Micro-Teaching Tapes in Anatomy and Physiology

John E. Stencel
Olney Central College
Olney, Illinois 62450

How many times have students understood most of your lecture, but were not sure of a particular concept or would have liked to go over that mechanism one more time? How often have you tried to help a student, but could not because he had another class, or had to go to work, or had to participate in extra-curricular activities? And how many times has a student been absent when you presented a difficult concept, and been unable later to understand another student's notes? These questions were answered with the development and use of micro-teaching tapes as a supplement to my anatomy and physiology classes.

Individualized Instruction

Individualized instruction is a valuable tool for independent, self-paced learning. In the late 1960s and throughout the 1970s, Postlethwait, Novak, and Murray (1972) and others set the pace with audio-tutorial instruction replacing the large lecture hall with individual carrels and tape decks. At about the same time, Postlethwait and Russell (1971) introduced the mini-course unit lasting from fifteen minutes to hours dealing with single conceptual units of subject matter. Creager and Murray (1971) subdivided a course into individualized modular units, each unit with definite objectives, a pre-test, a modular program, a post-test, and a modular assessment. They emphasized that, within the modular program, the student should participate actively. Since then, many individualized instructional techniques have been developed, including Heimler and Cunningham's auto-instructional science kits (1972), Smith (1972), Elston's learning activity packages (1979), and Hertzler's tape tutor-assisted instruction (1978).

The use of small informal lectures has been successful at Olney Central College. Students can openly share viewpoints, challenge questions and information, or solve problems as they are currently presented. Micro-teaching tapes are offered as a supplement or self-tutor. A micro-tape involving a brief explanation of a difficult concept taken from a lecture is not just another presentation, but it is a series of stages involving student participation. As the student listens to the cassette tape, he fills in blanks, answers questions, or writes down information. The student becomes actively involved in the learning process.

Reasons for Micro-tapes

The micro-tape approach was selected because:

1. It aids the student in repeating a difficult concept over and over when he has time to learn it.

FIGURE 1. Student uses cassette player and micro-teaching package at park bench.

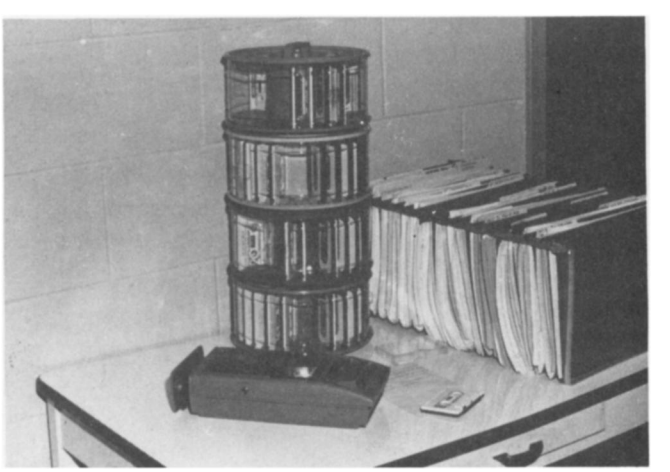

FIGURE 2. Retrieval system in Learning Skills Center. Cassettes and outline sheets are easily accessible for student use.

2. Since many of our students commute many miles each day, they can take these units home and study them overnight. Students who do not have cassette players may check one out from the Learning Resources Center or Learning Skills Center. (fig. 1).

3. If a student is absent and misses a difficult concept, he can hear and see it explained in a micro-unit and not be confused by a set of unexplained notes from another student.

4. It provides another mode of actively learning the material. The explanations on micro-tapes are usually different from classroom presentations.

5. By constructing micro-tapes, the instructor learns the material better and can present the concepts in a more knowledgeable, lucid manner in the classroom.

6. The micro-tape units can be used as background or remedial tapes for review or as new knowledge missed somewhere else. Some micro-tapes can be used for enrichment.

Selecting Pertinent Micro-units

I noted that a number of students did poorly on essay questions, especially those dealing with the physiological mechanisms. Some students could not understand a difficult concept explained only once in class. Many times, I would go over a concept after class or explain it during an office hour. But how many students who did not understand the concept would not come in for help or could not reach me?

After going through my lecture materials, I selected the most important and difficult concepts and arranged them in a list. The list was rated by students from 1 to 5, with 5 the most important. The micro-tape units I began with are listed in table 1. Later, additional micro-tapes were selected from student requests, many of these resulting from testing experiences. After student conferences, suggestions were given for other micro-tapes.

TABLE 1. Suggested Topics for Micro-tapes

1. The ovarian cycle
2. The capillary bed, filtration, diffusion, and osmosis
3. The automatic nervous system
4. The nerve impulse
5. DNA-RNA and protein synthesis
6. Anatomy of a nephron
7. Physiology of a nephron
8. The micturition mechanism
9. Chemical transmission across a synapse
10. The breathing mechanism
11. Acidosis
12. Alkalosis
13. The anatomy of a muscle fiber

Micro-tape Construction

After the pertinent micro-tape units are selected, a set of performance objectives should be written. Each set should state given conditions. They should also list skills to be learned and include some method of evaluation to test whether the skills were understood. In the latter case, a post-test score of 80 percent correct was the method of evaluation. I selected a diagram or flow sheet to explain the method or concept and then wrote a script to explain it. The script answers all performance objectives. Students skip the micro-tape unit if they get 90 percent right on the pre-test. After completing the micro-tape unit, they take a post-test; if they score less than 80 percent on it, they listen to the tape again.

All micro-tape units are very short, lasting from four to fifteen minutes. Thus, a student can listen to the tape over and over again within an hour. Usually references are included that are on reserve in the library. Some micro-tapes refer to pre-tapes that might help the students understand the current micro-tape, but most micro-tape units are self-contained learning experiences. Included in the micro-tape unit is an evaluation sheet that the student completes. This helps the instructor in making corrections, additions, and revisions for the current or revised units.

Statistical Analysis

To ascertain any statistical verification of learning, a micro-tape entitled the Temin Provirus Cancer Hypothesis was administered collectively to 41 freshman anatomy and physiology students and 41 faculty members at Olney Central College. The students had the materials presented in lecture and were tested on it a month ago. The faculty was never exposed to the material.

In the pretest, 54 percent of the students scored 80 percent or better while 88 percent in the post-test scored 80 percent or better, showing a 34 percent increase in learning. None of the O.C.C. faculty scored 80 percent or better on the pretest. However, 63.42 percent scored 80 percent or better on the post test, showing an increase of 63.42 percent in learning.

Additional Aids

Through an Olney Central College institutional grant (SPARK FUND), I was given money to purchase one hundred twenty-minute (ten minutes on each side) cassette tapes. The Learning Resource Center duplicates some fifteen tapes per unit; ten are stored in the Learning Resource Center and five in the Learning Skills Center (fig. 2). Both centers have cassette players for student use or check-out. Tape units can be checked out for only one school night so that students will listen to them soon, and so that more students can use them.

Continued Demand and Revisions

For the last two years, I have been accumulating new micro-tape units and revising some of the old ones. It takes about ten to fifteen hours to complete a micro-tape unit. Evaluation shows that students use and enjoy listening to the micro-tapes and that the tapes have been helpful in learning the more difficult concepts of human anatomy and physiology.

References

CREAGER, J.G., and MURRAY, D.L. 1971. *The use of modules in college biology teaching.* Washington, D.C.: Commission on Undergraduate Education in the Biological Sciences, The American Institute of Biological Sciences.

ELSTON, T. 1979. *Inservice workshop in competency-based occupational instruction for vocational educators.* Learning Activity Packages. Springfield, Ill.: State Superintendent of Education.

HEIMLER, C., and CUNNINGHAM, J. 1972. Autoinstructional materials in science methods courses. *American Biology Teacher* 26(1):25.

HERTZLER, E. 1978. Tape tutor-assisted instruction. *American Biology Teacher* 40(5):272.

POSTLETHWAIT, S.N., NOVAK, J., and MURRAY, H.T., Sr. 1972. *The audio-tutorial approach to learning, through independent study and integrated experiences.* 3rd ed. Minneapolis: Burgess Publishing Co.

POSTLETHWAIT, S.N., and RUSSELL, J.D. 1971. Minicourses: The style of the future? *In* Creager, J.G., and Murray, D.L. (eds.) *The uses of modules in college biology teaching.* Washington, D.C.: CUEBS.

SMITH, J.E., Jr. 1972. The learning activity package. *In* Kapfer, P.G., and Kapfer, M.B. (eds.) *Learning packages in American education.* Englewood Cliffs, N.J.: Educational Technology Publications.

Making the Most of Onion Root Tip Mitosis

Marshall D. Sundberg
University of Wisconsin-Eau Claire
Eau Claire, Wisconsin 54701

Prepared slides of onion (*Allium cepa* L.) root tips are commonly used to study the process of mitosis. In many instances the student may simply be required to recognize and identify the various mitotic stages. These same slides may be used to fuller advantage both to provide a greater insight into the process of mitosis and to demonstrate the roles of cell division and cell elongation in the growth of the root.

The objectives of this article are to present two laboratory exercises using onion root tip slides which I have found to be successful in my introductory college botany course. The first, demonstrating the duration of successive mitotic stages, is incorporated into the laboratory on mitosis. The second, part of the root lab, graphically demonstrates the roles of cell division and cell elongation in the growth of the root. The only equipment needed are slides of onion root tips and compound microscopes.

Duration of Mitotic Stages

This exercise is conducted after students have learned to recognize the various stages of mitosis as viewed under a microscope.

Each student must obtain an onion root tip slide and locate the region, slightly behind the root cap, where the greatest mitotic activity occurs. This area should then be centered, under high power, in the field of view. Once a field is chosen, the slide should not be moved and only the cells within that field will be examined. Each student should then proceed to fill in the section of table 1 labeled "STUDENT, Number of Cells/Stage." The individual student data are then cumulated to provide "CLASS" data.

One basic assumption of this exercise is that in an active meristematic region, the frequency of occurrence of a given mitotic stage is proportional to its duration. That is, the longer the duration of a stage, the more cells in that stage will be found. A second assumption is that the duration of the cell cycle in onion root tips, from the beginning of interphase to the end of telophase, is about 24 hours (Mazia 1961). The duration of each mitotic stage may now be estimated using the following equation:

$$\text{time/mitotic stage} = \frac{\text{number of cells/stage}}{\text{total number of cells}} \times \frac{24\,\text{hr.}}{\text{mitotic}} \times \frac{60\,\text{min.}}{1\,\text{hr.}}$$

Students should now complete table 1 by estimating the duration of each stage based on their own data and the cumulative class data. The data presented in table 1 are representative for a class of twenty students. The estimates obtained from this procedure are relatively accurate. The durations of prophase, metaphase, anaphase, and telophase in onion root tips are 71, 6.5, 2.4, and 3.8 minutes respectively (Cohn 1969). The lower-than-expected figure for prophase nuclei is probably due to the students' inability to differentiate between interphase and early prophase, but this is a minor deficiency. In addition, the exercise demonstrates the use of large population sampling to obtain more accurate results. A number of students may completely lack one or even two stages in their individual results, but these gaps will be balanced by their classmates' data.