

## Editorial

### PROGRAMMED LEARNING

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It is only a little more than three years since B. F. Skinner, in an article entitled "Teaching Machines" laid the foundations for programmed learning.<sup>1</sup> Important as this article is, the title is unfortunately misleading. We are interested in learning, not teaching, viz., the title of this magazine. It is a paradox that oftentimes the more the master teaches the less the student learns. In the final analysis, if learning takes place at all, the student must learn by himself. Traditional classroom procedures have often obscured this fact. The student, in effect, often defies us to teach him. Programmed learning, on the other hand, makes it crystal clear to the student that he and he alone must do the task. It is the function of the program to make this task possible by breaking it into small tasks that may be accomplished by almost any one. It reduces the teaching and increases the learning.

The term "machine" has proved to be a poor one for a reason which Skinner could not have foreseen. Experience has convinced many programmers that special mechanical equipment is not necessary. Many language programs today use only a textbook and a tape recorder.

Since the program may consist only of a textbook and a tape recorder, the question would naturally arise in what way the new programmed learning differs from the textbook integrated with the language laboratory. The latter materials, whether arranged systematically (i.e., structurally) into pattern practices or haphazardly into conversation-to-have-your-hair-cut-by, are echoic: the student repeats what he hears until he learns it. The generation of new utterances was left to the classroom or to written "homework." The first was inefficient, since the teacher can really work with only one student at a time; the second led to the constant reiteration of error.

Programmed learning, on the other hand, is essentially maieutic. The student is led by tiny steps to discover the facts

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<sup>1</sup>*Science*, 24 Oct. 58 pp. 969-977. Earlier work, such as Pressey's at Ohio State and earlier articles by Skinner himself, had little effect on the educational world at large.

for himself. Specifically in foreign language study, he is led to create new utterances by himself, apparently without assistance. *Ars est cōlāre artem*. The student is blissfully unaware of how extensive at first this help is, and the good programmer, like the good teacher, gives the student only as much help as he needs. It is essential to withdraw this help by insensible degrees until finally the student stands alone, truly independent of both program and teacher.

Although there are different types of programs, they all have these features in common.

1) The material is broken up into small steps, each step small enough to minimize the chance of error. Thus the student usually practices what is right rather than repeating his own errors.

2) The student knows at once, either by a mechanical contrivance like pulling a lever on a machine or by sliding a mask in a book, whether his answer was right or wrong. If the program is properly constructed, nine times out of ten his answer will be right. This immediate confirmation of his response to the stimulus increases the chances that he will produce the same response when exposed to the same stimulus another time; in other words, he will probably get the answer right the next time, too.

If the student gives a wrong answer, the program has failed to teach this particular point. It has been said, only half in jest, that there are no wrong answers, only wrong questions. It is the function of the programmer to reduce the number of errors as far as seems practical. (The expression is purposely obscure; we do not know what the optimum error rate is.) Those who do not program are not aware of one of the most important effects of the program: the feedback to the man who wrote it. While the writer of a textbook has no real way of knowing where his book is weak, the programmer's own behavior in composing the program is constantly modified by the behavior of the students. He can observe the learning process, either by direct observation through some kind of monitoring, or by tabulation of the errors in the responses. A problem that is missed by 20% of the students is, to a programmer, obviously faulty and is either rewritten or (more often) broken down into several additional steps. The program is thus constantly refined in a way that a textbook can never be.

But suppose that a student does miss some particular point; what then? In this case, he is just where he would have been with a textbook; he must "concentrate," "study" the point that

he has missed and "learn" it, all by some mysterious ability which some students possess and others do not.

Does, then, the program assist the student at every point except those where he truly needs help? Does it tell him then to sit erect, put his feet on the floor, and buckle down like a man? For those who can do it, this is a fine solution. But the programmer is not content with this. He knows that errors will occur. Therefore he builds into the program massive and constant review. The same problem will occur many times in different guises. The programmer who neglects to do this has written a poor program; the one who does it without monotony has written a brilliant one. *Repetitio est mater studiorum*, but mother need not be dull.

At present almost 200 firms are engaged in producing either programs or mechanical equipment for the programs. Needless to say these programs will differ greatly in quality. Some of them will be worthless because the author lacks technical ability in programming. Others will be worthless because of their content. One of the most popular programs to date is a programmed book on English grammar using the old discredited semantic basis for grammatical categories. Tests have shown<sup>2</sup> that, although the error rate on this program is low, students learn little. The structuralist might say that this is because it contains little for the student to learn.

Granted the soundness of the material and programming, the advantages of the program over the textbook stagger the imagination. Compare the conventional class, in which the student makes perhaps one recitation an hour, with a program in which a bright student makes 200 recitations per hour. At the least, I would expect that with programmed learning students would learn twice as much in half the time. But in spite of this enthusiasm I would like to offer a few caveats.

If the program is intended only to replace the usual homework and language laboratory work and utilizes existing equipment and facilities, then the task is not too great. One should look at the qualifications of the programmer. If the program is structurally orientated, then his name should be known to you or to other of your colleagues interested in linguistics. In examining the available programs, you can reject those based on a non-scientific view of language, in some cases at a glance. But as with a textbook, even if the orientation is sound, the material may not be good from other points of view. It is commonly said by teachers that the only way to evaluate a text

<sup>2</sup>*Programmed Instruction*, Vol. 1, Bulletin 2 (Oct. 61), p. 4.

is to teach from it. In a different way perhaps, the only way to evaluate a program is to take it like a student, earphones and all. The correct choice is so important that it would be well worth the time to go through a substantial portion of any program before purchasing it.

Try to pick a program with some sparkle to it. It has been claimed that a program resembles a private tutor to an amazing degree. We would point out that some tutors are crashing bores, and this is true of programs as well.

Finally, consider the testing. Be sure that the author has had the opportunity to profit by feedback from students. Some programs will appear on the market after extensive testing and rewriting; others will appear with no pretesting at all. You should satisfy yourself not only on the results of the test but how extensive it was and under what conditions the test was carried out.

Great caution must be exercised when the use of the program will require extensive new equipment. The purchase of such equipment may conceivably commit your school to the use of programs from only one company. If this is the case, you would need to examine not only all the other foreign language programs your school might use but those in other subjects as well.

If the program is expected to replace the conventional class, we must in all candor point out that the missionary zeal of the programmers is built largely on faith, although they themselves might prefer to paraphrase my words to say "extrapolation of data." Preliminary tests on certain programs have been encouraging, very encouraging. But many of our conclusions are based upon miniature programs which take perhaps half an hour for the average student to complete. To my knowledge, no one has programmed more than the first year of foreign language at the high school level. Will it be possible to construct a four-year sequence in a foreign language? I am betting a substantial portion of my life that it is, but in all honesty I must say that we don't really know.

But whether, as some believe, programming can do *all* the routine drill work which the teacher must now perform, leaving him free for real teaching, or whether it will only supplant the textbook and the pattern practice tapes, this much is clear. A program for the teacher interested in the learning process is what the microscope is for the bacteriologist, what the X-ray machine is for the surgeon, and what the telescope is for the astronomer. For the first time in history we can observe the

learning process of academic subjects. This tool, aided by our linguistic science, will certainly revolutionize language learning and with it, language teaching.

## SELECTED BIBLIOGRAPHY

There are two periodicals in addition to the *Programmed Instruction* mentioned in the notes. They are *AID* (auto-instructional devices), PO Box 4456, Lubbock, Texas, and *Automated Teaching Bulletin*, 1021 North La Brea Ave., Los Angeles 28, California. There are also three standard texts:

*Automatic Teaching: The State of the Art*, edited by Eugene Galanter (New York 1959)

*Teaching Machines and Programmed Learning*, Lumsdaine and Glaser (Washington 1960)

*Teaching by Machine*, Lawrence M. Stolurow, US Department of Health, Education, and Welfare (Washington 1961)