PROSPECTIVES IN PROGRAMING

Proceedings of the 1962
Center for Programed Instruction
Institutes conducted at Teachers
College, Columbia University; the
University of California, Berkeley;
and the University of Chicago

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FOREWORD

THE PAPERS in this volume were presented at three Institutes in programed instruction conducted by the Center for Programed Instruction, Inc., during the summer of 1962. The Institutes were held at Teachers College, Columbia University, New York; the University of California, Berkeley; and the School of Education of the University of Chicago. Each three-week Institute included 120 class hours, of which these lectures formed an integral part.

The Institutes were established to teach those who would teach others. During the academic year 1961-62, the Center received over forty requests from universities and school systems to conduct summer workshops in programed instruction comparable to the seven given by the Center's staff in 1961. Neither staff nor suitcases with durable enough hinges were available to meet these demands. Therefore, it was decided to conduct three Institutes aimed primarily at school and university people who were, or would be, teaching courses, workshops, or in-service seminars in the field of programed instruction.

The Institute papers are oriented toward a view of tomorrow as it relates to programed instruction. The guest and core faculty members provided information and viewpoints pertaining to their work. In each instance they were encouraged to do some crystal-ball gazing and to predict the state of the art five to ten years from now. As director and core faculty member of the three Institutes, I had extended invitations to participate in the Institutes with the expectation that divergent viewpoints would be expressed. That this was borne out you will discover for yourself as you proceed through the volume.

The book is not an introduction to the field of programed

instruction, nor does it strive to answer questions as to which programs are available for school, military, or industrial use, and how they have been used. It *is* concerned with the psychological, philosophical, pedagogical, and research issues underlying the total concept of programed instruction, with all the ramifications of programed instruction's emergence into the educational spotlight, and, to a lesser but nonetheless vital extent, with all its implications for the industrial and military sectors of our society.

To say that each writer is committed to the growth and development of the field of programed instruction would not be inaccurate. But, by the very nature of this commitment, he has become sensitive to the fact that ideas expressed in a program must be constantly tested, that feedback must be obtained, and that the ideas must then be reworked on the basis of this new information and then tested again. This sensitivity carries over with obvious ease into the realm of theorizing and prognosticating. As one of the authors has stated, in a few years he may well have undergone a radical change of view. This is inevitable in a field as new and rapidly expanding as programing. However, only through the statement of an idea or a viewpoint may it be examined and proved true or false. If false, then, as Charles Darwin has stated, "One path toward error is closed and the road to truth is often at the same time opened."

It is hoped, too, that the reader will approach this collection with a sense of exploration and not necessarily consider it as an exercise in proving preconceptions. Most of the authors have been optimistic about the outlook for potential growth in the field; at the same time they have realistically recognized the problems that must be explored and the questions that must be answered. There is a great need for continued testing and refinement of present methods of programing. The majority of the authors ask for increased use of programs in the daily school setting. Many, who concern themselves with research issues, see room for improving present research techniques. In all probability the viewpoints expressed during the Institutes and in this book would not have been considered ready for launching a year earlier, as the intellectual climate was not right. The field of pro-

gramed instruction had to accumulate a much larger body of knowledge, experience, and programs before many of the divergent views stated herein could have been formulated. Because the Institutes brought together a group of people who possessed the entering behaviors to examine closely, synthesize, and provide feedback on the divergent views, these papers provide to no small degree signposts to the road to truth.

The Institute lectures were all tape recorded for the purpose of providing material for this book. Because of some inaudible portions and occasional duplication, it was not possible to include all the taped material. It may be stated with certainty, however, that over 90 per cent has been included. In most cases the authors have revised their material somewhat or incorporated in their papers portions of the postlecture discussions. Discussions conducted during meals and evening tête-à-têtes helped to clarify many of the ideas presented at the formal meetings. Although not recorded for posterity, those "off-stage" discussions helped to shape the thinking of the faculty and the participants, and thus in large measure determined the intellectual climate of the Institutes; in addition, they affected to a significant degree the final form of the papers in this volume. Following the predictions made during the summer Institutes, each author was permitted an opportunity, during the fall months of 1962, to review and revise his views. In three instances the question-and-answer discussions immediately follow the formal paper. The curriculum of the Institutes, with topics covered, exercises provided, a typical schedule, and a list of the films and texts used during the three-week period, may be found in the Appendix.

The book was designed to serve a number of purposes:

1. To serve as a text or source book for courses, workshops, and seminars in programed instruction.

2. To provide some food for thought for those who are actively engaged in the field.

3. To give the ever busy administrator and classroom teacher, whether they be in the educational, industrial, or military sector, facts about, and theoretical concerns of, programed instruction.

4. To serve as an up-to-date compilation of thinking in the

field for the parent or lay reader who has a basic knowledge of this area and is interested in learning what tomorrow may hold for programed instruction.

The book is organized into five sections, each of which is an independent unit. The reader who is concerned with a specific area may select the section or sections of most interest to him. However, the book has been arranged so that the earlier papers present a framework for understanding the later chapters that are concerned primarily with research and development issues. Thus, the general reader may begin with the first chapter and read through the entire collection. A general overview of all the sections may be obtained, prior to a detailed study, by perusing the articles by Barlow, Crowder, Basescu, Filep, Finn, and Glaser. Some chapters are vignettes that provide a change of pace for the start-to-finish reader. It is hoped that the references provided by each author will offer a fountain of information for the reader who thirsts to learn more about the topic.

It is impossible to name everyone who has contributed to the success of the Institutes and the preparation of this volume. But to our hosts, Professor Max Brunstetter and Professor Phil Lange at Teachers College, Professor Richard Crutchfield at Berkeley, and Dean Francis Chase at the University of Chicago, sincere and heartfelt thanks for their part in providing the facilities and moral support which enabled the Center to present the Institutes on their campuses.

I am also extremely grateful to fellow core faculty members Dr. Edward Green and Dr. Joseph Tucker. Their contributions were many and varied, and it would be difficult to find a measure suitable to assess their efforts. In addition, recognition should be given to the members of the Center's staff who participated in certain sessions at one or more of the Institutes. They include Bernard Basescu, Lewis Eigen, Mrs. Renée Ford, Dr. Leo Goldstein, Dr. Lassar Gotkin, Jerome Kaplan, and P. Kenneth Komoski.

A thank you, too, to Mrs. Corinne Willing and Carolyn Robert for their competent services in the preparation of this manuscript. Their untiring assistance in matters of style, copy editing, typing,

and general support during the preparation of this volume was more than any one editor could ask for.

To Martin Mayer, a word of thanks for his early shaping of the editor. And to my many teachers who were willing to take the time to provide individualized sequences when needed, this learner is most grateful.

ROBERT THOMAS FILEP

JANUARY, 1963
NEW YORK CITY

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SECTION 1: The Setting and Counterpoint

The modern classroom does not, however, offer much evidence that research in the field of learning has been respected or used. This condition is no doubt partly due to the limitations of earlier research. But it has been encouraged by a too hasty conclusion that the laboratory study of learning is inherently limited because it cannot take into account the realities of the classroom. In the light of our increasing knowledge of the learning process we should, instead, insist upon dealing with those realities and forcing a substantial change in them. Education is perhaps the most important branch of scientific technology. It deeply affects the lives of all of us. We can no longer allow the exigencies of a practical situation to suppress the tremendous improvements which are within reach. The practical situation must be changed.

B. F. SKINNER, 1954

Programed Instruction in Perspective: Yesterday, Today, and Tomorrow

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> What profit hath a man of all his labour which he taketh under the sun? . . . All the rivers run into the sea; yet the sea *is* not full; unto the place from whence the rivers come, thither they return again . . . The thing that hath been, it is *that* which shall be; and that which is done *is* that which shall be done; and *there is* no *new* thing under the sun . . .
>
> ECCLESIASTES 1:3, 7, 9.

YET MAN will continue to labor; the rivers will continue to run into the sea; men will continue to say, "See, this *is* new."

Programing Pioneers

As the century passed the first quarter mark, Sidney L. Pressey described "A simple device which gives tests and scores —and teaches" (1926). This device was a machine which presented the student with multiple-choice questions one at a time. The student selected which of the two to four answers to the question he thought was correct. He then pressed down one of four levers to indicate his answer. If he chose the correct answer, his pressure on the lever operated the device to turn up a new question. If he did not press the correct lever, the machine counted the choice but the same question remained in the viewing window until the correct lever was pressed. Pressey's students used this machine (and variations of this machine) in some of their courses at Ohio State University. These students all studied *regular assignments and then consolidated and extended their learning by taking teaching-machine tests.*

B.F. Skinner (1954) described applications of the principles of learning to education and to the use of teaching machines. These principles were accumulated from his years of work with animals in laboratory experiments. Skinner prefers fill-in questions to

multiple-choice questions on the basis that the student should be required to construct his own answer rather than merely make a choice. As soon as Skinner's student completes his answer to a question he is permitted to check it against one or more acceptable answers.

While Pressey's student studies regular assignments and then takes a teaching-machine test, Skinner's student may not have any conventional assignment at all and *is not tested* by the questions. In Skinnerian *programed instruction* (whether mechanized or not) the student is initially asked questions which he can easily answer correctly, without any previous study of this particular lesson. Then the student is *taught by the sequence of questions.* More and more is asked of him as the lesson proceeds, in very small steps, so that the student is always (or nearly always) correct but is encountering harder and harder problems or is being required to be more and more skilled with the material. Pressey has continued through the years to advocate what he calls "adjunct programs," consisting of multiple-choice questions to be used for review and consolidation of learning (1962). There is a very real difference between Pressey and Skinner.

In 1955, Norman A. Crowder suggested a modification in the use of the Pressey-type teaching machine. Crowder described what he calls "automatic tutoring by *intrinsic programing.*" In this case, the student studies a small amount of material and is asked a question. He selects an answer to the question. If he is correct, he is given new material to study and asked another question. If he is not correct, instead of being required to guess again (as with Pressey's machines), he is given some review material which explains his error. Then he is retested. *Study assignments and teaching-tests are combined* by Crowder. The exact sequence of material, the program, may be different for every student. Each answer a student chooses determines what he is given to study next.

The importance of reward or reinforcement as a part of the instructional sequence is emphasized by Skinner more than by Pressey. For a while it appeared that Crowder felt that "the essential problem is that of controlling a communication process

by the use of feedback" (Galanter, 1959) and that there was no need to arrange the program so that the student makes a minimal number of errors. However, in a recent paper Crowder says: "I think it desirable that on a routine program step (if there is such a thing) no more than 15% of the students should select a wrong answer. However, a major program branch might have a question that would be failed by 90% of the students" (Coulson, 1962). Thus Crowder would both agree and disagree with Skinner's premises. This 15 per cent is not far from the common 10 per cent set by many Skinnerians. Fifteen per cent is far fewer errors than actually are reported to occur in many research reports purporting to present studies involving Skinnerian programed learning.

Skinner has never denied the appropriateness of branching or the possible desirability of different types of sequence for students of differing backgrounds. The distinction between "intrinsic" and "extrinsic" programing made by Crowder is not a difference between straight-line sequences for all students as opposed to lessons involving branches. Crowder's distinction is between an individual answer within the program determining whether or not a branch occurs (an *intrinsic* program), as opposed to separate tests, teacher's judgments, or other criteria external to the instructional program (*extrinsic* factors) determining the instructional sequence to be followed.

To the extent that Crowder advocates keeping the error rate generally low and distinguishes his programs primarily on the basis of the method for determining when and to what extent branches occur, his differences with Skinner seem to have been needlessly exaggerated. One might put it that the differences apparently boil down almost to matters of style. Crowder prefers to follow Pressey in using multiple-choice questions as multiple-choice questions make intrinsic branching and mechanization more convenient. Skinner prefers brief-answer fill-in questions which require the student to construct his own answer and leave branching to be determined by extrinsic factors (Crowder also prefers a great deal more straight reading material as opposed to Skinner's occasional "panels").