



COURTESY THE AUTHOR

## Program and Pupil

Phil C. Lange

*Controversy and hope  
mark the growth  
of programmed instruction.*

"PROGRAMED instruction" is a developing technology of teaching that draws heavily upon research in the behavioral sciences. Currently it shows at least four faces to the curriculum worker:

1. There is *research*.
2. There is a psychological emphasis now focused on *enforced intensive inter-*

*action* between the individual learner and a carefully structured sequencing of learning activities.

3. There is *empirical determination of the curriculum*—a team effort—that demands specifiable and observable objectives, precise appraisal of the learner, and proof of learning.

4. There is the *production and use of instructional materials and methods*; and there is an associated expectation—pro and con—that the movement will produce materials and procedures which may be automated or learner managed or

may in some way materially lessen the repetitive tasks of the teacher.

This is a mixed bundle of promises and problems. There is abundant literature giving reasons why educational leaders and especially curriculum builders need programmed instruction. On the other hand, programmed instruction, now in its infancy, greatly needs the experience, the sense of curricular balance and the practical help of school leaders and curriculum developers.

### What Are the Questions?

Programed instruction, in the opinion of this writer, has much to offer even in its present form. Its promise for the future—if properly nurtured—is indeed great. Just now, like a child who helps us to see our world anew and review our knowledge by his attention to details and by endless queries, this approach helps us in several ways. It causes us to re-examine the learning process, to remember that it is within an individual learner that learning occurs; to ask again, why learn this, why with this method, and with *what result*.

1. *Research oriented.* It has been shown that programs will teach effectively in a variety of forms. Research that compares techniques and methods—like most research—produces mostly inconclusive data, makes us less certain of older practices and gives us new problems to attack. Yet this movement gains from psychology its discipline of careful observation and research design. Research promises to be its persisting characteristic.

2. *Psychological emphasis.* Behavioral psychologists have incorporated the principle of reinforcement into programing techniques. To give instructional cues to a learner, the programmer elicits observ-

able behavior. This science must be respected. On the other hand, a programmer who makes a religion of teaching only clearly described overt terminal behaviors to one learner faces some limitations. He must realize that some very effective teachers in large classes transmit to students such qualities, for example, as appreciation for poetry, self respect, initiative, creativity and other evasive, yet significant, objectives which seemingly get learned without precise definition.

Teachers know that many students have a background for learning and for being rewarded that makes a constant diet of success rather questionable. For those who like to find their own way through a problem, the step-by-step instruction to an unknown objective is too restrictive. Without belittling the effectiveness of reinforcement principles and of step-by-step sequencing, experienced educators will want more of the psychological attention put on learning that is divergent. They will want to stress learning in which the student becomes the decision-maker as to the terminal behavior and as to the interim steps.

The current emphasis on efficiency in learning is, of course, helpful. We must recognize, though, that neither our cultures nor individuals are consistently committed to efficiency in teaching and learning. In fact, any teacher knows that the digressions and incidental learnings are often very rewarding and enriching experiences. There are assumptions about motives and satisfactions in programs that may take on different coloration with school use. Being right may be reinforcing; but being "one of the boys" may be more so.

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As programing is used with a greater variety of students and teachers it will need to give more psychological attention to certain factors. For example, it will need to study both reinforcers that have become "internalized," and subtle cues unconsciously provided by teachers.

3. *Curricular steps empirically determined.* Sometimes programing is not to be labeled as curriculum development. The determination by programmers of the sequencing of student behaviors has a procedural orthodoxy that under other headings would sound familiar to any experienced developer of curriculum. One programing company issues a flow chart for the production of academic programs. This chart shows more than conventional concern for the nature of the learner, the structure of the subject matter, and the nature of learning and characteristic learning difficulties. The programmers stress an empirical criterion—the fact that the learner *must learn* or the curriculum building and teaching have failed. This is like saying that it is the school that has failed and not the dropout.

This empirical approach gives much attention to the individual. *Each* student is to learn. In fact, a strong argument can be made that in many schools, especially at the secondary school level and beyond, the attention to the individual learner has been subtly eroded by concern for normative behaviors. This can be stated another way: Most schools have administrative and marking systems that are designed to facilitate the sorting process more than to reinforce learning.

Teachers who want student performances that fit a normal curve tend to eliminate from their tests what *everyone* is sure to know and what *no one* will know. Thus too often the most essential learnings—which were so well taught that

everyone learned them—are omitted from "the tests that really count"—i.e., when we really get down to sorting. Tests pay off on peripheral material. Quite the opposite is the nature of curricular emphases in programed instruction, and this may contribute to its efficiency.

4. *Instructional materials and automated instruction.* One narrow way of seeing programed instruction is to examine the teaching materials it has produced. These range from prohibitively costly research programs utilizing computers or other complicated automated devices to inexpensive homemade paper and pencil programs. They follow the pattern of "a dialogue between an asking teacher and an answering student" who interacts with "the deliberate sequencing of questions and answers so that concepts, skills or facts are learned logically, cumulatively and efficiently."

Currently most programs show these characteristics:

- Specific behavioral objectives (usually ungraded)

- Individual pacing (self-pacing, self-operated)

- Small, sequential steps (tailored and researched)

  - Active response (interaction)

  - Immediate confirmation (feedback)

  - Low error-rate (high success)

  - Possibly a record of student performances.

Undoubtedly time will modify some characteristics: for example, individual pacing, small steps, errorless programs.

Actually few programs are yet available. Finn and Perrin,<sup>1</sup> for the year 1961, reported 296 programs; yet not all of these were actually available to schools and 70 percent were concentrated in the

<sup>1</sup> James D. Finn and Donald G. Perrin. *Teaching Machines and Programmed Learning* (OE-34019). Washington, D.C.: Superintendent of Documents, U.S. Government Printing Office, 1962. 85 p.

mathematics and science areas. Using a more rigorous standard for availability, as of September 1962, *Programs*, '62 reported 122 programs of which over 60 percent were in mathematics and science and most all programing dealt with factual right-wrong content.<sup>2</sup>

Some quite ingenious work is now being done with devices and methods that combine audio and visual and other sensory approaches. Most programs, however, are packaged to be book-like, depending upon prerequisite reading abilities.

As for automated instruction for schools, this relates more to future promise than to present practice. Nevertheless, here, too, we note some gains, especially in research. Machine presentation provides an objectivity not always available with a teacher; moreover, with data processing we can analyze factors previously unmanageable.

For a student who otherwise could not reach an expert we can provide one kind of Socratic dialogue. For students embarrassed by laughter from their peers, relief may be afforded by being able to make errors in private. For a student who feels that teachers dislike him, the program is impartial.

For some teachers the programs are doing basic routine instruction, enabling the teacher to give more help to individual pupils. Some teachers complain that the programs control too much of the learners' time, leaving them very little opportunity for work with the teacher.

### Experience To Grow On

The main issues of instructional technology are not to be minimized into nar-

<sup>2</sup> *Programs*, '62 (OE-34015). Washington, D.C.: Superintendent of Documents, U.S. Government Printing Office, 1962. 386 p.

rowly conceived contests, as between a book-format and machine. A new development needs to meet demands for the future as well as the present. We can expect some healthy readjustments as programing gains more school experience.

1. The research spirit of programmed instruction must be nurtured. We need the developing process more than its timely products. We must preserve the real genius of programing as a searching for new ways of solving instructional problems. When the task of building a program is made a part of teacher education, this spirit comes alive in the excitement of analysis, of constructive and divergent thinking. Some educators see a great future for programing as a part of teacher preparation.

2. Although programing has an unbalanced emphasis on individualized instruction, this is now a timely counterbalance to our excessive use of group norms, our obsession with grading and classification.

3. The success factor built into programs could provide a refreshing stimulus for many of the academic underachievers; the ungraded nature of programed materials can provide a flexibility lacking in graded materials; the self-pacing quality of programs suggests that there are no time limits as to how far and how fast a student may go. To reap these benefits, however, most schools will have to make major readjustments in their appraisal systems, their pupil organization and scheduling.

4. Schools will challenge the excessive concern of programmers for the observable, logical and easily programed learnings. Schoolmen want a more balanced curriculum and instructional methodologies. There will be opposition to excessive pressure upon the learner to proceed

along a narrow path not of his original choosing. Schools must give students a taste for setting their own goals and determining their own pathways. Students, too, like to build their own programs.

5. We expect much more speculation about the teacher's influence on the effectiveness of the program being used by the student. In fact, research with automated instruction may make its greatest contribution by revealing the relative importance of different teacher characteristics.

6. Efforts to build programs that will do all of the teaching may be somewhat misplaced in school situations, where competent teachers should be available. In the animal laboratory or in industry the expert personnel may have been very limited. Good teachers should not become mere functionaries—especially not to cater to materials designed to free them of drudgery. Programs for school must provide for teacher involvement.

7. We can expect practical use of programs and the resultant criticism to point up problems of utilization. Educators will demand more and better programs in a much greater variety of content and performance levels. Whatever the format—book or machine—the programs must meet much higher standards of student use. Improved or replaced must be: *faulty* hardware; textbook formats that are too bulky, that lack indexing, that are poorly edited, or that lack teachers' guides and suggested supplementary activities for students.

Accurate information is needed about programs so the teacher can make some initial estimate about the appropriateness of a book for a learner. The teacher needs to have a whole system of materials, programed and others, with cues from performance scales, pre-tests and post-tests.

This should enable him to guide the student at varying speeds and different levels and learning patterns among materials individually most advantageous. Self-pacing along one path or in one medium or one format is an inadequate provision for individual differences.

8. A frequent claim for programing is its promise to free the teacher from routines so as to do really creative teaching. Does this mean: that creative teachers are now limited to routines; that routinized teachers must be reeducated for creativity; that students learn more or differently from creative teaching; that we need a new kind of teaching? For educational leaders there must be more here than meets the eye.

Characteristic of any innovation is the fact that while it changes the lives of its users, their usage gives direction to its development. Programed instruction lends itself to instructional research and thus needs to be nurtured as a process, not a product. Unlike the motion picture movement, which lost its impetus and its contact with learners when locked too soon into one format, programed instruction needs the utilization, wisdom and practical demands of educators to keep it flexible and available to explore and take shape in many usable forms.

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