Impact of Auto-Tutorial Laboratory Instruction in Biology on Student Attitudes

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The objective of the study described in this article was to determine the effects of auto-tutorial laboratory instruction on student attitudes toward learning at Skyline College. Our course, "Man in a Biological World" is a lower-division, general education life sciences course designed for non-biology majors. It had been taught in a lecture-laboratory format for five semesters. Students attended three lecture hours each week and a scheduled three-hour laboratory period, which began with a 50- to 90-minute introductory lecture. At least two sections of the course were offered each semester; the laboratory exercises for each section were identical. However, the introductory lecture varied from instructor to instructor. The course content, testing, and grading were the same for all students.

Brewer (1974) cites two disadvantages for this conventional approach, including:

1. The quality of material varies with the instructor.
2. The instructor repeats the same material with decreasing enthusiasm.

All students are different, and instructional methods should reflect students' individuality if they are to provide maximum learning opportunities (Bloom 1973). Meleca (1973) views the auto-tutorial approach as a viable means of teaching biology to non-science majors. Auto-tutorial instruction has a distinct advantage over conventional instruction (Sturges and Grobe 1976). At Purdue University, auto-tutorial students performed at the same level as conventional students but with greater convenience (Hechinger 1970). Brewer (1974) reports that the auto-tutorial students were "virtually unanimous ... that this particular audio-visual course (Plant Anatomy) provides a superior atmosphere for effective learning."

Auto-tutorial instruction allows the students to take as much time as necessary to learn in a non-competitive environment (Douglas 1976), and students who succeed develop self-discipline (May 1977).

Procedure

Our course included fifteen specially designed minicourses. These were based on laboratory exercises and study guides used in conventional instruction. Each minicourse included the following:

1. A study guide with from four to twenty pages.
2. A slide-tape module consisting of approximately sixty-five color transparencies synchronized with a twenty-minute cassette tape.
3. Laboratory experiments performed by students.
4. An optional activity required of students contracting for a grade of A or B. The Grade Option Activity was a related experiment designed to

FIGURE 1. Student studying slide-tape module in the laboratory. Photo by LeeRoy Kloezeman.

FIGURE 2. Students often worked in small groups to complete experiments. Photo by Isao Tanaka.

provide students with more advanced conceptual material.

5. A fifteen-point objective posttest.

6. A minicourse evaluation.

Students attended three lecture hours each week and laboratory "by arrangement." Each week, students were assigned one minicourse; the experiment, study guide, and posttest were to be completed by the following Monday. Students spent as much time in the laboratory as they felt necessary. The laboratory was open to students for approximately twenty hours during the week.

After reading the study guide, the students watched the module. The module was set up on a portable carrel in the back of the laboratory (fig. 1). We had two carrels, each with four sets of headphones.

Students worked individually or in small groups (fig. 2). A student assistant was available at all times to help with experiments, answer questions, and administer posttests.

After completing the experiment and all the questions in the study guide, students turned in the study guide and took the posttest, which was immediately scored and returned.

Data Collection

We required students to complete a minicourse evaluation after taking the posttest. Summative course evaluations were obtained from 20 conventional students and 31 auto-tutorial students.

We conducted a summative evaluation of the laboratory portion of the course at the end of a semester of conventional instruction. During the following semester, the auto-tutorial laboratory instruction replaced the conventional presentation; we had students complete the same summative evaluation.

Responses to selected questions on the summative evaluations are given in table 1. We used the first question to determine whether the students perceived that the laboratory exercises accomplished stated objectives. Eighty percent of the auto-tutorial students responded that the objectives for each laboratory exercise were accomplished compared to 61% of the conventional students. A major difference between conventional and auto-tutorial instruction is in the statement of objectives. The study guides used for conventional students did not have stated objectives; therefore, students had no means of knowing whether they achieved their learning goals. That the students felt they had accomplished the objectives suggests that auto-tutorial instruction promoted learning.

The students were asked to rate the laboratory exercises (Question 7, table 1). Students who had received individualized instruction rated the laboratory exercises higher than students receiving conventional instruction. The study guides used in the laboratory exercises were essentially the same for both semesters. We only modified the study guides to clarify procedures that were necessary for students to

TABLE 1. Student response to selected questions

Data expressed in percent. Conventional students—N=21. Auto-tutorial students—N=31.

		Agree	
		Conventional	*Auto-tutorial*
1.	Objectives for each lab exercise were reached.	61 (A+B)	80 (A+B)
2.	Overall evaluation of lab exercises. A=excellent; B=good; C=average; D=below average.	76 (A+B)	90 (A+B)
3.	Found labs stimulating.	66 (A+B)	70 (A+B)
4.	Labs were relevant to my interests.	42 (A+B)	77 (A+B)

work independently. In the process, we added objectives and lists of materials. The data and questions directed the students' attention toward particular events during their experimentation and also provided criteria for grading the study guides.

Question 3 asked students to respond to the statement, "The labs were stimulating." The auto-tutorial students gave the laboratory exercises higher ratings than did the conventional students. This indicated that the students may prefer to be in charge of their own educational experiences. Seventy-seven percent of the auto-tutorial students, as compared to 42% of the conventional students, agreed with the statement in Question 4, "Labs were relevant to my interests." Because the laboratory exercises were identical for both groups, this suggests that students respond favorably to individualized instruction.

We also asked students to respond to two statements regarding the minicourse, "Ecological Adaptations of Tracheophytes." These statements were:

"I found this minicourse stimulating."

"This minicourse was relevant to my interests."

Only 40% of the students said that the study of plants was relevant to their interests; however, 70% found the minicourse on plants stimulating. These results indicate that the students were more stimulated by the teaching method than by the content.

A course for non-science majors should provide the necessary tools for interpreting genetic regulation, nutrition needs, and population growth (Dodge 1976). A laboratory course provides students with experiences that facilitate learning. However, the course must be accessible to students. Conventional courses require students to commit a three-hour block of time. With the added flexibility in scheduling it provides, the auto-tutorial approach to laboratory instruction may enable students who might otherwise not have time to enroll in a laboratory science course.

Students reacted positively toward auto-tutorial instruction. They enjoyed their learning experiences and felt they were achieving. Auto-tutorial instruction does not have to be used for an entire course, but can instead be incorporated into selected segments of a course when appropriate (Postlethwait, Novak, and Murray 1972). It is a viable alternative method of laboratory instruction for students attending conventional lectures.

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Pre-Labs

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rapidly and smoothly. When half the students were prepared, they also served as instructors. These students explained procedures or demonstrated techniques to their partners or others at their lab tables.

Mandatory attendance at the pre-lab exercises would probably enhance student performance. Our observations of the increased preparedness when half the class was participating suggests that serious consideration should be given to requiring attendance at the pre-labs. We plan to incorporate a written exercise over the pre-lab material for the students to complete and hand in when they come to lab.

We feel that the above measures have contributed to meeting the lab requirements of our course in two hours per week. The pre-lab exercises offer the advantage of uniform instruction for all students and increase use of in-lab time for the study of important concepts.

Drugs

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clause, as students will discover if they write to their Congressional representatives regarding the issue.

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