils.

The recorder was used to supplement regular teaching. The teacher demonstrated and discussed hem construction with the class when the majority were ready and needed information. The recorder and flip chart were used for girls who were absent or not ready for the information or needed extra assistance, relieving the teacher of repetition and allowing the pupils to work according to individual ability. The pupil worked on her own garment, following the instructions and turning the machine off and on as needed.

Use of the machine for new learning also had some real advantages. The teacher pre-recorded a demonstration and used the machine for the talking while she demonstrated. The pupils then did the construction, leaving the teacher free to help and check on each pupil's accomplishment.

Further suggestions were given for future use. The tapes can be easily copied and a good system of filing worked out. The accompanying illustrative material could be in picture form or on slides. However, the use of the real garment or fabric seemed to develop more learning, especially for the slow pupil. The same idea can be used in other areas, especially in foods, home nursing, care of children, and housing. (30).

Mrs. Cornelius presently plans to continue experimentation in the clothing area and include other areas as soon as possible. The preparation of the material to be used in and with the machine is very time consuming but, once done, can be used often and by any teacher. (30).

For a teacher of homemaking to develop an effective program, it is necessary that the teacher have a functioning philosophy of education and be aware of the place of homemaking education in the total educational program. Whatever a teacher does to, with, and for the students grows out of what the teacher believes and does about her beliefs. The place of homemaking education in general education is to contribute to the solution of problems concerned primarily with the home. Homemaking education should be based upon democratic principles and provide opportunities for the use of democratic procedures within the daily activities of the students. (31).

Outlook for the Future

The tools available to the teaching profession are expanding rapidly. Programmed instruction is still in its infancy. The place of programming in the overall guidance of learning has not yet been determined empirically. However, it is assumed that a program is a teaching aid, constructed by teachers, tested by students, and that the early programs will be replaced by better programs, not merely new programs more effective and efficient programs. (32).

Educators and leaders in business and industry are looking to programmed instruction with great hope and anticipation that programming can fulfill the promise of a powerful tool in coping with some of the most perplexing problems of the times: school dropouts, chronically changing technology, displaced labor retraining, the desperate and increased shortage of excellent teachers, the shortage of skilled labor, and even the need to help underdeveloped countries build self-sustaining economies. If programmed instruction is to fulfill the promise, seemingly, educators who already are 'partially' trained in the procedures involved in learning and in many subject matter areas must rally in giving programmed instruction a fair portion of consideration, effort, and talent.

The number of schools that are field testing programs is increasing everyday. There seemed to be little question that the tutorial method of teaching is sound. The greatest problem right now is to get the necessary background of research to devise the best methods of utilization in programs and devices, to construct self-teaching programs and good machines to present the programs. (5).

Because programming technology is in such an early stage of development the present demand for good programs greatly exceeds the supply. Graduate students, teachers at all levels, and other persons are attending programming courses and workshops in increasing numbers. Many publishers and programming companies are training people in programming technique. Some industrial firms are doing likewise, in preparation for programming parts of their training courses. But not everyone can become a good programmer, and many will receive training much too brief to be of value. The supply of good programmers will probably not begin to match the demand during the next five years. (11).

Some publishers will find a ready market among adults for programs in topics of general interest (English, grammar, mathematics, vocabulary building, foreign languages, history) originally written for college, high school, or even junior high school students. Programs in other subjects will be written specifically for the adult market: gardening, bridge, auto repair, music appreciation, and recreational activities. Many of the programs will be directed to the mass market and produced as paperbacks. Other publishers will promote comprehensive home study programs for adults and school children alike, covering a broad range of academic subjects. The program will be sold by direct mail and door-to-door in the manner of the encyclopaedia companies. (11).

Dr. Lloyd Morrisett, executive assistant of the Carnegie Corporation, called teaching machines a natural for home study. Many adults may want to take machine correspondence courses, or refresher courses to keep up with new fields. Properly programmed teaching-machine courses are the best hope for extension of adult education. Of greatest interest to adults will be the time saved by the teaching machine which cuts the time to master a subject by 50 per cent, or, as in the case of medical technology, as much as 75 per cent. (9).

However, some educators are inclined to go along with Dean Keppel's point of view. "There are definite limitations to the number of courses that can be taught with teaching machines," he said. "They cannot teach those subjects that require interpretation and insight." (9).

Although programming is still in the stage of comprehensive development as a technique and as a method of instruction to be used with the learners in society, there may exist another area of programmer or publisher responsibility. Perhaps every program should be accompanied by a request, and facilities for answering, for information gained from the program by a consumer.

Evaluation is never an easy process to carry out. The important thing for most teachers, trainers, and professional programmers to remember is that evaluation should be a continuous process. When one concludes that there is nothing more to learn about certain processes in instruction and learning, advancement has ceased. (4).

An estimation of $25 million a year is spent on research in programmed learning. In 1957, eight known projects were underway; in 1959, sixty; in 1961 over 100; and in 1962, over 200. (9). The effects of this research will not be fully known for another five to ten years. In Fine's (9) observations of 100 finished experiments, however, he concluded: Everybody can learn with teaching machines, students of all ages, adults, factory workers, and military personnel.

Sooner or later the art of curriculum development will become better understood and will reach the formulation stage. A program will teach the material contained and no other. Then the adequacies and inadequacies of curricula goals will quickly become apparent, and there will be an attendant opportunity to mend the goals in the light of research findings. (5).

Eventually, as with all technological advances, a great number of new jobs will be called into existence by programmed instruction. Skilled programmers will be needed. Thousands of guidance counselors trained to deal with students who have taken programmed instruction will be a necessity. Guidance counselors will find it essential to recognize the importance of teaching machines, and convey such knowledge to parents and students alike. (9).

The school of the future, which may well be a grammar, junior, and senior high school all in one, will be concerned with one goal: The education of each student according to individual talents. Horizontal grade levels with students approximately the same age may disappear. The present grading system may cease to exist as differences in test scores become less noticeable than differences in the time needed to finish any given course. (9). No one can accurately predict what the school of 1975 will be like, what function the new classroom will serve, or what the teacher's role will be. All that can be said for certain is that teaching machines now confront educators with a vast challenge and immense possibilities of change. The next decade is going to be an interesting one for American education. (9).

In the far distant future a system may become a computer-centered reality. Systems Development Corporation believes that "teaching machines" can be effective but that the present machines are limited by a lack of ability to adapt to student needs. Systems Development are currently devising a system by which a limited number of computers in a large area could control all the programmed instruction in that area. This, however, is a development of the future and more must be learned about the operations of the human learning process before graduating to full automated systems. (5).

Many prolonged studies are going to be necessary to produce balanced conclusions about the final value of programmed instruction, although the evidence has been promising thus far. In the meantime, improved programming techniques are certain to appear, new uses for programming are bound to develop, and the programs of today are likely to be outmoded by the programs of tomorrow.

What is most needed now is for more teachers, more schools, and more learners to gain experience in the use of programmed materials, and to share the findings with others. Voluntary cooperation, extended field study, resistance to over-generalization, and the yearning to experiment are the avenues to progress. The future contains unanswered questions, but the performance of the present time shows that the capability for discovering the solutions is indeed at hand. (4).

There is not sufficient research available on the use of the teaching machines to make definite conclusive statements, but preliminary experiences indicate that the development of the principles for programmed instruction may well result in greater advances in the efficiency of learning than results from any other single development in the technology of teaching. (33).

CHAPTER III

DEVELOPMENT OF THE SAMPLE PROGRAM

A short, relatively independent, unit on construction of bound buttonholes (sometimes referred to as fabric bottonholes) was selected for presentation in a sample program. The sample program consisted of two parts and a total of 186 frames. Part I of the program explained the placement of buttonholes and Part II described the techniques of constructing bound bottonholes.

The first step in the development of the program was the selection of the following objectives for the student:

1) The student should be able to work independently and at an individual rate.
2) The student should acquire a limited understanding of programmed instruction.
3) The student should learn how and where to mark buttonhole placements.
4) The student should learn how to construct bound buttonholes.

In the exploratory attempt to develop a program the linear, or Skinnerian, form of programming was used. The linear program is composed of small steps leading logically through the subject matter from topic to topic. Each frame in this extrinsic method consists of one or two simple sentences which carry the exposition forward in small steps. The method of composing a frame with a modest amount of old information and a small amount of new material is used. As the student proceeds through the program the frames contain more information, thus advancing from the simple to the complex.

In the linear program it is important that the student make as few errors as possible. Continuous, active student response is required, providing explicit practice and testing of what is learned at each step. Through reinforcement, the probability of a correct response is increased. A basis is provided for informing the student, with minimal delay, whether each response is correct by providing the answer on the following page, as in Part I of the sample program, or by providing the answer below each frame as in Part II. The frames are written in such a way as to cue or prompt the responses by the student, followed by the so-called "fading" or "vanishing" of the cues in later items of the program so that the learner is gradually freed from dependence on the cues.

General Programed Teaching Corporation psychologists have evidence that use of a variety of frame styles helps to eliminate response sets and makes the program more interesting to the learners. Frame variety also permits a greater variety of lead-in techniques in the development of concepts, such as multiple-choice, true-false, constructed-response, and completion. This theory is followed in the sample program. (20).

The following resource books were used for the writing of the sample program:

> Better Homes and Gardens Sewing Book (33) and the Singer Dressmaking Course in Eight Easy Steps (34) were selected because of the extensive distribution and the general use and acceptance of the books by persons in the field of clothing.
>
> The Bishop Method of Construction was chosen by reason of the improved techniques described by Edna Bishop (35) and the Bishop Method is considered by many as an authoritative method.
>
> Clothing Construction and Wardrobe Planning by Lewis, Bowers, and Kettunen (35) was used since it was the textbook of the students in the pilot study.

The frames were submitted to a college home economics instructor who had done some work for a programming company. The frames were revised and submitted to two high school home economics teachers. The frames were again revised and submitted to thirty-seven students in two Clothing I classes, at Shawnee-Mission East High School in Shawnee-Mission, Kansas, and revised into the present form. The first revision was basically concerned with frames that were too long, need of more frames on a main idea, and careful development of the most important terms. The second revision covered some subject matter rearrangement. The third revision, after the students worked through the program, led to the clarification of a few frames in which the programmer assumed too much on the part of the student, and to the direction of the student's attention to the diagrams at the end of the frame. The students in the pilot study had completed one school year of clothing construction, and ranged in grade levels from sophomores to seniors and in intelligence from slightly below average to very high.

Written and oral instructions were given to the student prior to beginning the program. One class period was allowed for each part of the program. However, Part I was completed in 20 to 30 minutes. Upon completion of the program students were instructed to give the program and answer sheet to the teacher and proceed with assigned material in the text. When all students completed Part I, an oral discussion took place. The students were enthusiastic about the teaching technique of programmed learning. Several of the students thought the programming material was very easy and perhaps a bit foolish at first, but upon finishing the program strongly favored further instruction in such form. The students were asked to give written comments after finishing Part II of the program.

The students responded freely with suggestions on specific frames, the misunderstanding of certain words, the needed improvement of certain diagrams, and discussion on presentation of the program. Each suggestion was considered for the final revision of the program.

A survey was taken concerning the preference for the form of the program in Part I or the form used in Part II. Nineteen students favored the booklet form of Part I, generally stating that it was more interesting and not as tempting to look ahead when the page had to be turned to do so. Eighteen students voted for Part II with the overall comment of disliking to turn pages so often, thus distracting from the subject matter.

Part I of the sample program was presented in the form of a small mimeographed booklet. The students began on page one, responded, proceded to page two for the correct answer and frame two. When the last page was reached, students returned to page one for the next frame and the sequence was repeated. (Appendix B). Part II was presented in booklet form in the pilot testing, but the form could also be used in a simple teaching machine. In Part II page one was completed before going to page two. The correct answer was given below each frame as the student worked vertically down each page. The students used an answer sheet which also served as a cover sheet. The responses in both parts of the program were written on a separate sheet of paper, so that the program could be reused and the answer sheet served as a scoring record for each student.

After the final revision, the sample program was presented to clothing students at two high schools in the Greater Kansas City area. Each teacher recorded facts involved in the program testing.

Argentine High School in Kansas City, Kansas, was participant X.

At X school the students ranged in ages from fourteen to seventeen and were all in the second year of clothing. The intelligence level of the thirty-three girls ranged from somewhat above average to below average. The sewing ability of the students showed wide variation: four girls sewed very well, fifteen girls produced just average, and four girls did very poor work. The time required for Part I of the program was 20-35 minutes and for Part II it took 30-50 minutes. Five girls had to take the program home to complete it. The students preferred the form of Part I. Students at X school also displayed greater knowledge of the information in Part I as shown by their ability to determine the placement of bottonholes and make the required markings.

The teacher at X school thought the results of the practical test were disappointing in certain respects. Only one student could completely make a buttonhole with no assistance after completing the program. After the first attempt students were allowed to use the program as reference materials. However, the teacher found it necessary to give some oral directions and some personal assistance in certain cases. The following reasons were cited for the problems that arose:

1) The teacher felt the slow students could not make practical application of what was read.
2) There possibly could have been an improvement in the construction of the bottonholes, if the students could have made the bottonholes immediately after completing the program, rather than waiting until the next day.
3) The slow students had a difficult time understanding the diagrams. The teacher suggested that if individual samples of each step were given to each student this would have aided in the understanding of the programmed information.

4) The majority of the students had previously learned the two-strip method; therefore, the method given in the program was confusing in parts. When the students tried making a bound bottonhole without assistance, some students returned to the two-strip method rather than attempting to recall the instructions given in the program.

The students at X school felt they had learned from the program. Some of the slower students said the information was repeated too much, while the brighter students did not think there was too much repetition. The teacher preferred the programming technique for average to above average students. The teacher at X school emphasized the importance in the future of illustrative material accompanying the program.

Shawnee-Mission East High School, Johnson County, Kansas, was participant Y. At Y high school the students ranged in ages from fifteen to eighteen. There were seventy-five students in Clothing II and thirty-seven students in Clothing III that took part in the program testing. The intelligence level of the 112 girls ranged from a little below average to high. There were all levels of sewing ability evident at the Y school. The time required for the Clothing II students was 12-30 minutes for Part I and 24-70 minutes for Part II of the program. The time required for the Clothing III students was 10-22 minutes for Part I and 30-50 minutes for Part II.

The students at Y school preferred for form of Part II. However, the students agreed there was more temptation to look ahead in Part II, but the students felt Part I was too time consuming.

The teacher at Y school commented that the content of the program was very complete and the technique of teaching very good, with the addition of some visual aids. The Clothing II students did better on an objective test than on the practical test. The Clothing III students did better on the practical test and not as well on the objective test. The teacher believed this was due to the fact that the Clothing II girls read the program more carefully, thus retaining more basic information. The Clothing II students had more difficulty in making the bound bottonhole the first time, because the students could not visualize how every construction step should actually look without some sample of the construction procedure. Not any Clothing II student could make a bound buttonhole without errors on the first try. Some visual aids and oral instructions were needed for the successful construction of a bound buttonhole on the second attempt by most of the Clothing II students. The students with a higher intelligence level were able to more easily visualize the construction steps.

The Clothing III students did below average to only average work on the objective quiz. It is assumed the students felt more familiar with the subject and read the information too hurriedly. Since the third year students were more familiar with bound buttonholes, the steps were more easily visualized. The Clothing III students made bound buttonholes on the first attempt, with some imperfections. The results of the second try were good.

The researcher concluded that there should be visual aids in addition to the program. The suggestions are as follows:

1) An enlarged sample of each basic step in the construction of bound buttonholes should be tacked to a large poster or flannel board set up in the front of the classroom for students to observe as they go from step to step.

2) A resource center could be set up in a corner of the room with individual samples of the steps in making bound buttonholes for the students to use as a guide or reference.

3) A brief summary outline of the construction steps could be given as supplementary material.

Clothing construction is a course in which much basic information must be taught. Example of basic units in clothing construction being taught by programmed instruction are in the stage of investigation by Cornelius. (30).

Efficiency of learning clearly depends upon 1) the individual who does the learning, 2) the nature of the task to be learned, and 3) the conditions under which learning occurs. Motivation is an important component in attaining the desired consequence. Students in the pilot study were actively motivated. In addition, the students were continually reinforced throughout the program, thus, stimulated to reach the desired goals.

After having explored the contribution of programmed instruction as may be applied in the teaching of clothing construction in high school, evidence of the pilot study tended to indicate value in the utilization of the programming technique in clothing construction classes.

CHAPTER IV

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The problem in the study was the exploration of the possibilities of programmed instruction as may be applied to the teaching of clothing in home economics. Investigation of the relevant literature revealed the advantages and disadvantages of programmed instruction and served as an analysis of the technique of programming and the application of programmed learning. The development and administration of a sample program on the placement and construction of bound buttonholes is presented as a possibility of programming in clothing construction classes.

The writer assumed that:

1) Programmed learning is a method in education based upon the stimulus-response theory and the psychological principle of reinforced learning.

2) Each person is a separate entity with different hereditary and environmental backgrounds, and with different inborn abilities.

3) Homemaking education should be based upon democratic principles and provide equal opportunities for a person to develop to his optimum capacity at the rate best suited to that individual.

4) Students learn through actively participating in the learning situation.

5) American education exhibits urgent needs for continuous improvement.

6) To this date, programmed instruction in home economics is restricted by limited research in this field.

A review of literature included previous studies concerned with programming, the examination of surveys and tests made on programmed instruction, programs and steps of procedure, and the discussion of the advantages and disadvantages of programmed learning as a supplementary method in education.

A sample program on construction of bound buttonholes was prepared and then tested by: 1) a college home economics instructor and revised, 2) two high school home economics teachers and revised, and 3) presented as a pilot study to two Clothing I classes and revised into the present form.

This study attempted to cast some light upon the field of programmed learning. Machines and other self-instructional devices are currently being used experimentally at all grade levels and in many different subjects. Action during the next few years will determine the place of programmed instruction in education. If it is used carelessly without a proper understanding of its scope and purpose, its great potential may never be realized. The primary objective is to educate the individual, which should be done by any means that will achieve the goal. (5).

Research efforts made by the writer added varied contributions to the development and use of programs in general and specifically in the area of clothing construction. Studies and trial tests promote acceptance of programmed instruction as a teaching technique, and helps programmers to refine their materials and processes. More important, this study and other research turns up questions of great pertinence and significance for continued research.

Conclusions

The following conclusions were delineated from the data:

1) Programmed instruction can usefully serve the teacher as a

supplementary teaching method, both in saving of class time and improved learning on the part of the student.

2) Programmed instruction can be applied in the area of clothing construction, especially in the basic techniques of dressmaking.

3) More research studies are needed. Educators in all fields, specifically home economics, should investigate the possibilities of programmed instruction.

Teaching machines and programmed learning can have a major impact on education. The use of programming can effectively and dependably guide the student's learning-by-doing as the student proceeds, as rapidly as his abilities permit, through carefully pretested instructional programs. Not only do programmed materials have the potential for producing much more efficient learning than has before been generally possible, but wise use should make possible the much more constructive use of the teacher's talents.

Educators and students the world over will find that programmed instruction provides opportunities to solve the problems described in Chapter Two: the military, and the acute shortage of educational facilities in under-developed countries.

Automatic teaching devices can be built today which, in the writer's opinion, would function satisfactorily with minor supervision for many subjects ranging from kindergarten to college level. Although the effectiveness would be expected to increase as experience is gained, there are a few subjects especially dependent upon a personal exchange of ideas or skills in which the machines would be at a disadvantage.

Programmed learning, used only to supplement the present educational methods, could very well aid in the betterment of some of the deplorable conditions in the educational system. The creation of programs alone is a remarkably good teacher-training tool.

Program writers and research psychologists will continue to differ on methods and ways of presentation of the various disciplines of programmed instruction. The concept of a perfect or totally standardized mode of teaching is at present inconceivable. Research in the field will continue to be done by private individuals, institutions, industry, and the military service.

In the light of the findings thus far, several tentative statements may be made about programmed learning. First, programming can be effective and students have learned successfully from the method. Second, programmed learning can reduce student error; proper analysis followed by suitable revision of the material can decrease errors even further during the learning process. Third, a learning program tends to level the differences in learning capacities among students; while all students exposed to the program may demonstrate achievement, the gain seems to be more conspicuous among the lower portion of the class distribution. Fourth, individual learning time may vary widely since students work at individual speeds. Fifth, predictability of individual success may decrease because slow learners and others may perform better on programmed material than would have been indicated by previous behavior on other methods of learning. Sixth, motivation to learn indeed may increase because of student's immediate knowledge of success.

It is recognized that teaching machines and programs will not solve all of the educational problems. However, in view of the broad observations it would seem desirable for teachers, trainers, and administrators to become familiar with the principles of programmed learning. There can be a bright future for programmed instruction, but its progress will be measured by years rather than by days or weeks.

Recommendations

Programmed techniques might be advanced by:

1) Psychologists, educators, statesmen, technologists, and scientists working together on recent developments to evolve a sound educational program designed to improve present methods, thus helping to eliminate illiteracy.
2) Teachers and administrators striving to gain as much information as possible about programmed instruction by reading available sources of information, consulting with other educators and psychologists, attending workshops on the technique of programming and preparing and testing programs.
3) Educators evaluating programs on the basis of sound empirical evidence of the programs' effects on the achievement and attitudes of both students and teachers.
4) Studies being made to compare programmed instruction with conventional instruction through the use of control groups over an extended period of time.

The following are recommendations of programming techniques for effective teaching:

1) Utilize programming in underdeveloped countries to provide educational opportunities for a greater number of people.
2) Offer programmed enrichment units in addition to the regular curriculum.
3) Apply programmed sequence to the problem of students' review.
4) Introduce and utilize programmed material in the classroom in the form of remedial exercises.

The suggestions that follow represent the writer's attempt to show how programmed instruction may be used in clothing construction classes:

1) Teachers could develop programmed materials in small independent units which could be used interchangeably in all clothing courses. An example of this procedure would be in programs developed on such construction techniques as zipper insertion, hems, use of interfacing, facings, and application of waistbands. As students in any one class have need for a specific program, the program could be checked out, used, and returned for another student's use.

2) Aside from actual garment construction techniques, factual information which often consumes a great portion of the class time in clothing might be programmed. Examples of topics might be: 'Use of the Sewing Machine,' 'Interpretation of Pattern Symbols and Markings,' and 'Use of Small Sewing Equipment'. Class time could be devoted to more individual assistance given by the teacher and enable the teacher to work with a larger number of students.

3) With many of the facilities necessary for the production of a program already in the department, the logical media for the presentation of programmed instruction in the clothing laboratory seems to be the mimeographed textbooks which may be used in conjunction with slides, filmstrips, flip charts, and other visual aids.

4) Commercially prepared programs which are available in the fields of art and design could be used in clothing classes. These programs could be used in the study of line, design, and color as relates to the selection of clothing for the individual.

The writer hopes that the teacher contemplating the use of programmed instruction or the teacher who may only want to know more about the technique will gain from this study sufficient familiarity with the useful concepts and techniques to encourage such a teacher to apply the knowledge to classroom procedures. Looking at behavior from the point of view of the experimentalist, the teacher can have fresh insights that need not dehumanize the relationship with the students, but rather afford a more effective teacher-student relationship.

Historically, enterprises which have given man increased control over the environment have been benefited in the long run. The development of a science of behavior could give man increased control of the social environment, and there is little reason to assume that the development of such a science of behavior would necessarily have harmful effects.

If programmed learning accomplished nothing more than to put the spotlight on the behaviors of teaching and learning, the efforts of the individual teacher or training specialist in developing programmed materials would be amply repaid. The future belongs to those who are willing to experiment.

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APPENDIX

A. Letters from Programming Firms

B. Sample Program on Bound Buttonholes

EASTMAN KODAK COMPANY

ROCHESTER, NEW YORK 14650

AL OFFICES
ATE STREET

TELEPHONE
AREA CODE 716 LOCUST 2-6000

July 21, 1964

Miss Ann Leinn Gibson
8110 Troost, Apartment 204
Kansas City, Missouri

Dear Miss Gibson:

In re: Your letter of July 15 concerning programs in home economics

Probably the best bibliographies of programs are Programs '63, U.S. Government Printing Office and that of Dr. Carl Hendershot of Delta College, Michigan. Neither of these list any programs in the area of home economics. I suspect you may have selected an area in which little or nothing is available commercially.

Although I realize it may be difficult to contact home economics departments in schools during the summer, this may be your best source of information. Teachers who have participated in programing workshops in the Rochester area have programed portions of their courses without making their programs generally available. Another source is the workshop director who could tell you if any of his participants had written programs of interest to you.

Also, the Journal of the National Society for Programed Instruction, Trinity University, 715 Stadium Drive, San Antonio 12, Texas, publishes a current list of workshops.

Best wishes on your interesting project.

Very truly yours,

Robert M. Jacobs

Applied Training Research

RMJacobs:MJE

Forbes

Forbes Products Corporation • 1465 Jefferson Rd. • Rochester, N. Y. 14623 • 716-GR 3-0482

June 20, 1964

Miss Ann Leinn Gibson
8110 Troost Avenue
Apt. 204
Kansas City, Missouri

Dear Miss Gibson:

Thank you for your letter of July 15th. We are sorry, but we cannot help you in your request. We are plastic fabricators and have no program in the line of Home Economics.

Very truly yours,

Jean Alves

(Mrs.) Jean Alves

ICATIONAL NEWS SERVICE

P. O. BOX 508 / SADDLE BROOK, NEW JERSEY 07663

Telephone: Area Code 201 - 523-5355

Publishers of

HING AIDS

AZINE OF EDUCATIONAL TECHNOLOGY

October 30, 1964

Miss Ann L. Gibson
8110 Troost
Apt. 204
Kansas City, Missouri

Dear Miss Gibson:

I do not have any knowledge of curriculum materials in home economics, and I have not come across any programs in this area.

I suggest that you contact Dr. Carl Hendershot, Delta College, University Center, Michigan. He publishes what is probably the most complete listing of programs available today. Perhaps your college library has his bibliography of programs.

In any event, I doubt that the principles employed in programming for home economics would differ from those in other subject areas.

Best wishes for success on your thesis.

Sincerely yours,

Lawrence Lipsitz

Lawrence Lipsitz
Editor
TEACHING AIDS NEWS

Electronic Teaching Laboratories
5034 Wisconsin Avenue, NW, Washington 16, D. C.
EMerson 2-9722
Cable Address: ELECTRONIC

June 17, 1964

Miss Ann Leinn Gibson
8110 Troost, Apt. 204
Kansas City, Missouri

Dear Miss Gibson:

Thank you for your letter of June 10, 1964. I have checked through all of my reference material and I find no programed material in any area of Home Economics. However, I would like to suggest that you contact the Center for Programed Instruction, 345 West End Avenue, New York, New York. They would be able to tell you if there are any programs of this nature in the development stages.

If we can be of further help to you, please let us know.

Sincerely yours,

ELECTRONIC TEACHING LABORATORIES

Irene E. Heavey

(Mrs.) Irene E. Heavey

July 29, 1964

Mrs. Ann L. Gibson
8110 Troost, Apt. 204
Kansas City, Missouri

Dear Mrs. Gibson:

I am sending you literature describing our commercially available programs and a sample of a program entitled The Principles of Programed Learning.

I hope this may be of some assistance to you. We do not have any programs in the area of home economics.

Very truly yours,

D. E. Cornell III

DEC:jc
Enc.

TEACHING MACHINES

221 SAN PEDRO DR., NE / P.O. BOX 8451 / ALBUQUERQUE, NEW MEXICO 87108 / TELEPHONE 505 256-9811

ENCYCLOPAEDIA BRITANNICA PRESS
425 North Michigan Avenue • Chicago 11, Illinois

July 23, 1964

Miss Ann Leinn Gibson
8110 Troost
Apartment 204
Kansas City, Missouri

Dear Miss Gibson:

Thank you for your recent request for books in the field of home economics.

We regret our inability to be of service to you in this matter since we have not developed any material in this subject area. At this time we have no plans for doing so.

If this office may be of any additional service, please do not hesitate to write us.

Cordially yours,

B. A. Hays
B. A. Hays
National Sales Manager

BAH:cf:lb

GPTC
GENERAL PROGRAMMED TEACHING CORPORATION

post office box 11231
palo alto, california 94306
(415) 941-0514

December 2, 1964

Miss Ann Leinn Gibson
8110 Troost, Apartment 204
Kansas City, Missouri

Dear Miss Gibson:

Thank you for your recent inquiry. We regret the delay in answering but the letter went to our Albuquerque office and was transferred to our California office.

We have a program entitled Interior Decoration, which is an adult program and would be suitable for home economics instruction. It is available and can be purchased from:

Mr. Ivan R. Bender
Director, Sales Service Department
Encyclopaedia Britannica Press
425 North Michigan Avenue
Chicago, Illinois 60611

We do not have any programs concerning buttonholes.

We are in the process of having printed a "Portfolio" which lists all of our programs and many other areas of information concerning programmed instruction are covered in this publication. As soon as it is received from the printers we will mail you a copy.

If we can be of further assistance, please let us know.

Sincerely,

Charlotte Fisher

Charlotte Fisher (Mrs.)
Customer Service

Student Directions for Program

Need pencil and mimeographed answer sheet.

Read the directions thoroughly.

Part I

1. Begin on page one, read and answer frame #1. Then turn the page and in the left hand margin will be the answer to #1. Compare the answers and proceed to frame #2. Then turn the page and continue until you reach the last page in the book. When #10 has been answered you will turn back to page one again to find the correct answer. Then proceed to frame #11, answer and continue as before. Illustrations will be in the extreme right margin.

2. Do not begin the program until the teacher reviews the directions orally and all questions are answered.

The form of Part II is slightly different. Part II could be used in book form or in a teaching machine.

Part II

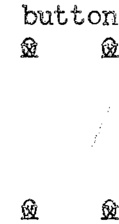
1. Use the answer sheet as a cover sheet.

2. Read the answer from #1. The correct answer will be given below the frame. Move the answer-cover sheet down and check the answer. Continue down the page, frame #1, 2, 3, and so on. When the entire page is completed, continue to the next page. Illustrations are in the left margin.

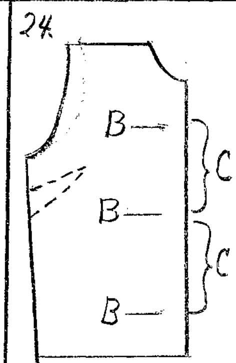
Students will be held responsible for materials covered in the program on a short quiz, final test, and in practical application.

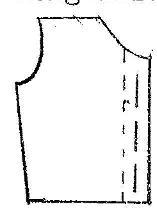
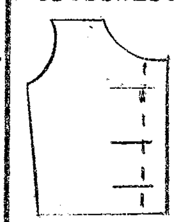
PART I PLACEMENT OF BUTTONHOLES

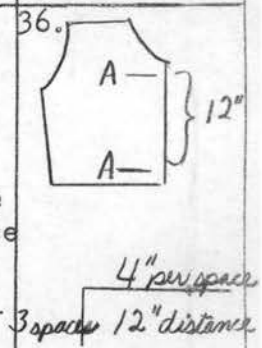
60. space closing edge length	1. Buttonholes may be classified as either worked or bound buttonholes. What are the two types of buttonholes?	
10. decorative	11. Which type buttonholes are more decorative a. bound b. worked	
20. bustline dart	21. When it is necessary to re-space buttonholes after altering a blouse, mark a buttonhole in line with the __________ ________ when using an odd number of buttons.	
30. upper, lower	31. Measure the distance between the upper and lower buttonhole markings. After marking the upper and lower buttonholes, measure the __________ between the two.	
40. spaces buttonholes	41 Buttonholes are constructed in the overlapping edges of a garment. On what part of the garment are buttonholes made?	
50. 1/8 center	51. So in determining where to start the crosswise buttonhole, remember 1/8 inch from the ________ ________.	

1. worked bound (either order)	2. Buttonholes may either be worked or b____________buttonholes.	
11. a. bound	12. Tailored garments frequently have bound buttonholes because bound buttonholes are ____________________.	
21. Bustline (bust dart)	22. In re-spacing buttonholes, mark a buttonhole in line with bustline dart when using an ____________(odd/even) number of buttonholes.	
31. distance	32. After measuring the distance from the upper buttonhole to the lower buttonhole, decide upon the number of buttons to use. It is necessary to decide upon the number of buttons to be used, after measuring the distance from the upper buttonhole to the lower buttonhole. (Observe diagram.) True or False	32. Decide to use four buttons. 
41. overlapping edges	42. The <u>overlapping</u> edge of a garment is where you would construct the b________________.	
51. center line	52. The next step is to decide upon the length of the buttonhole. There are two easy ways to determine the length: 1. Measure the <u>width</u> of the button, plus its <u>thickness</u>, plus 1/16 inch for ease. (The 1/16 inch is not always necessary for very thin buttons.) To determine the length of a buttonhole add the w______ of the button, plus the t____________, plus _________ inch for ease. (Observe diagram.)	52. Width  +  Thickness + 1/16"

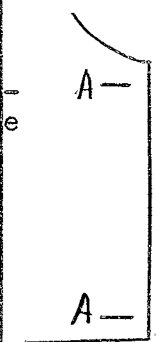
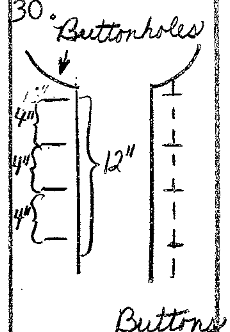
2. Bound	3. Buttonholes that are not bound buttonholes are w____________ buttonholes.	
12. decorative	13. Bound buttonholes require more time than machine-made buttonholes, but can be made by any beginner who can stitch and press accurately. Any beginner can make bound buttonholes if she can and will stitch and press accurately. True or False	
22. odd	23. When the buttonholes must be re-spaced, a buttonhole is marked in line with the bustline dart when using an ______number of buttons.	
32. True	33. Subtract one from the number of buttons to be used to find the number of spaces. The number of buttons minus one equals the number of s__________. (Note diagram.)	33. 4 buttons - 1 3 spaces
42. buttonholes	43. The edges that lap over each other on the front of a garment is where the buttonholes are constructed. These edges are called ____________ edges	
52. width thickness 1/16	53. What two dimensions of the button must you measure in order to determine the length of the buttonhole?	

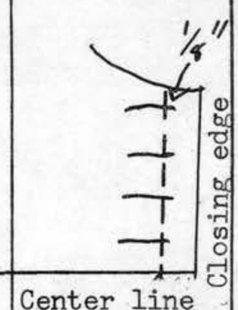
3. worked	4. There are two types of buttonholes. True or False	
13. True	24. Stitching and pressing with accuracy are very important in making b______ b______________________.	
23. odd	24. After marking a buttonhole even with the bustline dart, place markings above and below for the number of buttonholes that are required. (B). Make certain the buttonholes are equal distance apart. (C). Buttonhole markings should be made above and below the buttonhole marking at the b______________. (Study diagram.)	
33. spaces	34. After deciding upon the number of buttons to use, subtract one from the number of buttons to determine the number of s________________.	
43. overlapping	44. The closing edges are the outer most edge of the overlapping edges. The outer most edges of the overlapping edges are called the __________ edges.	
53. thickness width (either order)	54. The width plus the thickness of a button will give the necessary length of the buttonhole. Sometimes __________ inch is added for ease.	

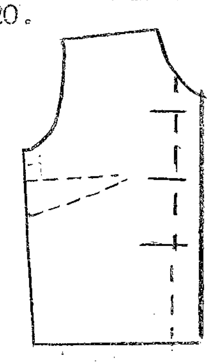
4. True	5. The two types of buttonholes are __________ and __________ buttonholes.	
14. bound buttonholes	15. In making bound buttonholes accurate stitching and pressing is not necessary. True or False	
24. bustline	25. The re-spaced buttonhole markings should be equal distance apart. True or False	
34. spaces	35. The number of buttons minus one equals the number of ______________.	
44. closing	45. Buttonholes may be made in either of two directions: a. Lengthwise buttonholes - run parallel to the closing edges. b. Crosswise buttonholes - are at right angles to the closing edge. Buttonholes that are made in the same manner but constructed in different directions from the closing edges can be classified as l__________ buttonholes and c______________ buttonholes. (Now study diagram.)	45. Lengthwise  Crosswise 
54. 1/16	55. One method of finding the length of the buttonhole is to measure the ________ of the button, plus the ________ of the button and add ________ inch for ease.	

5. worked bound (either order)	6. <u>Bound</u> buttonholes are often used on tailored garments. Tailored garments frequently have ______ buttonholes.	
15. False, Accuracy is the first point to stress in making bound buttonholes.	16. The first point to remember in making bound buttonholes is to <u>stitch</u> and <u>press</u> ac__________.	
25. True	25. In re-spacing buttonholes the buttonhole markings above and below the <u>bust-line</u> <u>buttonhole</u> <u>marking</u> must be e______ distance apart.	
35. spaces	36. To determine the positions of the other buttonholes, <u>divide</u> the distance from the top buttonhole <u>by</u> the number of <u>spaces</u>. In order to mark the positions of the remaining buttonholes divide the distance from the top buttonhole to the lower buttonhole by the number of ______ (Now study diagram.)	
45. lengthwise, crosswise	46. Bound buttonholes are most commonly constructed <u>crosswise</u>. Crosswise bound buttonholes are more often used than **lengthwise** bound buttonholes. True or False	
55. width thickness 1/16	56. The second way to determine the length of a buttonhole is to: <u>Cut</u> <u>a</u> <u>slit</u> <u>in</u> a scrap of cloth and keep making it larger until the button will slide through easily. <u>Measure</u> <u>the</u> <u>slit</u> and make the bottonholes this length. Measuring the width plus the thickness of a button is the only way to determine the thickness necessary for the length of a buttonhole. True or False	

6. bound	7. The type of buttonholes frequently found on tailored garments are: a. worked b. bound	
16. accurately	17. Commercial patterns usually indicate the position for buttonholes. If the blouse must be altered in length then the buttonholes must be re-spaced accordingly. If the length of the blouse is changed the buttonholes must be re-______.	
26. equal	27. It is important that buttonhole markings are e______ d__________ apart.	
36. spaces	37. The distance from the top buttonhole to the lower buttonhole must be measured and divided by the number of spaces in order to mark the positions of the remaining buttonholes. To determine the positions of the other buttonholes, the distance from the top buttonhole to the lower buttonhole must be divided by the number of ____________.	
46. True	47. Bound buttonholes are more commonly constructed (lengthwise/crosswise) ____________________.	
56. False refer to the first of frame 56 if you answered True.	57. For unusual shaped bottons it is often the best to cut a slit in a scrap of cloth and continue to extend the slit until the button goes through easily. Then m___________ the slit and make the bottonholes this length.	

7. b. bound	8. Bound buttonholes are frequently used on tailored garments because they are more decorative than worked buttonholes. Which type of buttonholes is more decorative?	
17. re-spaced	18. Re-spacing of the buttonholes is necessary when the garment length is altered. True or False	
27. equal distance	28. The second method of re-spacing buttonholes may be used for either an even number or an odd number of buttonholes. Locate the position for the upper buttonhole and then locate the position for the lower buttonhole. (A). The first step in re-spacing buttonholes by this method is to locate the position for the u_________ buttonhole and the l___________ buttonhole. (Note diagram.)	28. 
37. spaces	38. Before marking the positions of the remaining buttonholes measure off the spaces. To mark the positions of the buttonholes in the middle, measure off the spaces. True or False	30. 
47. crosswise	48. In constructing a tailored garment the bound buttonholes will most usually be made in what direction?	
57. measure	58. One easy way to determine the length of the buttonhole is: (1) Measure the w_________ of the button, plus the ___________ of the button, plus ________ inch for ease.	

8. Bound	9. Which type of buttonhole is often used on tailored garments because it is more decorative?	
18. True	19. What must be done to the placement of the buttonholes when a blouse is altered in length?	
28. upper, lower	29. Locating the position for the upper buttonhole and the lower buttonhole is the first step when re-spacing buttonholes on a blouse by this method. True or False	
38. True	39. To mark the positions of the buttonholes in the middle, measure off the spaces. True or False	
48. crosswise	49. The crosswise buttonholes begin about 1/8 inch from the <u>center</u> <u>line</u>, toward the closing edge, and extend into the garment as far as necessary. Begin crosswise buttonholes about 1/8 inch from the c________ l______ toward the closing edge. (Now study diagram.)	
58. width thickness 1/16	59. Another easy way to determine the length of the buttonhole is: (2) Cut a slit in a piece of cloth and continue to make it larger until the button slides through easily. Then m__________ the slit and make the buttonholes this length.	

9. bound	10. Bound buttonholes are frequently used on tailored garments because they are more dec__________ than worked buttonholes.	
19. re- spaced	20. Re-spacing of buttonholes can be accomplished by two methods. If there is an odd number of buttonholes (3, 5) mark a buttonhole in line with the bustline dart. When using an odd number of buttonholes mark a buttonhole in line with the b______________ d______________. (Observe diagram.)	20. 
29. True	30. The position for the __________ and __________ buttonholes must be marked in beginning to re-space buttonholes on a blouse.	
39. True	40. The positions of the middle bottonholes are determined by measuring the number of s__________ and then marking the place for the b_________.	
49. center line	50. Buttons tend to pull to the end of the crosswise buttonholes, nearest the edge of the garment. Therefore when buttonholes are placed _______ inch from the _________ line the buttons will be on the center of the figure.	
59. measure	60. In summarizing the placement of buttonholes: Step One: Decide how far apart to s________ the buttons. Step Two: Determine how far the end of the buttonhole will be from the cl________ e________. Step Three: Determine the l__________ of the buttonhole.	

PART II - CONSTRUCTION OF BOUND BUTTONHOLES

1. Bound buttonholes may be made of the same material as the garment or of a contrasting fabric.

   Bound buttonholes should never be made of a contrasting fabric.

   True or False

1. False (Contrasting fabric is sometimes used to give an added, sportive effect.)

2. Bound buttonholes can be made from either contrasting material or the same material as the garment.

   True or False

2. True

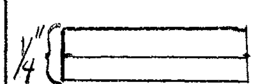
3. The material which forms the lips of the bound buttonholes should be cut of the lengthwise grain.

   The strip that runs along the length of the buttonhole should be cut on the ________________ grain.

3. lengthwise

4. To have strength and firmness in the bound buttonholes, cut the buttonhole fabric on the l________ g____________.

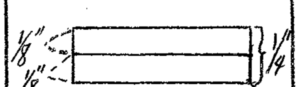
4. lengthwise grain.



5. The overall width of a bound buttonhole should seldom exceed <u>1/4</u> inch and sometimes it should be less. (Observe diagram.)

   How wide should a bound buttonhole be?

5. 1/4 inch (or less)



6. If the total width of the buttonhole is <u>1/4 inch</u>, then each lip should be 1/8 inch. (Note diagram.)

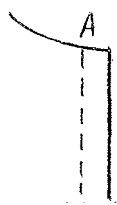
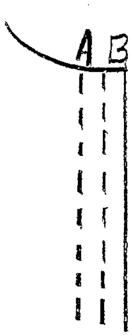
   The overall width of a bound buttonhole should be 1/4 inch or less.

   True or False

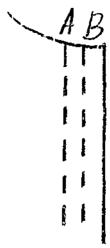
	6. True
	7. On light-weight or medium-weight material each lip of the bound buttonhole should be: a. 1/8 inch b. 1/4 inch c. 1/2 inch
	7. a. 1/8 inch
	8. If each lip on a bound buttonhole is 1/8 inch then the total width of the bound buttonhome is ______ inch.
	8. 1/4 inch
	9. The lips of the bound buttonhole should never overlap. Usually the lips will just touch each other. Make an effort to avoid any wide space between the edges or lips. It looks better if the lips on the bound buttonholes overlap. True or False
	9. False, the lips should just touch each other for a neat, well-made effect.
	10. The lips of a bound buttonhole should: a. Just meet b. Be wide apart c. Overlap
	10. a. Just meet
	11. The two 1/8 inch lips of a bound buttonhole should just meet. On a bound buttonhole each lip should be ______ inch in width.

	11. 1/8 inch
	12. When the lips of a bound buttonhole just touch, they look neat and allow room for the button to fit through comfortably. The two lips 1/8 inch in width should just meet. True or False
	12. True
	13. The patch method of constructing bound buttonholes is the most successful for beginners. Since this is a beginner's unit on bound buttonholes the p__________ method will be used.
	13. patch
	14. The patch method provides definite lines to stitch by, thus greatly aiding the beginner. By providing definite guide lines for stitching the beginner usually finds the _________ method to be successful.
	14. patch
	15. Remember that a bound buttonhole is made through the garment section and interfacing, but must not be made through the facing. The bound buttonhole is not made through the f____________.
	15. facing
	16. The buttonhole should be made through the garment section and int__________.
	16. interfacing

	17. The bound buttonholes must be made through the garment section and interfacing, before the f________ is attached.
	17. facing
	18. Bound buttonholes are made through the garment section and interfacing, but must not be made through the facing. True or False
	18. True (If you answered this False, go back and review frames 13, 14, and 15)
	19. The buttonholes must have marked guidelines. It is important to have marked g____________ to help direct the sewing.
	19. guidelines
	20. Marked guidelines aid in accurate stitching of the bound buttonholes. The marked guidelines are useful in making neat and accurate buttonholes. True or False
	20. True
	21. The markings for buttonholes should be done with contrasting thread. In obtaining uniformly even buttonholes c_______ thread should be used.
	21. contrasting

	22. Marking the position for bound buttonholes by basting stitches is very important, therefore ________ thread should be used.
	22. contrasting
	23. Baste-stitch the <u>center</u> <u>front</u> (A) on the interfacing through to the outside of the fabric with contrasting thread. (Observe diagram.) The marking of the center front line would appear on the interfacing and the o________ of the fabric.
	23. outside
	24. The basting that marks the center front (A) should extend the length of all buttonholes and appear on the interfacing and the outside of the garment. The basting that marks the center front (A) should extend the length of all buttonholes. True or False
	24. True
	25. The center front marking is basted through both the in____________ and the ________ of the fabric and extends the length of all buttonholes.
	25. interfacing outside
	26. By baste-stitching, mark a second line (B) parallel to the center front line and 1/8 inch to the right of the center front line.* The second basting line should be parallel to the first line and an ________ inch outside the center front marking.
	26. 1/8

*Directions used are given as you view the diagram or fabric.



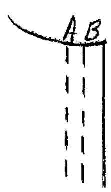
27. Line B represents the outside end of the buttonhole. (Review diagram.)

The buttonhole will begin at line B, which is ________ inch from the center line.

27. 1/8

28. Line B is where the buttonhole begins. (Refer to diagram.)
True or False

28. True



29. The buttonhole should begin at which line? (line A/ line B) (Note diagram,)

29. line B

30. Line B is 1/8 inch to the right of the center front line (A); therefore, the buttonhole should begin 1/8 inch to the right of the center line.

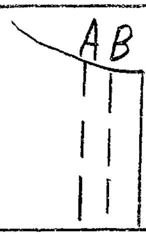
The buttonhole begins (B) ________inch to the right of the center line.

30. 1/8

31. The buttonhole begins at line b, 1/8 inch from the center front line. (A).

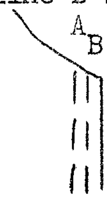
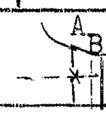
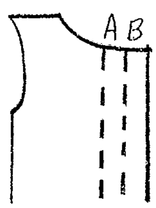
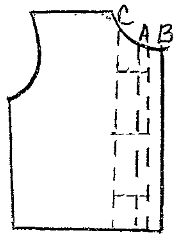
True or False

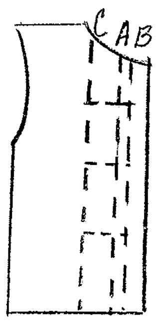
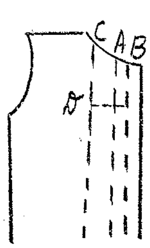
31. True

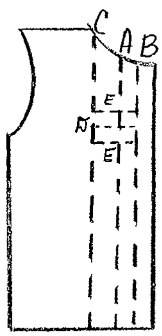
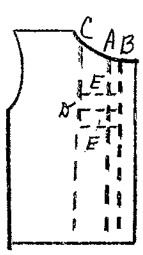


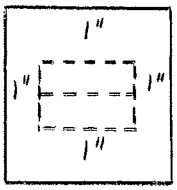
32. Line A represents the center front of your garment and where the button will be placed. (Review diagram.)

On which line will the button be placed?

	32. Line A or center front
	33 Label line A and line B by telling what these lines represent. 
	33. A is center front (center line) B is outside end of buttonhole
	34. Indicate by marking an X, where the button should be placed. 
	34. Line A or center line 
	35. The outside basting line (B) marks the outside end of the buttonhole. This line is ________ inch from the center front line. (A).
	35. 1/8
	36. The button is sewn on the center front line, therefore the button will be sewn __________ inch from the outside end of the buttonhole.
	36. 1/8
	37. Next baste a line (C) parallel to the lines A and B. Line C should be the distance of the <u>length of the buttonhole</u> from line B. The distance from the outside basting line (B) to the inside basting line (C) is the length of the b______________.
	37. buttonhole
	38. Line C marks the inside end of the b_______________.

	38. buttonhole
	39. Basting lines A and C mark the ends of the button-hole. (Study diagram before answering.) True or False
	39. False (Remember line A marks the center front of the garment. Line B is an 1/8 inch from the center front and marks the outside end of the buttonhole.)
	40. The basting lines B and C mark the ends of the buttonhole. True or False
	40. True
	41. The parallel lines B and C connecting the ends of all buttonholes are used to check the l__________ of each buttonhole.
	41. length
	42. What is the purpose of baste-stitching lines B and C?
	42. measure or mark length of buttonhole
	43. Next baste stitch a crosswise pattern marking (D) for the buttonhole location. Line D indicates where the center of the _______ is located.
	43. Buttonhole
	44. The crosswise line D represents the center of the buttonhole and will serve as a guideline for the placement of the buttonhole. True or False

	44. True
	45. What is the purpose of buttonhole markings? a. Stitching guidelines c. Both a and b b. Mark length of buttonholes d. Neither a nor b
	45. c. Both a and b
	46. Lastly, baste-switch a line (E) on either side and parallel to line D. These lines should each be 1/4 inch from the line (D) marking the center of the buttonhole. The last marking lines are basted at ______ inch on each side of the center of the buttonhole line. (D)
	46. 1/4
	47. The line (E) parallel to line D is to be used as a guideline. Each guideline E should be ______ inch from the line marking the center of the buttonhole (D).
	47. 1/4
	48. Read the descriptions carefully and study the diagram, then match the letters to the correct description. ______ 1. Center front line ______ 2. Inside end of buttonhole ______ 3. Center of buttonhole ______ 4. Outside end of buttonhole ______ 5. Parallel lines marking the width of the lips of the buttonhole

	48. 1. A 2. C 3. D 4. B 5. E
	49. After the stitching lines have been marked the first step has been completed. Next cut a strip of the fabric one inch wider on each side (total 2") than the length of the buttonhole and one inch longer on each side than the width of the buttonhole. The fabric should be ______ inch wider on each side than the length of the buttonhole and ______ inch longer on each side than the width of the buttonhole.
	49. one one
	50. How much wider on each side than the length of the buttonhole should the finishing strip of fabric be cut?
	50. one inch on each side.
	51. How far beyond each buttonhole on each side should the finishing strip of fabric extend?
	51. one inch
	52. The strip of fabric should be _____ inch wider on each side than the length of the buttonhole and ___ inch longer than the width of the buttonhole on each side.
	52. one one
	53. The total width of the finishing strip should be ______ inches more than the length of the buttonhole.

53. two

54. The total length of the finishing strip should be _____ inches longer than the width of the buttonhole.

54. two

55. The basting lines serve as a guide for placing the finishing patch of fabric so the finished buttonhole will be in the correct location.

True or False

55. True

56. The strip of fabric that has been cut is to be placed on the <u>right side</u> of the garment <u>right side</u> down.

The finishing strip is applied to the garment front with right sides together.

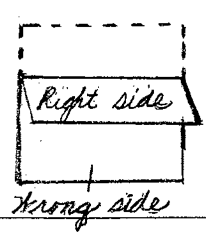
True or False

56. True

57. The patch strip should be placed with right side of the fabric down and spaced evenly over the buttonhole.

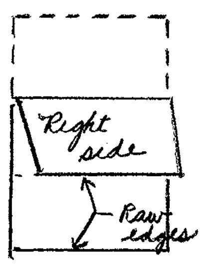
The patch strip must be applied to the garment ______ side to _______ side.

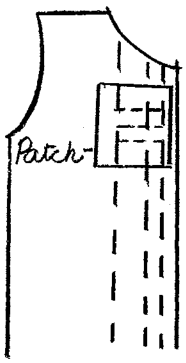
57. right
right



58. Fold the finishing strip down approximately 1/3 of the way, right side out. (Observe diagram.)

A fold is made in the finishing strip approximately ______ of the way from the top.

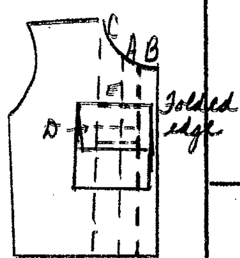
	58. 1/3
	59. How far down is the finishing patch folded?
	59. 1/3
	60. The finishing strip is folded down approximately 1/3 of the way from the top with right side out and pressed. After the finishing strip is folded 1/3 of the way down, the fold should be p____________ well.
	60. pressed
	61. After folding the top of the finishing patch down 1/3 of the length on the patch, it is then necessary to ____________ well.
	61. press
	62. The finishing strip is folded right side out and both raw edges on the top side. The finishing strip should be folded 1/3 of the way down with the r______ side of the fabric turned outward.
	62. right
	63. The right side of the strip must be turned outward. True or False
	63. True



64. The finishing patch is now placed on the right side of the garment with both raw edges of the patch upward. (Study diagram.)

The finishing patch is placed right side down on the ________ side of the garment.

64. right



65. Place the top fold on the upper guideline (E) on the right side of the garment.

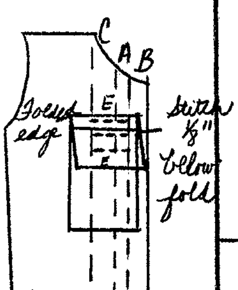
The top fold is placed on which basted guideline?

65. E or upper

66. The top fold placed on the upper guideline (E) is on the right of the garment.

True or False

66. True



67. With a short machine stitch, stitch 1/8 inch below the first fold from guideline B to C. (Note diagram.)

A row of short machine stitching* from guideline B to C is done ______inch below the fold.

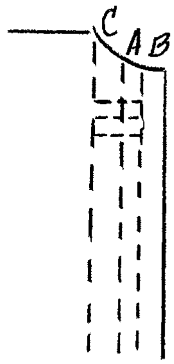
67. 1/8

68. The row of horizontal stitching from guidelines B to C is how far below the fold?

68. 1/8 inch

* About 20 stitches to the inch.

	69. When stitching 1/8 inch below the fold from guideline B to C, be certain to <u>backstitch</u> at the beginning and end of the stitching. To prevent the stitching from pulling out, b____ at the beginning and end of the row of stitching.
	69. backstitch
	70. <u>Backstitching</u> is important in securely fastening the row of stitching. True or False
	70. True
	71. The row of stitching from guideline B to C is ________ inch below the folded edge and the stitching is locked at each end by ___________
	71. 1/8 backstitching
	72. Next fold the finishing patch on the bottom guideline. (E). After the first row of horizontal stitching has been sewed, between guidelines B and C, the fabric is again folded, this time on the bottom guideline (E). True or False
	72. True
	73. Fold on the bottom guideline E and again stitch horizontally <u>1/8 inch</u> from the fold. How far is the second row of stitching from the bottom fold?
	73. 1/8 inch

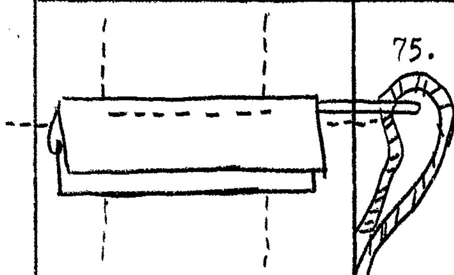


74. The second row of horizontal stitching should also go from guidelines B to C.

The guidelines B and C mark the ends of the buttonholes; thus, the second row of stitching is also the length of the buttonhole.

True or False

74. True



75. If the buttonhole is made of a lightweight fabric insert a thin cord through both folded edges of the finishing strip. (Observe diagram.)

When making a bound buttonhole in lightweight fabric insert a thin cord through the ________ edges.

75. folded

76. A bound buttonhole on lightweight fabrics is made exactly like a bound buttonhole on medium or heavy weight fabrics.

True or False

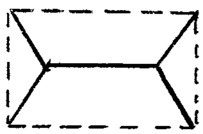
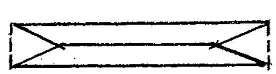
76. False (On lightweight fabric a thin cord should be inserted in the folded edges.)

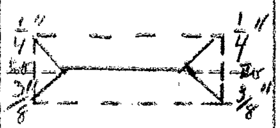
77. When making bound buttonholes on a lightweight fabric how can you give more body to the folded edges of the bottonhole?

77. insert a thin cord

78. In order to add body to bound buttonholes that are made in lightweight fabric a thin cord is inserted through the f________e__________.

78. folded edges

	79. On the <u>inside</u> of the garment, starting at the <u>center</u> between the two horizontal rows of stitching (E), clip through the interfacing and fabric, down the center of the buttonhole area and diagonally toward the corners. (Read the frame twice and look at the diagram.) The clipping is done on the _______ of the garment.
	79. inside
	80. On the inside of the garment the fabric and interfacing is clipped at the center between the two horizontal rows of stitching d__________ to the corners.
	80. diagonally
	81. On which side of the garment is the clipping done?
	81. inside (or underside or wrong side of fabric)
	82. Begin clipping at the center between the two rows of horizontal stitching and clip__________ to the corners.
	82. diagonally
	83. In the space below draw a diagram indicating how the buttonhole area is clipped.
	83. 



84. When clipping diagonally to the corners this should form triangles 1/4 to 3/8 inch long at each end of the buttonhole. (Note diagram.)

By clipping diagonally to the corners t________ will be formed.

84. triangles

85. The triangles formed by clipping diagonally to the corners should be 1/4 to 3/8 inch in length.

True or False

85. True

86. The triangles at each end of the buttonhole are formed by clipping ____________ to the corners.

86. diagonally

87. The triangles left after cutting diagnonally to the corners are:

a. on each end of the buttonhole

b. on only one end of the buttonhole

87. a. on each end of the buttonhole

88. Remember triangles formed on each end of the buttonhole, by clipping the corners diagonally, should be about 1/4 to 3/8 inch in length.

The small triangles on each end of the buttonhole patch should be ________inch in length.

88. 1/4 - 3/8

89. It is important to remember when clipping along the center line (D) of the buttonhole to make the triangles about ________________inch in length.

89. 1/4 - 3/8

90. After the clipping process is completed, turn the finishing patch to the inside.
CAUTION: Do not handle the triangles.

After clipping, the finishing patch should be turned to the inside of the garment.

True or False

90. True

91. The triangles should not be handled when turning the finishing patch to the inside.

True or False

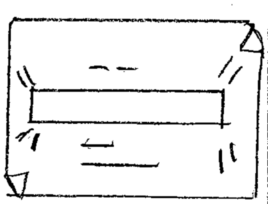
91. True

92. After clipping the center of the buttonhole, turn the finishing patch to the __________ of the garment.

92. inside

93. Be careful in turning the patch to the inside, not to handle the ______________.

93. triangles



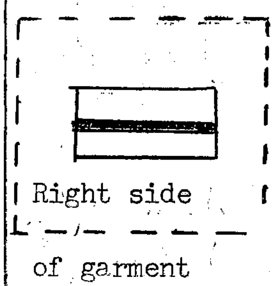
94. After turning the finishing strip to the inside, carefully pull the ends of the strip to square the corners of the buttonhole. (Observe the diagram.)

The ends of the finishing strip should be pulled in order to s________ the corners of the buttonhole.

94. square

95. The ends of the finishing strip should be carefully pulled to accomplish s__________ c_______, thus giving a well-made effect to the buttonhole.

95. square corners



96. When carefully pulling the ends of the finishing strip to square the corners, the <u>folded</u> <u>edges</u> should <u>meet</u> in the center of the buttonhole. (Note diagram.)

The ends of the finishing strip carefully pulled should cause the f_________ e_________ to meet in the center of the buttonhole.

96. folded edges

97. By carefully pulling the ends of the finishing strip the f_________ e_______ will just meet.

97. folded edges

98. It is important that the <u>folded</u> <u>edges</u> just meet in the center of the buttonhole.

True or False

98. True

99. What should happen when the ends of the finishing strip are carefully pulled?

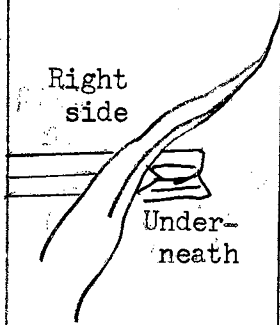
a. The folded edges of the buttonhole meet

b. The corners of the buttonhole are squared

c. Neither should occur

d. Both should occur

99. d. Both should occur

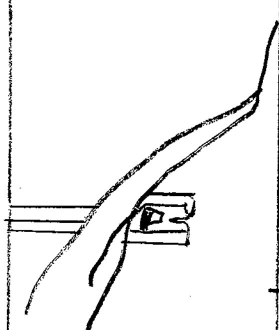


100. Next place the garment right side up on the sewing machine. Turn back top edge of the garment to reveal the triangle and end of strip. (Study diagram.)

The edge of the garment should be turned back so the triangle and end of the finishing strip is easily visible.

True or False

100. True



101. After turning back the edge of the garment so that the triangle and the end of the finishing strip can be seen, stitch the base of the triangle securely to the finishing strip by going back and forth several times. (Study diagram.)

The triangle is stitched securely to the f______ strip.

101. finishing

102. When the garment is placed right side up, the triangle is permanently stitched to the f__________ s____________.

102. finishing strip

103. The base of the triangle is securely sewn to the finishing strip by going back and forth several times.

True or False

103. True

104. Stitch the opposite end of the buttonhole in the same manner. This stitching of the triangles further squares the corners.

The purpose of stitching across the base of the triangles, connecting the triangles to the ends of the finishing strip, is to s_______ the corners.

	104. square
	105. What is the main porpose of stitching the base of the triangles to the ends of the finishing strip?
	105. Square the corners
	106. The reason for stitching the triangles to the finishing strip ends is to square the corners. True or False
	106. True
	107. The base of the triangle should be stitched back and forth several times to the ends of the finishing strip. True or False
	107. True
	108. It is important to securely stitch the triangles to the ends of the finishing strip in order to have s__________ c__________.
	108. square corners
	109. Now, remove marking threads and press buttonhole. Trim away the excess finishing strip. In finishing the buttonhole; remove the basting, press and trim. True or False
	109. True

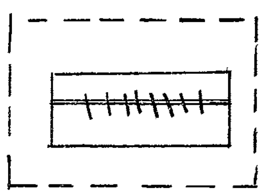
110. The finishing strip should be trimmed to 1/2 inch on all sides of the buttonhole.

How far should the finishing strip extend on the ends and sides?

110. 1/2 inch

111. The buttonhole should be pressed and trimmed to ______ inch on all sides.

111. 1/2



112. Diagonally baste the lips (folded edges) of the bound buttonhole together, while completing the remainder of the garment. (Observe diagram.)

To hold the lips of the bound buttonhole together, baste diagonally.

True or False

112. True

113. The diagonal basting that holds the lips of the buttonhole together is removed immediately after trimming and pressing of the buttonhole.

True or False

113. False
(This basting is left in until the garment is completed in order to hold the lips of the bound buttonhole together while working on other sections of the garment.)

114. After the buttonhole is trimmed and pressed the facing is attached to the garment permanently.

The facing is attached after the buttonhole has been sewn.

True or False

	114. True
	115. The facing is attached (before/after) the bound buttonhole is constructed.
	115. after
	116. After the facing is attached it is important to baste around the buttonhole so that the facing will stay in place. To hold the facing in place, baste around each buttonhole. True or False
	116. True
	117. After the facing is attached, it is important to b______ around each buttonhole.
	117. baste
	118. With the right side of the garment up, insert a pin at each corner of the buttonhole. The pins are used to mark the c________ of the buttonholes.
	118. corners
	119. A pin is to be inserted at each corner from the right side. True or False
	119. True

120. After inserting a pin at each corner, turn the garment to the under side and slash the facing just as the buttonhole was slashed.

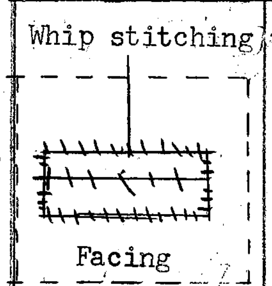
The slashing of the facing is done from the un_______ s________ of the garment.

120. under side

121. The facing is slashed the same as the buttonhole was slashed, therefore, the facing should be clipped down the middle and to each corner.

True or False

121. True



122. Next, turn under the facing edges about 1/8 inch and whipstitch the facing to the outer edges of the buttonhole.

After slashing the facing at the buttonhole, the facing edges should be hemmed under about ________ inch.

122. 1/8

123. After turning under the facing edges 1/8 inch, the edges should be w______________ in place.

123. whipstitch

124. How much do you turn under the facing edges around the buttonhole?

124. 1/8 inch

125. What type of stitch do you use to secure the facing edges to the outer edges of the buttonhole?

125. whipstitch

126. The facing edges should be neatly turned under 1/8 inch and inconspicuously whipstitched in place.

True or False

126. Very true!

CONCLUSION: Upon completion of your bound buttonhole check it against these standards for a good bound buttonhole.

A. Accurately spaced and aligned.

B. Made along a true grain, except in special cases.

C. The right size for the button.

D. Square and firm at corners.

E. Made with bound edges of suitable and even width.

F. Flat because the buttonholes have been carefully slashed, pressed, and trimmed.

G. Free from any lines of stitching which show from the right side.

VITA

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