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A BASIC REFERENCE SHELF ON PROGRAMED INSTRUCTION. A SERIES ONE PAPER FROM ERIC AT STANFORD.

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ANNOTATED REFERENCES ARE DIVIDED INTO GENERAL INTRODUCTIONS TO PROGRAMED INSTRUCTION (INCLUDING PSYCHOLOGICAL AND LEARNING PRINCIPLES), USER GUIDES (CASE STUDIES), PROGRAMERS' MANUALS (INCLUDING DEFINITION OF OBJECTIVES AND PROGRAM ANALYSIS), AND REFERENCES FOR PROFESSIONALS EXPERIENCED IN PROGRAMED INSTRUCTION (THEORETICAL AND ANALYTICAL PAPERS). (LH)

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A BASIC REFERENCE SHELF

ON PROGRAMED INSTRUCTION

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A BASIC REFERENCE SHELF ON PROGRAMED INSTRUCTION

This guide to the literature presents recommended reading organized under four subject headings:

A. *General Introductions to Programed Instruction,*

B. *Manuals for the Program Writer,*

C. *User Guides and Information, and*

D. *References for the Researcher, Programer, or User Already Familiar with the Fundamentals.*

A. *General Introductions to Programed Instruction*

1. Green Edward J. *The Learning Process and Programmed Instruction.* New York: Holt, Rinehart and Winston, Inc., 1962. 228 pp.

As the title indicates, Green's book is a treatment of psychological principles and processes underlying programed instruction. The first half of the book is devoted to discussion, in language which the layman can understand, of certain basic assumptions and concepts involved in the analysis of behavior. After these principles of conditioning and learning are described, the author proceeds with the principles and techniques of programing. The "technique" chapter and the following one on "evaluation" are useful for the teacher, student, and other interested individuals who are looking for a thoughtful and readable explanation of programed instruction.

2. Stolurow, Lawrence M. *Teaching By Machine.* Washington, D.C.: United States Government Printing Office, 1961. 173 pp.

In his monograph Stolurow proposes to examine the potentiality of self-instruction and automated teaching in regard to some critical problems in education. He opens with a general introduction to a systems approach to education and follows with an examination of the components in such a

system: (a) the teaching machine, including a complete history of machines used since the 1920s, (b) the learner, including a review of learner characteristics, and (c) the program, including such programing variables as task factors, practice conditions, feedback factors, time factors, prompting and sequencing. Finally, a review of relevant research findings is presented, with some consideration of the implications for education.

3. Taber, Julian I., Robert Glaser, and Halmuth H. Schaefer. *Learning and Programmed Instruction*. Reading, Massachusetts: Addison-Wesley, 1965. 182 pp.

This text is primarily a description of some major concepts and operations in learning which are related to instructional programing. The authors describe principles of behavioral psychology, methods for organizing subject matter for instructional purposes, techniques for writing program frames and sequences, techniques in program production and evaluation, and research on various areas of programed instruction. The primary purpose of the book is to bring together basic principles of behavior with suggested programing methods in a form which may be considered by educators and psychologists interested in programed instruction and educational technology.

B. *Manuals for the Program Writer*

4. Lysaught, Jerome P., and Clarence M. Williams. *A Guide to Programmed Instruction*. New York: John Wiley and Sons, 1963. 180 pp.

This guide is designed to familiarize the reader with the origins and fundamentals of programed instruction and to teach him to create and evaluate programed materials in different subject areas. The book is comprised of nine chapters which help the reader to (1) understand the characteristics of programed instruction, (2) select appropriate units to be programed, (3) assess the entering behavior of the learner, (4) develop appropriate objectives of the unit of study (this chapter includes several pages of examples of specific behavioral objectives), (5) select a

programing framework for individual items (the chapter illustrates several varieties of linear and intrinsic program models), (6) construct the sequence and individual items, (7) edit and review the first version, (8) test and evaluate the initial versions of the program, and (9) utilize programed materials in light of curriculum needs.

5. Mager, Robert F. *Preparing Instructional Objectives*. Palo Alto, Calif.: Fearon Publishers, 1962. (60 pp, in intrinsic programed format.)

Mager's program is devoted to stating objectives and communicating the teacher's intent to others. In several chapters, Mager deals with the importance of explicit objectives, the characteristics of meaningful objectives, the identification of the terminal behavior, and the description of the criterion of acceptable terminal performance. In the author's words, "The objectives of this book are such that, if they are achieved, you will be able to perform the following tasks: (1) given one or more instructional objectives, you will be able to select those stated in performance terms; (2) given a well-written instructional objective, you will be able to identify the portion of it that defines minimum acceptable performance; and (3) given one or more performance-test items, you will be able to select those appropriate to the evaluation of the objectives." This particular examination of objectives is a useful one not only for the programer, but also for the teacher, curriculum planner, and the instructional designer.

6. Markle, Susan Meyer *Good Frames and Bad: A Grammar of Frame Writing*. New York: John Wiley and Sons, 1964. (278 pp, in programed format.)

This is a manual to teach the analysis, critique, and preparation of teaching items in certain kinds of programed sequence. A primary objective of the program is to guide the novice program writer in developing techniques of eliciting behavior through good frame writing. In the author's words, "upon completion of *Good Frames and Bad*, the student will be able to: (a) describe the principles upon which linear and intrinsic programing were based and to describe methods for combining techniques

drawn from each; (b) analyze frames and identify their potential function (introductory, terminal, etc.) depending upon their structure; (c) use the terminology of programing correctly . . . in describing programs and frames; (d) identify and repair gross errors in frame design and sequence construction; (e) 'transfer'; i.e., given adequate subject-matter knowledge, facility in communication, experience with appropriate students, and guidance in the statement of objectives (not included in this program), the student will [be able to] produce in his own field a first draft of a program that will satisfy the criteria set forth . . . ."

7. Thomas, C. A., I. K. Davies, D. Openshaw, and J. B. Bird. *Programmed Learning in Perspective: A Guide to Programme Writing*. Barking, Essex, England: The Adelphi Press, 1963. 182 pp.

A handbook prepared by four members of the Royal Air Force School of Education. This volume is designed "to offer to teachers a system of programing which they can apply to their own subjects." After some introductory chapters about the rationale and history of programing, the authors describe the steps involved in their system of programing: (a) analyzing the subject-matter; (b) describing the desired terminal behavior; (c) collecting and organizing the material; (d) constructing the matrix and flow diagrams; and (e) preparing the frames. The heart of the system is the organization of a matrix of the rules and examples by which the student will learn the subject matter. Once the rules are set out in matrix form, a flow diagram of the function of each frame and its relationship with preceding or succeeding frames can be planned. Finally, the programer can write the program frames, with careful reference to the matrix and flow diagrams. The book concludes with two detailed examples of how these stages are applied to two subject matters (Ohm's Law and the Pythagorean Theorem).

C. *User Guides and Information*

8. *Recommendations for Reporting the Effectiveness of Programmed Instruction Materials*. Joint Committee on Programmed Instruction and

Teaching Machines. Washington: Division of Audiovisual Instruction, National Education Association, 1966. 35 pp.

This short document, made up of two reports and two supplements written over a period of five years, is relevant to anyone concerned with increasing the effectiveness of educational programs and procedures. The task faced by the Joint Committee was to provide assistance to users (and publishers) concerned with the selection, effective use, and evaluation of instructional programs. In general, the report deals with recommendations about reporting effects of a program. *Supplement I* to the report contains suggestions for information to be included in a program manual for teachers and other users. *Supplement II* contains recommendations for those who are preparing technical documentation about the learning outcomes of programed instructional materials.

9. Schramm, Wilbur (Editor). *Four Case Studies of Programed Instruction.* New York: Fund for the Advancement of Education (477 Madison Avenue), 1964. 120 pp.

This book of case studies is useful for the reader who is seeking information on the use of programed instruction. Several educational researchers examined in detail the experiences of schools using some form of programed materials. The kinds of questions investigated were: What had this school done with programed instruction? What were their reactions to the experience? What problems had they found in putting the method into effective use? What was the present outlook in these schools? Of particular interest is the introduction, which pulls together some themes and problem areas which cut across all four studies. The problems of enrichment versus individualization, of suitability and quality of programed materials, of student and teacher satisfaction, and of the context in which programs are used are discussed in light of user reactions to programed instruction.

10. Ofeish, Gabriel D. *Programmed Instruction: A Guide for Management.* New York: American Management Association, 1965. 416 pp.

This book analyzes the emergence of programed instruction, explains the benefits of a programed-instruction-based training system, and

discusses its applications to many industrial training problems. The bulk of the book is devoted to case studies of how programed instruction is being used in training programs of such companies as General Electric Company, Trans World Airways, American Telephone and Telegraph Company, Burroughs Corporation, Liberty Mutual Insurance Company, Pfizer Laboratories, and numerous other industries, associations, and educational institutions.

11. *Programmed Instruction Guide. Entelek*-Northeastern University. Boston, Mass.: *Entelek, Inc.*, 1967.

The first volume of this guide, published twice each year, contains references to 1773 programs, categorized into 158 major subject matter areas. The Data Bank includes the following information about each program or portion of a program: title, author and publisher; availability of teachers' manuals, tests, teaching devices, and evaluative data; information about the style, level, cost, length, and target population of the program. In addition to program information, the Guide lists other bibliographies, periodicals, and producers of programed materials.

D. *References for the Researcher, Programer, or User Already Familiar with the Fundamentals*

12. Lumsdaine, A. A., and Robert Glaser (Editors) *Teaching Machines and Programmed Learning: A Source Book.* Washington, D. C.: Department of Audio-Visual Instruction, National Education Association, 1960. 724 pp.

As the title suggests, the volume is a collection of more than forty papers, including the classic articles of Pressey and Skinner, and provides an excellent introduction to the state of the art of programed instruction in the later 1950s. The readings are organized into chapters dealing with Pressey's self-instructional devices, Skinner's teaching machines and programing concepts, contributions from the military and industry, and studies of variables in programed learning. In addition, an annotated bibliography of all known published and unpublished papers, as of June 1960, is appended to the volume.

13. Glaser, Robert (Editor) *Teaching Machines and Programed Learning II: Data and Directions.* Washington, D. C.: Department of Audio-Visual Instruction, National Education Association, 1965. 831 pp.

A successor to the first *Teaching Machines and Programmed Learning I: A Source Book,* this volume comprises a set of individually authored chapters which report experimental data and summarize and comment on the state of the art and practice some five years after the first *TMPL* book. Chapters in the first part deal with such topics as analysis of objectives, research on programing variables and techniques, theory and practice in adaptive and computer-based systems, assessment of the effectiveness of programs, and the impact of programing on classroom instruction. The second part includes review chapters specific to such subject matters as mathematics, science, reading, English, and foreign languages. The third part on implementation includes chapters on the use of programed instruction in schools, industry and government. The final chapter discusses the directions of an educational technology based on behavioral science.

14. Coulson, John E. (Editor) *Programmed Learning and Computer-Based Instruction.* New York: John Wiley and Sons, 1962. 291 pp.

This book is the edited proceedings of a 1961 Conference on the Application of Digital Computers to Automated Instruction, which brought together major speakers on automated teaching and programed learning and on computer capabilities, systems and programing. Part I presents empirical data and theoretical models of programed instruction. Part II consists largely of discussions of the factors leading to the development of a CAI system, of descriptions of equipment and systems applications, and of preliminary observations of effectiveness of such equipment and procedures. Part III includes predictions of future developments in the application of computers to instruction.

15. Lange, Phil C. (Editor) *Programed Instruction.* Yearbook of the National Society for the Study of Education, 1967, volume 66, Part II. 334 pp.

The 1967 NSSE Yearbook is a collection of recent papers by scholars and researchers in the field of programed learning. The three sections of the yearbook are devoted to (1) the foundations of instructional programing, including historical factors and underlying concepts, (2) the systematic development of programs, with emphasis on behavioral analysis and sequencing and on empirical testing, and (3) practical issues and applications of programed instruction, including administrative considerations, individualized instruction and teaching machines.

16. Smallwood, Richard D. *A Decision Structure for Teaching Machines*. Cambridge, Massachusetts: The M.I.T. Press, 1962. 122 pp.

This monograph is designed primarily for the advanced researcher and explores techniques for adapting instruction to learner history and requirements. The author describes a decision structure which can be utilized in making instructional decisions based on the individual learning characteristics of the student. The decision structure estimates the effects of the student's past learning history upon his future performance, based on data stored in the machine on how previous students have performed on the material about to be presented. It evaluates the effectiveness of alternative possible presentations according to some criterion preselected by the instructor. Its decision can be based upon whatever elements of the student's past performance the educator decides to use. The author describes in detail the decision structure, develops some of the mathematical tools required for its use, and presents results of preliminary experiments.