INNOVATIVE TEACHING USABLE IN UNDERGRADUATE FOODS AND NUTRITION COURSES

by

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INTRODUCTION

It has become obvious to educators because of population and knowledge explosions that the use of traditional teaching methods is inefficient and ineffective in keeping pace with current educational demands. Further, the percentage of the population demanding more education is increasing and the problem of using traditional teaching methods is increasing in geometric proportions as more educated people contribute to the enlarging volume of knowledge (Postlethwait et al., 1969). Among the many problems university administrators and educators have to face is improvement of undergraduate instruction (Kerr, 1964). Tope (1969) reported that undergraduate students are not getting enough attention in the university.

The objective of this study was to examine trends in American education and to review literature concerning innovative teaching utilized in undergraduate courses in foods and nutrition. It is hoped that the study may be useful in future curriculum building and/or change.

TRENDS IN AMERICAN EDUCATION

Changes in our society have brought changes in education. Since World War II, the federal government has placed heavy emphasis on establishing new goals to increase knowledge, to increase the number of persons to be educated, and to improve teaching methods. The National Defense Education Act of 1958 provided funds to accomplish those goals (Brown et al., 1969).

As a result of federal funding, several important trends resulted.

Among them are increased emphasis upon innovation, changes in instructional patterns, increased individualization of instruction, and greater use of new media (Brown et al., 1969).

Innovations in curriculum, methods, and instructional organization have become characteristic of today's educational research. Such innovations may be completely new approaches or may be only variations of traditional methods made possible by new technological devices. Three types of instruction used currently in American schools are large group, small group, and individualized. Federal support has made it possible for schools to be provided with more instructional materials. There is evidence that these materials are used in all levels of education (Brown et al., 1969).

It has been estimated that our fundamental knowledge has been increasing at a phenomenal rate — doubling every ten years (Brown et al., 1969). This new knowledge explosion presents one of the greatest challenges to teaching (Henderson, 1969). Tope (1969) identified three significant trends in college today: (1) changes in students, (2) growth of knowledge, and (3) advances in educational technology. She discussed increased numbers of students going into higher education, their increased range of abilities, and diversity of backgrounds and experiences. She believed that those factors must be recognized at the undergraduate level, since most undergraduate students were not getting enough attention when compared with graduate students.

Various media of communication may convey different types of messages (Brown et al., 1969). These media are means to ends, the ends being the unique goals of each educator (Dale, 1969). Brown et al. (1969) cited a paper by Jackson to point out that educational technology can improve the quality of education through greater individualization of instruction and

can provide a greatly enriched library of teaching materials. They mentioned threatening possibilities to be recognized in educational technology: (1) depersonalization of instruction, (2) expense involved in the truly creative use of technological devices, (3) reduction of the professional integrity of the live teacher, (4) subtle alterations in the social character of the learning process, and (5) the risk that poorly trained teachers depend too much upon media when they should be spending time to improve their own abilities.

AIMS OF UNIVERSITY TEACHING

McKeachie (1960) stated that research to date indicates that new media can be used to achieve educational objectives, depending upon the objectives, characteristics of students, and excellence of the materials. However, he believed that it is unlikely that professors will disappear from the academic scene because there is a definite need for face-to-face contact between faculty and students.

Henderson (1969) discussed the important task university teachers have of teaching large numbers of young people at critical professional and technological levels. He believed there is sufficient evidence to show that many college teachers are not sufficiently trained to teach college classes. He pointed out that systematic investigations of teaching in the last few years reveal too many costly examination failures which could have been prevented, too many remedial-type student learning difficulties, too many incidents of inadequate classroom management and poorly organized laboratories, and too many signs of poor lecturing. He emphasized the fact that many university teachers cling to traditional mass-teaching techniques to the neglect of more effective alternative and supplementary methods.

There is not now, never has been, and never will be the perfect university, according to Kerr (1967). He theorized that a perfect university is really an imperfect one urgently seeking perfection. He made reference to the fact that most large universities are judged on how effectively they carry out three functions — research, graduate training, and service to the community. It was his belief that more and more faculty time and more and more facilities have been devoted to research, graduate training, and service and less to improving undergraduate instruction. He stated that too often undergraduates have been offered specialized courses imposed in a sequence developed for those majoring in the subject.

Kerr (1967) suggested many approaches for making undergraduate instruction more effective. His suggestions were to hold freshman seminars, to have honors programs, to give credit for field study, to spread liberal-general education throughout four years instead of the usual two years, to use better advising procedures, to have more careful evaluation of teaching performance, to design courses specifically for the non-major, to find more opportunities for independent study, to introduce problem-oriented courses, to make better selection and supervision of teaching assistants, to consult with students in the formulation of educational policy, to improve orientation programs, to devote more faculty time to undergraduate students, and to employ more effective machinery for the encouragement and approval of new and experimental programs.

The new media offer unusual challenges and opportunities for research and improvement of quality of instruction in higher education (McKeachie, 1967).

THE DIVERSIFIED NATURE OF FOODS AND NUTRITION

Foods and nutrition is a major area of study in home economics. Vail et al. (1973) indicated a basic knowledge of marketing principles, an understanding of nutrition, food preparation, meal service, and food preservation are required in the study of foods. Paul and Palmer (1972) emphasized the need for a greatly increased understanding of the chemistry, physics, and physical chemistry of food materials and the process used in preparing them for consumption. Food science knowledge is expanding rapidly. Food science depends heavily on research in fields such as chemistry, physics, biochemistry, and microbiology for satisfactory answers to questions concerning the complex nature of foods (Charley, 1970).

The science of nutrition is a study of the relationship between man and his food and implies the psychological and social as well as the physiological and biochemical aspects. Nutritionists have emphasized the role of social, economic, physiological, and biochemical factors involved in the availability and utilization of nutrients. Nutrition draws heavily on findings of chemistry, biochemistry, microbiology, physiology, medicine, and cellular biology (Guthrie, 1971).

EDUCATIONAL TECHNOLOGY AND INNOVATIONS

Educational technology is an inherent factor in accomplishing the educational goals of the innovative teacher (Brown et al., 1969). Innovative teaching techniques aim to fulfill current needs of higher education (Henderson, 1969).

Technology and new media have aroused more controversy and curiosity among educators than any other educational development of recent years

(Baskin, 1967). He pointed out that the controversy centers around determining whether or not the new technology can be employed in teaching and learning and whether or not new media can be used to educate larger numbers of students without completely automating the educational process. Dale (1969) stated that technology used in instruction should be a boon and not a danger to education. He indicated that educational technology can recognize individual tastes, needs and services as well as make individualization of instruction more manageable.

The increased use of instructional technology in college aims to change the role of the teacher so that he can put increased emphasis on learning processes which require close personal relationships with students, and to design a learning and teaching environment in which the learner has more self-direction in the management of his own development (Dale, 1969). When used in sensitive and intelligent balance with conventional teaching methods, Baskin (1967) believed that new media can offer much in higher education.

Audiovisual technology, one aspect of educational media technology, functions in many different roles. These roles include: (1) extending human experience; (2) guiding student response; (3) stimulating interest; (4) providing meaningful information; (5) overcoming physical limitations, such as spatial and geographic; (6) stimulating problem solving; and (7) providing diagnostic and remedial tools (Erickson and Curl, 1972).

Figure 1, according to Allen (1967), represents an effort to resolve the difficult task of matching instructional media with learning objectives. The diagram illustrates the fact that each type of instructional media contributes to learning in varying degrees - - low, medium, or high.

Fig. 1 - Instructional media stimulus relationships to learning objectives (Allen, 1967).

LEARNING OBJECTIVES

INSTRUCTIONAL MEDIA TYPE	Learning factual information	Learning visual identifications	Learning principles, concepts, and rules	Learning procedures	Learning skilled motor acts	Developing desirable attitudes and opinions
Still pictures	medium	high	medium	medium	low	low
Motion pictures	medium	high	high	high	medium	medium
Television	medium	medium	high	medium	low	medium
3-D objects	low	high	low	low	low	low
Audio recordings	medium	low	low	medium	low	medium
Programmed instruction	medium	medium	medium	high	low	medium
Demonstration	low	medium	low	high	medium	medium
Printed textbooks	medium	low	medium	medium	low	medium
Oral presentation	medium	low	medium	medium	low	medium

Contributions of Audiovisual Materials to Learning

Henderson (1969) stated that there are a number of periodicals devoted to the study of educational uses of audiovisual materials, emphasizing the nature and extent of their contributions to higher education. He summarized contributions of audiovisual materials to learning, with emphasis on their use in higher education. It was his belief that audiovisual aids supply a concrete basis for conceptual thinking and help enlarge students' understanding, especially in subjects they find hard to assimilate when traditional lecturing methods only are used. Audiovisual aids can add a useful variety to lecturing, reinforce the learning students gain from other teaching resources, and have a high degree of interest for students. He emphasized that an especially unique aspect of audiovisual aids is to provide experiences not easily obtained through other avenues, thus contributing to the efficency and depth of students' learning.

Factors Affecting Adoption of New Media

Many factors contribute to the use of audiovisual materials: availability of materials and equipment, attitude of the teacher toward the audiovisual approach, adequate financial support, reaction of the school administrator, applicability of the technique in particular teaching situations, and perception of educators of the function served by the materials. Little research has been conducted to determine the extent to which audiovisual materials are used for instructional purposes, but it is apparent to everyone associated with the educational establishment that audiovisual materials are widely employed in teaching (Tauber and Stephens, 1965).

Rossi and Biddle (1966) discussed certain characteristics of instructional media that are instrumental in aiding or slowing up adoption by school systems. Cost is one of the most important factors affecting adoption of new media -- the cheaper the medium, the more likely it is to be adopted. Flexibility, i. e., usefulness of the medium for a variety of educational purposes, is another important factor. Other media may be adopted if they support or slightly modify present educational practices rather than if they displace or change them. Popularity and effectiveness of a medium in relation to student response is another important factor in the adoption of a medium.

Two problems confront college and university administrators concerned with innovation -- the process of getting it underway and the process of evaluating it. Innovation that is generated within the institutuion by faculty members themselves is likely to be more significant in its effects, better tested and evaluated, and longer lasting than change that is imposed by force from other sources (Wessell, 1967).

TYPES OF INSTRUCTION AND RELATED STUDIES IN FOODS AND NUTRITION

Programmed

Programmed instruction is a process, i.e., a sequence of events leading to a set of desireed instructional outcomes, each time the sequence occurs as designed (Brown et al., 1969). All programmed materials, according to Jacobs et al. (1966), have certain features in common. First, they require the student to focus his attention on a limited amount of material at one time. Second, they require him to respond in some way to each segment of material. Third, they give him immediate knowledge of

results after each response. These three features in a sequence constitute what is called a learning cycle; the learning cycle is a number of frames repeated many times in a program. Programmed instruction is not limited to any particular medium of presentation; material is presented in a manner that implements the learning cycle and usually permits self-paced work. Programs may be presented on paper for reading, on tapes for listening, or on television and films for watching.

Unlike many of the competing technological innovations, programmed instruction and teaching machines were developed explicitly for education. Because programmed instruction comes from a background of psychological theory and research, it has continued to have criteria and standards associated with its development that are quite different from those of other innovations. For example, it is characteristic of the procedure for developing programs to include a research effort designed not only to determine instructional effectiveness of the program, but also to find answers to scientific and technological questions (Jacobs et al., 1966).

Programmed instruction has been used effectively with students who vary in terms of age, level of ability, and kind of background. Studies have shown that individuals differ markedly in the amount of material they can learn and in the amount of time they take to complete a program. Different learning rates are not new in education but programmed instruction makes them more apparent (Jacobs et al., 1966).

Several advantages have been claimed for the use of programmed instructional materials: (1) they permit individualization of instruction, (2) they can reduce the amount of time required to teach, (3) they can improve the level of performance and reduce the incidence of failure among students, and (4) they permit assessment of reasons for successful

and unsuccessful experiences (Brown et al., 1969).

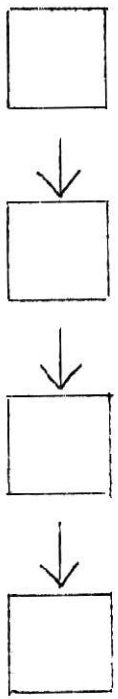
Jacobs et al. (1966) reported the educational principles that programmed instruction is based upon. Programmed instruction makes all instruction goal-oriented; each program step is intended to help the student acquire specific knowledge or skills, with superfluous material excluded. The instruction is organized into an effective sequence, with each step building upon preceding ones. Only one point is presented at a time. Active involvement of the student in the learning process is an important aspect of programmed instruction; the student responds in one way or another to every frame. Each student is allowed to proceed at his own rate. Finally, the student receives immediate knowledge of the results, i.e., whether he is right or wrong. The latter is a vital principle of programmed instruction.

Two types of programming which have been developed are linear, and branched or adaptive (Brown et al., 1969). A linear program is one in which the sequence of information presented to the student is fixed; i.e., all students are given the same stimuli in exactly the same sequence. A branched or adaptive program differs from a linear one in that the presentation sequence of the branched program is adjusted on the basis of what the student does (Thomas et al., 1963).

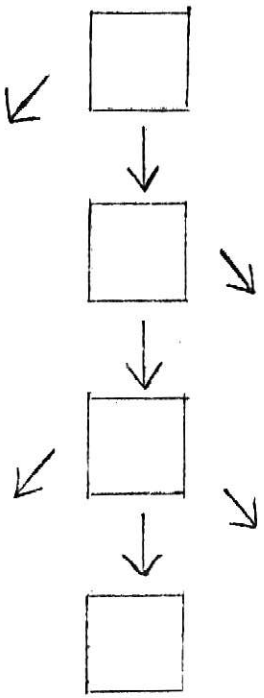
Figure 2 illustrates the various program patterns for linear and branched programming. It can be seen that branched programs are more adaptive than linear ones, especially in providing paths that vary with needs of students as indicated by their responses. Decisions about media to be used in program presentation are primarily based on the kinds of learning conditions needed to develop the types of student performance called for by the objectives (Brown et al., 1969).

Fig. 2 - Program patterns (Brown et al., 1969).

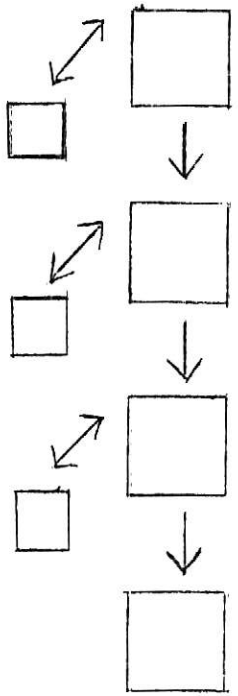
Linear
(Single Response)



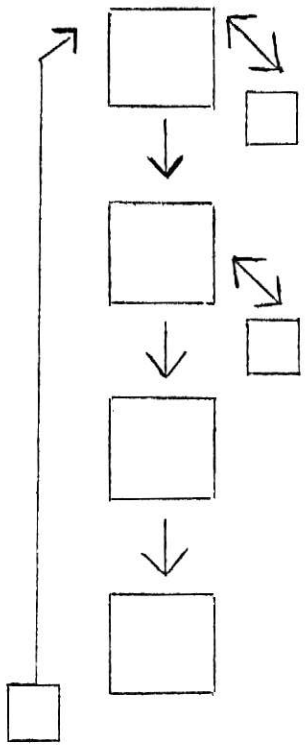
Linear
(Multiple Response)



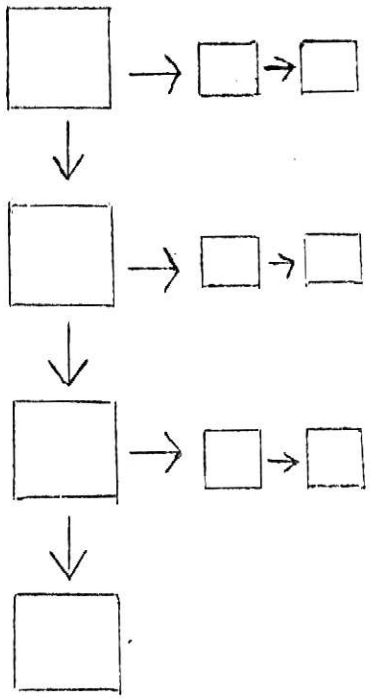
Branched
(To explain wrong answers)



Branched
(To remedial sequence)



Branched
(To skip known content)



Problems in classroom management which may arise when programmed instruction is used include the following: (1) students may finish at different times, therefore the teacher must provide those students who finish early with enrichment materials; (2) commercially prepared programs vary in their effectiveness and goals; (3) only a limited number of subjects are programmed commercially, therefore availability is restricted; and (4) as much time is required to write a good program as to write a good textbook (Brown et al., 1969).

McKeachie (1967) reported that students learn faster in the programs than in conventional lectures. He stated that in some cases, achievement is higher for the programmed learners and one must judge, if the program is tailor made, whether the extra investment in time will be justified by the gain in learning.

Weber (1965) studied programmed instruction as a means of teaching basic nutrition. Her assumption before conducting the study was that the learning of concepts and principles as well as depth of understanding in a discipline would be facilitated by this teaching method. Concept information and basic fundamental facts were delineated and developed into generalizations at an appropriate level. Students were given a pre- and post-test to measure the effectiveness of the program. The programmed instruction was held for two weeks of a three-week period; one week of homemaking activity not related to nutrition was held between the two weeks of programmed instruction. The mean post-test scores of the students who followed the programs were significantly greater, at the 1% level, than mean scores for those students having the conventional lecture method. It was noted from the students' performance on the questions designed to test above the knowledge level, that the programs taught depths of understanding.

Marovich and Campbell (1968) developed programmed instruction for use in teaching food science. Six phases of the course were programmed: lipids, carbohydrates, proteins, energy transfer, dispersions, and heating media. A pre-test was administered to the students before they studied the program. Results were 20-56% (40% average) correct on the pre-test and 75-99% (91% average) correct on the post-test. The students' comments indicated that programmed instruction could provide a learning situation, and the majority expressed approval of the active participation involved. All preferred use of programmed instruction as a supplement to the conventional method rather than as the sole instructional method.

Audio-tutorial

Audio-tutorial instruction employs an ordinary tape recorder as a programming device to guide and direct the learning activities of an individual student (Erickson and Curl, 1972). Postlethwait et al. (1969) described the audio-tutorial system as one emphasizing student learning rather than mechanisms of teaching. They stated that it involves the teacher: (1) identifying those responses, attitudes, concepts, ideas and manipulatory skills to be achieved by the students; and (2) designing a multi-faceted, multi-sensory approach which will enable the student to direct his own activity to attain those objectives. They pointed out that the audio-tutorial approach makes use of every educational device available and attempts to align the exposure to a sequence of learning experiences which will be most effective and efficient. Key concepts of the approach, flexibility and independence, accompanied by helpful guidance from the teacher when necessary, were considered important advantages.

Self-instruction is rapidly becoming an accepted method of learning,

with teachers and administrators discovering that this technique can be fully as effective as much traditional instruction and yet save time for both students and faculty. Students often learn more with audio-tutorial instruction than with conventional instruction -- making higher scores on achievement tests, developing more positive attitudes toward subject matter, and mastering up to a third more information in a typical course (Erickson and Curl, 1972).

Colleges faced with a shortage of laboratory space may need to curtail or omit independent study because it takes space. The flexibility available in a college student's schedule would permit ideal utilization of an audio-tutorial laboratory. The space allocated for that purpose would permit reduction in other laboratory needs and hence more than compensate for the area and expenditure required (Postlethwait et al., 1969).

Advantages of the audio-tutorial approach discussed by Postlethwait et al. (1969) included the following: (1) students can adapt the study pace to their own rate of learning, (2) interests of better students are not dulled by unnecessary repetition of information already learned, (3) scheduling problems can be simplified, (4) make-up laboratories and review sessions can be accommodated in less laboratory space and with less staff, and (5) the approach can be used to standardize instruction where desirable.

Tope (1969) found that the audio-tutorial approach to teaching a university-level introductory foods course was worthy of consideration. The results of her study indicated that students in the audio-tutorial group performed as well as those in the conventional lecture sections. Students' reactions to the audio-tutorial approach were favorable. The instructors were able to spend more time on a one-to-one basis with the students.

Tope (1969) discussed some problems that may arise when implementing an audiovisual program. These included the suitability of using the audio-tutorial method for the specific subject, recognition of technical deficiences in instructors' handling of equipment, and adaptation of learning theory to psychological issues. However, the greatest problem she actually found was stating instructional objectives clearly.

Individualized

Individualized instruction has long been a goal of American education. Ideally, individualized instruction means an arrangement wherein each student at any time possible can be engaged in learning those things that are most appropriate for himself as an individual. Of course, this ideal can never actually be reached, but we can move toward it (Esbensen, 1968).

Each student in a classroom is a unique person with his own needs, interests, and abilities. He should have the opportunity to work toward achieving objectives that are appropriate for him and be allowed to work at a pace that is challenging, but does not push him faster than he is able to achieve. He should be encouraged to work on an objective until he has reached it, or change to one that is more appropriate for his ability (Dell, 1972).

The teacher's roles in the individualized classroom are managing a classroom, advising students, tutoring, and modifying student behavior. The student in an individualized classroom learns independently. However, he has responsibilities for others as well as for himself (Dell, 1972).

Curricular materials in individualized instruction include terminal and instructional objectives, a list of activities, and several kinds of evaluation instruments. Student activity lists are usually prewritten and assigned uniquely for each student. A teacher in an individualized

classroom uses behavior-modification techniques to help students become self-managed learners. Evaluation is done for several purposes, such as for checking progress on activities or on objectives, for placement in a sequence of objectives, and/or as a survey for continuing achievement of objectives (Dell, 1972).

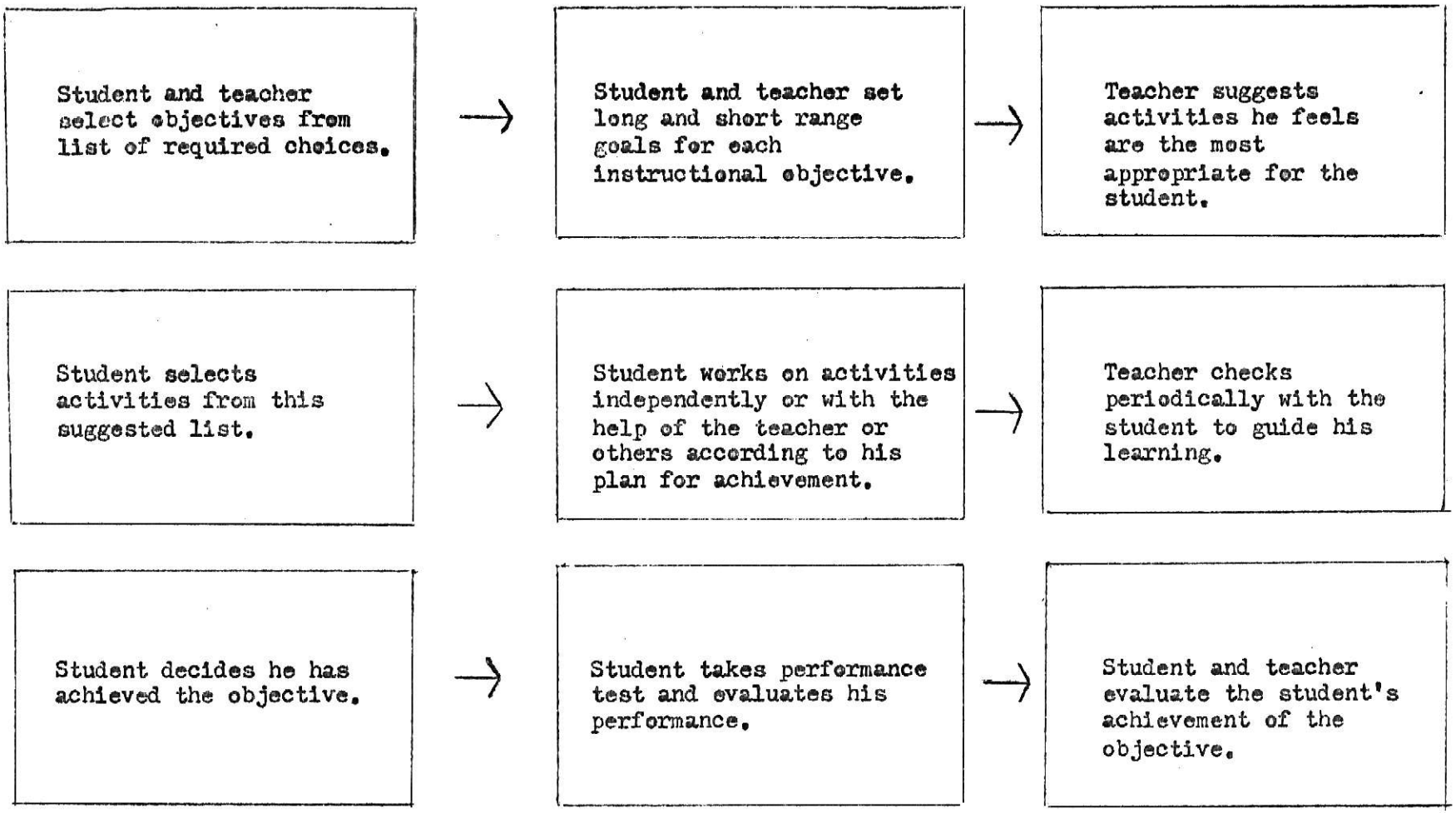
Terminal objectives are general educational goals that provide the basic outline for student curriculums. Such objectives represent the long-range goals of basic education, usually established by the school. Attainment of these goals depends on the achievement of short-range instructional objectives. Instructional objectives should be such that they can be achieved in a few days. The achievement of terminal objectives might take from six months to several years (Dell, 1972).

An instructional objective states what a student is expected to know or do. The purpose of such objectives is to describe the behavior a teacher expects a student to exhibit as part of a learning sequence. Instructional objectives also provide a means by which teachers and students can measure student progress toward long-range goals (Dell, 1972).

Dell (1972) constructed a diagram (Fig. 3) illustrating the possibility of combining individualized instruction with independent learning. By enhancing the positive aspects of individualized instruction, independent learning can help a student develop skills he will find helpful as an adult. Setting goals and formulating plans for achieving those goals are two parts of the student's role as an independent learner (Dell, 1972).

Five possible reasons for using an individualized instructional system were pointed out by Dell (1972). The complexities of our technological society make it difficult for students in the classroom to cover the broad spectrum of basic knowledge. Students are looking for meaningful

Fig. 3 - Combining individualized instruction with independent learning (Dell, 1972).


Student and teacher select objectives from list of required choices.
Student and teacher set long and short range goals for each instructional objective.
Teacher suggests activities he feels are the most appropriate for the student.
Student selects activities from this suggested list.
Student works on activities independently or with the help of the teacher or others according to his plan for achievement.
Teacher checks periodically with the student to guide his learning.
Student decides he has achieved the objective.
Student takes performance test and evaluates his performance.
Student and teacher evaluate the student's achievement of the objective.