The Audio-Tutorial System of Teaching Biology

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The audio-tutorial system of teaching has been used in the teaching of foreign language for several years. More recently the same type of system is being used for instruction in science in beginning courses at the higher education level. One of the first developers of this system in biology was Samuel N. Postlethwait of Purdue University (1963). Since this initial step, the Burgess Publishing Company has developed an *Audio Tutorial Biology Series* using material from various authors.

The course discussed here is taught at Meramec Community College, one of three campuses of the Junior College District of Saint Louis and St. Louis County, Missouri. This is a recently formed district and every aspect of the institution is under construction. The course, Introductory Biology, is offered for 4 credit hours and meets twice a week for approximately 6 hours. Approximately, because a typical class will come together in full session for only 1 to 1½ hr per week. The rest of the time is spent in the audio-laboratory during periods when the student has some free time. A brief description of the three types of student activities may make this clearer.

The course has two types of study sessions. An Independent Study Session (4½ hr/wk), a Group Discussion Session (1 hr/wk). The times are approximations as the type of material and the help needed vary. The independent study is done in a learning laboratory which is open from 8:00 AM–9:00 PM each week day with the exception of Friday afternoon, that being the afternoon that the next week's laboratory is set up. An instructor is on duty at all times to give directions and personal assistance to students as they may require it. A student may report to the laboratory at his convenience and study until he is satisfied. He may repeat the study as many times as he feels necessary and to the depth he may desire. The activities may include experimentation, observation of demonstrations, study of specimens, photographs, charts, slides, minor research projects, reading original research papers, reading of text, conferences with students and teachers, and solving study problems. All booths are set up identically and contain material appropriate to the week's work. This includes a tape player and the week's tape. It may include a microscope, literature, diagrams, charts, or other appropriate materials. Materials which are too bulky for inclusion within the booths are placed on a demonstration table or elsewhere in the laboratory as appropriate.

Tapes have been prepared by the biology staff of Meramec Community College and tutor the student through a variety of learning events. These may include listening to a brief lecture introducing the subject for the week, reading from appropriate passages in the text or a *Scientific American* article, doing an experiment, examining specimens, viewing demonstrations, filling in charts or diagrams, examining models, viewing an 8-mm movie, carrying on discussions with fellow students or the teacher on duty, or any other kind of activity commensurate with the objectives for the week. All activities which can be done under the conventional system can also be done under this system with the added feature of self-pacing by the students while being tutored by the staff member in the course

A typical study program on the subject of behavior might proceed somewhat as follows: The student on checking into the laboratory and having assigned himself to a specific booth puts on the headphones and turns on the tape player. The voice of the instructor may discuss various types of behavior and give some examples of experiments which have been carried on to study behavior. One objective might be to have the student study the behavior of mice in a maze. Materials for this activity would be available nearby in the laboratory, and the student would leave the booth to carry out this experiment, using the study guide as a manual. In the booth might be plants which had been treated with hormones or subjected to environments which changed their normal growth patterns. These would be pointed out by the voice on the tape with appropriate data tabulated on a chart nearby. Diagrams in the study guide might be labeled and further instruction or discussion via the tape may indicate subsequent activities for the student. If the student encounters difficulty at any point in this sequence of study events, the teacher on duty is available to give assistance.

In the group discussion session, the instructor directs the study. It includes the giving of general directions and announcements, movies, and items of this nature; but most importantly, it is the occasion for integrating and orienting the subject matter so that the student may appreciate its significance. The main objective in this session is to project to the student a personality for the course and to set an intellectual tone. The major effort is directed toward motivation and rapport.

Ideally the quiz session is divided into two parts. The first part is an individual oral examination over the material covered during the week. The second session is a group paper-and-pencil test over the week's material. To be eligible for the written test the student must have passed the oral examination.

The list of topics in the text (Marnum et al., 1965) studied in the one-semester course at Meramec Community College includes:

Life, The Microscope, The Cell
Chemical Background for Biology
Bio-chemical and Bio-physical Properties of Protoplasm
Molecular and Cellular Reproduction
Mendelian Genetics
Modern Genetics and Population Genetics
Enzyme Activity and Vitamins
Photosynthesis
Respiration and Energy Utilization
Animal Embryology and Plant Development
Homeostasis and Coordination, Animal and Plant Hormones
Nervous System and Animal Behavior
Internal Fluids: Animals and Plants
Comparative Study of Animal Respiratory, Digestive and Circulatory Systems
Plant Reproduction
Animal Reproduction

The advantages of this system of teaching over the conventional approach of 2 lectures, 1 recitation and 1 laboratory have been expressed very nicely by Postlethwait (1963).

1. Emphasis is placed on student learning rather than teaching.
2. Students can adapt the study pace to their ability to assimilate the information. Exposure to difficult subjects is repeated as often as necessary for any particular student.
3. Better students are not a "captive audience" and can use their time most effectively. Their interests are not dulled by unnecessary repetition of information already learned but they are free to choose those activities which are more challenging and instructive.
4. The students can select a listening time adapted to his diurnal efficiency peak.
5. Tapes demand the attention of the students. Students are not distracted by each other.
6. Students have more individual attention if they desire it.
7. Scheduling problems is simplified. The four hours of scheduled time from which the students are relieved under the new system can now be distributed throughout the week as necessary to adjust to the student's activities.
8. More students can be accommodated in less laboratory space and with less staff.
9. Make-up labs and review sessions can be accommodated with a minimum of effort.
10. The student feels more keenly his responsibility for his own learning.
11. Each student is essentially "tutored" by a staff member.

First-hand experience with the course at Meramec Community College of The Saint Louis and Saint Louis County Junior College District indicates that these advantages are very real. It is my belief that the one characteristic which far outweighs in importance any other consideration is the opportunity which the student has for personal confrontation with the instructor. This not only helps the student at the unique time when help is most needed, but also gives the teacher a chance to evaluate his various approaches to the topic and select ones which are successful with the different types of students. Any system which gives this amount of student-teacher contact cannot help but be a step in the right direction.

Literature Cited

Postlethwait, Samuel N., Harvey D. Telinda, David D. Husband, Bert M. Johnson, and others. 1963. *Audio Tutorial Biology Series.* Burgess Pub. Co., Minneapolis, Minn.

Marnum, Marvin R., Louise K. M. Peardon, Robert J. Gillespie, and Arnold J. Greer. 1965. *A Study Guide and Laboratory Manual for Introductory Biology—Biological Audio-Tutorial Studies.* Unpublished, St. Louis and St. Louis County Junior College District.