Designing instruction adapted to the learner

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ABSTRACT

The philosophical basis on which the Audio-Tutorial System and minicourses were developed is discussed. A brief history of this system as developed at Purdue University and a description of how it is currently being implemented are described and illustrated with photographs and diagrams. The Audio-Tutorial System, combined with use of minicourses, has great potential for adapting instruction to individual students' needs.

Additional index words: Audio-Tutorial System, Minicourses, Individualized instruction.

If one asks, What is the fundamental purpose of education? it should be clear that educators are concerned about more than a delivery system of information. Delivering information may be a part of the process; however, to learn is to change. Education is a process that changes the learner. If one can accept this statement as true, then an important guideline in producing an instructional system is that learning is something that must be done by the learner. The learner must be involved in the process of instruction. Aristotle recognized this principle and used a special technique to ensure learner involvement. Aristotle had a classic method for memory retention. He believed that when teaching an important point, if the student was slapped hard, he would never forget the information.

Today we have many communication tools to involve the learner in the process. These tools fall into four major categories: 1) Tangible items—real things and in a plant science course, tangible items would include things like live plants, models, and experimental equipment; (2) Printed items—books, study guides, etc.; (3) Projected images—including: 2x2 slides, movies, video tapes, and similar devices; and (4) Audio input—Audio input is used so extensively by all of us, particularly in the conventional instructional system, that it does not need to be defended as an instructional tool. Perhaps one should include a fifth category, that of human beings, the interaction between teachers and students, and students with students. This category is a very important component of the instructional design.

Given these facilities where does one begin to design an instructional program? If learning must be done by the learner, one should begin by designing learning activities—actions people take when they want to learn. These learning activities should be sequenced as symbolized below A- B- C- D- E- F with Activity B building on A, Activity C building on B, Activity D building on C, etc. In a plant science course, these activities would include such things as growing plants, measuring things, making critical and careful observations, doing experiments, collecting data from demonstration materials, viewing movies, listening to lectures, and, when feasible, doing carefully integrated programs designed to involve all parts of the human brain in a multisensory exposure to the subject matter. The integration of these learning activities can result in a synergistic effect and provide a more meaningful learning experience.

However, most learning situations can be enhanced by a clear statement of goals or objectives. The objectives are symbolized as A-B-C-D-E-F with the 1-2-3-4 at the right hand side of the diagram to suggest the close correlation between the activities and the product, i.e., achievement of the objective. Objectives should be clearly stated so the student will know precisely what is

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EXPERIENCE AT PURDUE

In 1961 at Purdue University an audio-tutorial approach to learning was initiated in a plant science course. The system has undergone continuous modifications from that time to the present and what follows is a brief look at the current status of the instructional design.

Central to, but only one aspect of the program, are the audio-tutorial lessons which are prepared by assembling the materials which the students will use for their learning activities, and the senior professor (Fig. 2) sitting among these, talking into a tape recorder as if tutoring one student through planned learning activities. The student (Fig. 3) sitting in a similar location with similar materials, thus experiences a simulated one-to-one investigation of the content assisted by the senior instructor.

These materials are multiplied as necessary to accommodate the total number of students enrolled in the course. As just mentioned, this is just one component of the total system. Three major study sessions are involved. A general assembly session (GAS) where all students are scheduled to meet for 1 hour/week, a small assembly session (SAS) involving 8 to 10 students for 30 min/week, and an independent study session (ISS) where each student studies independently and adapts the amount of study time to specific needs.

The independent study session is as follows: A learning center is equipped with the materials used in developing the audio-tutorial program and is open from 0730 hours until 2030 hours, Monday through Friday. Students come in at their convenience and proceed to a check-in check-out station (Fig. 4). Here they will receive special announcements, pick up objectives, appropriate journal articles and then check into a booth by turning over a tag to indicate its occupancy. At the booth (Fig. 5), the student will find those materials associated with a specific minicourse and will arrange the Study Guide and other printed materials as convenient. The student will place the headphones in position and turn on the tape recorder and very likely the first words will be to pick up the object for investigation. The senior instructor will pose questions that will lead the student to do learning activities designed to help the student to achieve the objectives. This may involve comparing a live specimen to prepared charts, reading certain paragraphs from the Study Guide, text, or journal article, viewing projected items such as \(2 \times 2\) slides, having their visual senses amplified through the use of a microscope and, when difficulties are encountered, an instructor (Fig. 6) and a tutor are available to give assistance specific to the student's needs. Materials which are too bulky or too expensive to place in each booth may be placed on a demonstration table or experiment area (Fig. 7) where the student can prepare typical laboratory experiments in the context of theoretical discussions. Again the instructor is available to discuss any aspects of the experiment requiring amplification for a specific student. Since no more than one student is usually at a given point in the study program at one time—one expensive microscope slide can be used for study by 900 students. Video tapes can be integrated into the instructional program at any time video is best adapted to the presentation of the materials.

Since each student is proceeding independently, a refreshment break can be taken whenever convenient. On completion of the study, students can evaluate their progress by practicing on a self-test board and through an audio tutorette.

The room decor is designed to stimulate thinking (Fig. 8) beyond the required content and every effort is made to make the learning center a pleasant place to study. The entry room is equipped with tables and materials to provide the students an opportunity to practice for an oral presentation they will make in the small assembly session.

The general assembly session is as follows: Students meet in a large auditorium and are exposed to conventional lectures,
multi-image presentations, special movies, and other kinds of activities best done in a large group. Content lectures are limited to 30 min of presentation after which students may discuss the content and write a summary.

The small assembly session involves students in an opportunity to talk about plants. Eight to ten students are assembled around a lazy-susan table equipped with the materials that have been used in the learning center the preceding week (Fig. 9). The instructor for this session rotates the table, selecting students at random to make a brief presentation about the materials before them. A student will say what the item is, read the objective appropriate to the item, and then teach the other students about it. The purpose of this session is to require each student to prepare in the same pattern that teachers prepare. It is said, The first time one really learns is when one teaches, and if this is true the procedure should be included in the instructional design. Since students are randomly selected to participate, all students must prepare presentations for all items. On completion of the oral presentations, each student is asked to write a summary of the journal article for the week.

In addition to the oral presentation, each unit of content is accompanied by a written quiz. The written quiz may be taken when convenient in a quiz room manned by a secretary. The arrangement at Purdue is feasible since nearly 1,700 students are involved in the combined botany and zoology courses using the audio-tutorial system.

As senior instructor, my office is always open to any student problems. Each student is welcome to discuss with me personally any concerns he or she may have.

When Dr. Robert Hurst came to Purdue in 1969 to be senior instructor of the zoology course, we asked the question, Would it be possible to divide the content of our two courses into small units to provide students more flexibility in adapting to their individual needs? We embarked on a program using minicourses which would enable us to combine portions of the subject matter in a variety of ways and thus adjust for different backgrounds and goals of most students. The botany course was divided into about 25 minicourses. On examination of these units of subject matter, it was clear several minicourses were common to both botany and zoology. Students then were asked to master the content for each minicourse and in the second course enrollment, these minicourses would not be repeated thus providing the student an opportunity to explore their own interests through study from a pool of optional minicourses.

Materials are set up on a scheduled basis since many biological materials require special preparation and cannot be made available throughout the semester. Students for whom botany or zoology are not prerequisite to advanced courses may select from the pool of minicourses of special interest to them. Prerequisite programs of required minicourses may be sequenced according to the student's enrollment requirements. Students may test out of any minicourse for which they have previously acquired the information.

Basically, a core of subject matter may be required, and the specific minicourses covering this content may be assigned individually or to large segments of the population enrolled in the course. Various activities have been designed to help the student achieve the objectives for these minicourses. This minimal achievement mastered to a 90% level is the equivalent
Fig. 7. Materials placed at a central location to be used by all students enrolled in the course.

Fig. 8. Challenging demonstrations and experiments are produced by tutors and TAs as their contribution for improving the course.

Fig. 9. A lazy-susan table equipped with materials to be used in the talk about biology session facilitates the randomization of student presentations.

of a "C" grade. Higher grades of "A" and "B" are awarded for excellence which require involvement in mind-expanding activities, such as: special research projects, A-B tests, outside readings, etc. Thus, students may use their own initiative to expand their knowledge of the subject matter which is most interesting and useful to them.

SUMMARY

At Purdue University the audio-tutorial system has worked well in the botany and zoology courses; however, as indicated at the beginning of this presentation, one should not begin instructional design based on a treatment or delivery system. Never in the history of man have so many communication devices been available to the teacher. The teacher can employ many avenues to convey his message to the learner, and the program he designs permits the student access to the instructor in a great many more dimensions than through the printed word only. The nature of the message is limited mainly by the imagination of the originator, the capacity of the technical devices to faithfully record and transfer the information, and ability of the recipient to interpret the stimuli he receives.

The responsibility for the outcome of the instructional program lies squarely on the shoulders of the two intelligent components of the system—the teacher and the student. One should expect the results of the media use to be dependent on the cleverness of the originator of the message and the capacity of the recipient to interpret that message. The mere involvement of more and varied communication tools does not guarantee success. The challenge is to use these tools effectively. This may require some daring and experimentation by teachers.

Nehemiah Grew said, "Paradoxical as it may seem, there is nothing so constant as change." It is true that our world is changing at a phenomenal rate. Wouldn't it be a paradox also if those of us (teachers) who prepare the younger generation to live in a changing world were resistant to change ourselves?

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FURTHER READING

