

DOCUMENT RESUME

ED 208 180

CE 030 237

AUTHOR Cox, J. Lamarr; Lane, Carolee
TITLE Evaluation of the Adaptation of the Personalized System of Instruction to Nontraditional Adult Learners. Volume II: A Synthesis of Research Findings on PSI and on Adult Learners.
INSTITUTION Research Triangle Inst., Durham, N.C. Center for Educational Research and Evaluation.
SPONS AGENCY National Inst. of Education (ED), Washington, D.C.
REPORT NO RTI/1926/01-01-F
PUB DATE 17 Apr 81
CONTRACT 400-79-0073
NOTE 121p.; For related documents see CE 030 236-238.

EDRS PRICE MF01/PC05 Plus Postage.
DESCRIPTORS *Adult Education; *Adult Learning; Adult Programs; Adult Students; *Autoinstructional Aids; Educational Research; Literature Reviews; Mastery Learning; *Nontraditional Students; Pacing; Peer Teaching; *Program Development; *Program Implementation; Research Needs; Student Characteristics
IDENTIFIERS *Personalized System of Instruction

ABSTRACT

This volume reviews literature and current practices in both the Personalized System of Instruction (PSI) and adult education that are pertinent to development and implementation of a PSI program for nontraditional adult learners. Chapter 2 provides a review of literature and current practices of PSI, especially that research providing evidence of raising questions about the internal mechanisms of PSI. It discusses practical findings on each of the five basic elements of PSI, as they pertain to adult learners: written materials, mastery, self-pacing, peer proctors, and motivational lectures. Chapter 3 presents findings from a review of literature on adult learning. Section A outlines some general qualities of adult learners and their implications for development of instructional materials and strategies. Section B briefly discusses some characteristics of nontraditional adult learners and several subpopulations considered promising for PSI implementation. Chapter 4 first summarizes some conclusions drawn relative to the research question of whether or not further investigation of PSI use for nontraditional adult learners is worthwhile. Conclusions are grouped under the five general characteristics of PSI. Some suggestions are then outlined for development and implementation of a PSI program for nontraditional adult learners. A bibliography of approximately 120 items is appended. (YLB)

 * Reproductions supplied by EDRS are the best that can be made *
 * from the original document. *

ED208180

RESEARCH TRIANGLE INSTITUTE
CENTER FOR EDUCATIONAL RESEARCH AND EVALUATION
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27709

RTI Report RTI/1926/01 - 01 F

FINAL REPORT

Evaluation of the Adaptation of the Personalized System
of Instruction to Nontraditional Adult Learners

Volume II

A Synthesis of Research Findings on PSI and on Adult Learning

by

J. Lamarr Cox
Carolee Lane

Prepared for

National Institute of Education
U.S. Department of Education
Contract Number 400-79-0073

17 April 1981

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

- This document has been reproduced as received from the person or organization originating it.
- Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

J. Lamarr Cox

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

The research reported herein was performed pursuant to a contract with the National Institute of Education, U.S. Department of Education. Contractors undertaking such projects under government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view and opinions stated do not, therefore, necessarily represent official National Institute of Education position or policy.

CF 030 237



Preface and Acknowledgements

Evaluation of the Adaptation of the Personalized System of Instruction to Nontraditional Adult Learners, the final report of the research conducted by the Research Triangle Institute under NIE Contract Number 400-79-0073, is presented in three volumes:

Volume I, Executive Summary

Volume II, A Synthesis of Research Findings on PSI and on Adult Learning

Volume III, PSI Meets ABE

The authors wish to express their appreciation to the following for their cooperation and contributions:

Dr. Jerome Lord, NIE Project Officer, for his insights, encouragement, and professional guidance throughout the research.

The students, teachers, and administrative personnel at the institution where the PSI program was implemented, for their cooperation, sincerity, and willingness to share with us both their triumphs and tribulations.

Dr. Robert Carbone, University of Maryland;

Dr. Fred Keller, University of North Carolina; and

Dr. J. Nevin Robins, University of Southern Mississippi, for their invaluable assistance in reviewing drafts of the project reports and making recommendations for the final report.

Steck-Vaughn Company for permitting the reproduction of revised versions of their materials for research purposes.

Scott, Foresman and Company for providing drafts of their reading materials.

Dr. Allen B. Knox, University of Illinois; Dr. Jane F. Flaherty, ETS; Dr. Jeffrey C. Barnett, Kansas State University; Dr. Edward S. Coble, City University of New York; and numerous other researchers and practitioners who provided valuable insights and suggestions during the developmental stages of the research.

Ms. Barbara Elliott for typing and proofreading the final report.

Table of Contents

	<u>Page</u>
Chapter 1. <u>Introduction</u>	1.1
Chapter 2. <u>Review of Literature and Practice of PSI</u>	2.1
A. Background	2.1
B. Written Materials in PSI	2.4
C. Mastery Requirement of PSI	2.13
D. Self-Pacing in PSI	2.23
E. Peer-Proctors in PSI	2.31
F. Motivational Lectures in PSI	2.47
G. PSI Systems	2.50
Chapter 3. <u>Review of Literature on Adult Learning</u>	3.1
A. Some Characteristics of Adult Learners	3.1
B. Some Dimensions of the Population of Nontraditional Adult Learners	3.44
Chapter 4. <u>Conclusions and Suggested Development and Implementation Guidelines</u>	4.1
A. Conclusions	4.1
B. Suggested Development and Implementation Guidelines	4.4
<u>Bibliography</u>	

List of Tables

<u>Number</u>		<u>Page</u>
2.1	Material Design Recommendations	2.6
2.2	Pearson Product-Moment Correlations Using Average Student Gain Quotients and Average Student Ratings of Proctors	2.35
2.3	The Average Number of Tests to Mastery and the Difference Between the Averages for Students of Trained and Untrained Proctors	2.43
2.4	Average Number Wrong Per Unit Test and the Differences Between the Averages for Students of Trained and Untrained Proctors	2.43
2.5	Design Considerations	2.56
3.1	Conditions of Adult Learning and Principles of Teaching Likely to Produce Those Conditions	3.42
3.2	Distribution of Noninstitutional Population 18 Years Old and Older With 8 Years or Less of Schooling, by Sex, Race, and Spanish Origin	3.47

List of Figures

<u>Number</u>		<u>Page</u>
2.1	Student Course Completion Versus Week of First Mastery Test	2.29
3.1	Four Curriculum Models: A Continuum	3.45

Chapter 1

Introduction

The Personalized System of Instruction (PSI) is a self-paced, mastery-oriented system that emphasizes the use of printed instructional materials and peer proctors. Lectures generally are reserved for motivational use. PSI has proven to be an exceptionally successful approach to instructing college students; such classes have been conducted in hundreds of settings, in dozens of content areas, and in more than 30 countries; reports of program outcomes generally have indicated an unusually high level of program effectiveness. However, only minimal research has been done on the effectiveness of PSI with adults in settings other than colleges and universities.

The Research Triangle Institute (RTI), under a contract with the National Institute of Education (NIE), has developed and implemented a Personalized System of Instruction (PSI) program for nontraditional adult learners.¹ This research involved a review of PSI as it has been developed for students in traditional academic environments, adaptation of PSI to the needs of a selected group of nontraditional adult students, and an evaluation of that adaptation. The methodology and findings of this research are described in three volumes: Volume I is an executive summary; this volume, Volume II, reviews particularly pertinent literature and current practices in both PSI and adult education; and Volume III describes the development, implementation, and results of the PSI program.

Given the limited level of effort devoted to the study, no conclusive findings regarding the effectiveness of PSI for nontraditional adults were attempted; rather, the primary objective of the study was to answer the question: "Is further investigation of the use of PSI for nontraditional adult learners likely to be worthwhile?" A secondary objective was to identify potentially fruitful areas for further investigation. The initial steps in the current research were, as noted above: (a) to review the literature and practice of PSI with particular attention to implications for the use of PSI with nontraditional adult learners; (b) to review literature on adult learning with emphasis on describing student characteristics and on identifying populations likely to allow a fruitful adaptation of PSI; and (c) to draw some conclusions regarding major factors that should be considered when developing and implementing a PSI program for nontraditional adult learners.

Chapter 2 of this volume provides a review of literature and current practices of PSI. Chapter 3 provides a review of literature on adult learning. Chapter 4 presents some conclusions and suggested development and implementation guidelines.

¹ For purposes of this report "nontraditional adult learner" is defined as an adult who is studying, usually part time, in other than the traditional (e.g., college or university) academic setting.

Chapter 2

Review of Literature and Practice of PSI

A. Background

The concept of PSI resulted from a 1963 brain-storming session and subsequent development effort involving Fred Keller and three other psychologists who were developing a curriculum and selecting teaching procedures for a department of psychology at the new University of Brasilia. The four, given complete freedom in the developmental effort, devised a plan that represented an attempt to make use of the findings of B. F. Skinner and others regarding the relationship between reinforcement theory and effective learning. According to Skinner, learning is maximized under conditions of frequent reward and infrequent punishment or threat. For a learning situation to be productive, the rewards should be specified, the rewards should be contingent on performance, and the learner should be actively involved in the learning process. Thus, a system of learning based on Skinner's principles must modify or rule out traditional modes of instruction that focus on lectures and assignments.

PSI was introduced into the U.S. in 1965 by Keller and Gilmour-Sherman. Since then, it has been put to the test of 16 years of various uses, modifications, praises, and criticisms in hundreds of college classes all over the world. The PSI system, as defined by its originators and summarized by Buterbaugh and Fuller (1975), has five distinctive elements:

Stress on written material. Each written unit of instruction begins with an explicit statement of the objectives for the unit. This provides the framework around which the facts and concepts of the unit are organized. This feature of PSI parallels typical adult learning situations, since much adult learning centers on the written word.

Mastery-based. Students move to subsequent units only after achieving complete mastery on an end-of-unit test, continuing to restudy and be retested on each unit until mastery is demonstrated.

Self-paced. Students move at their own rate through units of written instruction. This format, again, closely parallels the learning situations adults typically encounter in their lives.

Peer proctors. Students are tutored and tested by those of their contemporaries who have recently mastered the course units in an exemplary manner. This use of peer proctors is an attempt to achieve a positive social context for learning, and to make possible immediate and frequent feedback.

Nonemphasis on lectures. Lectures are not used to provide critical course content, but are supplementary, motivational activities. These special lectures are contrived to serve as one form of reward for students who have successfully mastered a specified portion of the written materials.

Experimentation with PSI has been at least partially a response to perceived problems in university education. Unsettling questions were raised by

researchers in the late 50's regarding the inefficiency of most college instruction. Studies casting doubt on college teaching efficiency noted that (1) time in class could be reduced by more than two thirds without affecting students' end-of-course achievement (Churchill and Basken, 1958; Gruber and Weitman, 1962), and (2) standard instructional activities such as lectures and discussions could be eliminated completely without altering student achievement (Dubin and Taveggia, 1968). Thus PSI and other educational technologies developed in the 60's were introduced within a context, and at a point in time, when many educators agreed that change in the existing system was essential (Kulik and Jaksa, 1977).

The instructional innovations of the 60's (including systems such as PSI) also were in part a response to the sudden heavy influx of students during that period, an influx produced by the liberalization of admissions policies formerly used in higher education (Hess, 1977). The broadening of admission to existing college programs created a critical need for methods for dealing with a wider diversity of students within what had been an essentially inflexible educational context. Cross (1976) summarized the problem as follows: "The challenge is clear: teach larger numbers of increasingly diverse students to master an expanded set of skills with more effective instructional methods requiring less staff and funds." Community colleges, created largely to absorb part of the load resulting from this sudden increase in the accessibility of education, made some of the most energetic attempts to respond to the overload of student populations previously underrepresented in higher education (e.g., older adults, minorities).

PSI was seen as a conspicuous success within this challenging context. College teachers generally found that students taught by PSI were able to achieve success in terms of both content learning and study skill learning, despite widely discrepant entry level skills. Numerous papers have documented successes with PSI. Kulik and Jaksa (1977) cited the combined evidence of a number of selected related studies. They reported that of 39 studies measuring student performance on final examinations, 87 percent showed PSI to be superior, with an average increment of 13 percent higher scores. Out of 9 studies measuring long-term retention, 100 percent showed greater retention among PSI students, with an average of 24 percent higher scores. Kulik and Jaksa eliminated from their tabulations any research studies having nonequivalent comparison groups, differential dropout, or prior student exposure to examination items; they thus considered the consensus they found to have solid research support.

McKeachie (1978), in his assessment of the relative effectiveness of various teaching approaches in producing defined learning outcomes, observed that new panaceas to cure the ills of teaching appear about every 5-10 years. He found PSI to be one of the most convincing and best researched of the new programs. McKeachie noted that research showed PSI to be effective in teaching most kinds of students at both the knowledge level and higher cognitive levels, and in increasing students' ability to retain what they had learned.

Many PSI researchers have attempted to do more than compare the system's results to those of traditional forms of instruction. Considerable research has provided evidence, or raised questions, about the internal mechanisms of PSI. Such questions as the following have been addressed:

- What particular factors, or interactions of factors (e.g., cognitive, affective, social), are at work in PSI?
- What, if any, adjustments can be made within the five elements of PSI set forth by its originators? What are the results of such adjustments?
- What kinds of students learn the most, or the least, when a course is taught by PSI?

This literature review focuses primarily on such studies, particularly those whose results relate to current findings in learning theory and instructional theory. Studies that have confined themselves to measuring the success of a particular PSI implementation are viewed as considerably less critical to present purposes and, thus, are only summarily covered.

The balance of Chapter 2 is a discussion of practical findings on each of the five basic elements of PSI, as they pertain to adult learners: (1) written materials, (2) mastery, (3) self-pacing, (4) peer proctors, and (5) motivational lectures. This is followed by a discussion of the total PSI system.

B. Written Materials in PSI

◦ Werner and Bono (1977) noted that the written word is the most common, but not the only, mode of presentation in PSI programs. The primary requirements for PSI course materials are: (1) that they are permanent, transportable, affordable, and available to students whenever they need them; and (2) that they allow for some type of repeatable evaluation of mastery. To the extent that alternate presentation modes (including various types of media, laboratories, and community experiences) can be adapted to permanent and available formats, they have been considered acceptable by some for use in PSI. Oral presentations of a one-time non-duplicatable type are not considered to be appropriate for serving the "materials" function in PSI.

Given PSI's heavy reliance on written material, it is vital that these materials be of high quality. Sherman (1972) stated that "production time for PSI materials is almost prohibitive due to the extreme care required in designing materials that are going to be so closely scrutinized and so heavily relied on for producing mastery-level learning." Adequate materials, according to Sherman, must (1) "teach" rather than "tell," (2) be sufficiently energetic and creative to "engage the student in searching, discovering, and verifying," and (3) make "each step during the learning an intrinsically rewarding one." Sherman contended that many PSI materials are written from a perspective that "continues to view the student as a sponge... [whereas] we should make every effort to engage the student." Sherman noted that "it is as cruel to bore students as to punish them" and recommended that those writing PSI materials consult articles² on techniques for writing compelling, interesting materials, "materials that themselves might decrease the procrastination problem." Hoberock, et al. (1972) reinforced Sherman's points by noting that PSI students quickly become frustrated over weaknesses in written materials because of the

² E.g., Speeth and Marguilies' "Techniques for Maintaining Student Motivation," (1969).

system's exclusion of lectures that traditionally compensate for weak course materials by reiterating their contents.

Table 2.1 lists a selection of the many and varied recommendations for materials design provided by PSI practitioners. A discussion of some of the potentially useful research and practice findings regarding PSI materials follows.

1. Unit Characteristics

Werner and Bono (1977) stated that the written portion of PSI units should have three basic parts: (a) the source material, (b) the study guide, and (c) the evaluation or test. They suggested that:

- The first one or two units should be easier than the balance to help provide early student successes.
- Subsequent units should require near-equal effort for the achievement of mastery.
- Source materials should be available for an adequate length of time and in sufficient number to allow easy access to all students.
- A study guide should be designed for each unit to provide assistance to students in mastering the unit objectives.
- The study guide should include an introduction that provides the rationale and overview for the material, a procedure statement that suggests strategies for proceeding through the unit, a statement of the unit objectives in behavioral terms (including what evidence of mastery will be accepted as proof that the objectives have been met), and practice study questions in the same general format as the unit tests.
- The study questions within a unit should be of gradually increasing difficulty, moving from low-level knowledge objectives to higher-level³ objectives requiring analysis, synthesis, or evaluation.
- Each unit should have three forms of a unit evaluation test, all of equal difficulty and approximately 15 minutes in length.
- Completed unit tests should serve the additional function of providing feedback for revising both materials and tests.

2. Unit Objectives and Tests

Several studies have investigated the advisability of providing study objectives to students at the beginning of each unit. Williams' (1976)

³ The terms "low-level" and "high-level" objective are used here in reference to the level on Bloom's taxonomy, marking distinctions in the level of complexity/inclusiveness of the objective itself rather than in the level of difficulty of the content material.

Table 2.1
MATERIAL DESIGN RECOMMENDATIONS

MATERIALS DESIGN STRATEGY	RECOMMENDED BY:
1. The study guide should contain a list of optional study procedures.	1. <u>Naumes (1976)</u>
2. Each unit should contain an introduction that attempts to motivate the student.	2. <u>Maginnity (1976)</u>
3. The material should include progress charts on which students can monitor their own progress (with an ideal progress schedule plotted on the chart so the student can compare his/her progress with ideal progress).	3. <u>Glick (1973)</u>
4. Activities should involve active learner participation, problem-posing orientation, and the development of practical skills and concrete products.	4. <u>Kindervatter (1977)</u>
5. A course based on a conventional text should be supplemented by written handouts that include the kind of elaboration and clarification that would ordinarily occur in a lecture.	5. <u>Tietenberg (1973)</u>
6. PSI units can productively include laboratory activities and field trips.	6. <u>Andrews (1977)</u>
7. An entire college program can be divided into PSI units, in which case various modules or units may require a few hours or a few weeks to complete.	7. <u>"Pacing Yourself Through College" (1975)</u>
8. PSI can be effective in the teaching of attitudes as well as in the teaching of facts, principles, and techniques.	8. <u>Lewis and Wolf (1974)</u>
9. Review units should be interspersed throughout a PSI sequence. If course material is cumulative, review units should also be cumulative.	9. <u>Johnson and Sulzer-Azaroff (1975)</u>
10. In courses that depend on written materials, it is critical that those materials communicate the context and the focus of the presented concepts.	10. <u>Sloos (1961)</u>

review of relevant studies found that use of study objectives increased end-of-course performance in PSI courses by an average of 15-20 percent. Semb et al. (1973) also noted that students who had been provided with study objectives performed better on tests than other students, even in cases where the test questions were not confined to specific items listed in the student handouts.

Scott and Tobias (1975) used a Gagné learning hierarchy⁴ to plan the sequence and structure of their PSI course. Terminal objectives included four components:

- Who is to perform?
- What is the performance to be?
- What will be provided the learner when this performance takes place?
- What constitutes adequate performance?

A learning hierarchy was developed by breaking the terminal objective for each unit into a succession of its component enabling (or subordinate) objectives. Scott and Tobias reported that although this method was rigorous and demanding, it resulted in improved test performance and provided indications as to when students could be exempt from and/or permitted to proctor certain enabling portions of units.

Brock, Gelong, and McMichael (1975) reported a use of job-task analysis to generate training objectives for a Navy training program. They combined PSI, as an effective method of instruction, with the Rundquist procedure, as an effective method for designing job-relevant training courses. Rundquist's ten steps for training course design were:

- Develop course mission (overall training goal).
- Identify job tasks.
- Establish job-entry standards.
- Group tasks for instructional planning.
- Develop training tasks (job task and school conditions).
- Specify the tests (add standards to training tasks).

⁴ Gagné divided learning into five distinct and separate domains termed: (1) information learning, (2) intellectual skills, (3) cognitive strategies, (4) motor skills, and (5) attitudes. The second of these domains, intellectual skills, was further broken down into five levels (discriminations, concrete concepts, defined concepts, rules, and problem-solving) that define a hierarchy and therefore necessitate sequential mastery of all learning tasks at one level to enable mastery of learning tasks at the next level (e.g., all concepts must be learned before it is possible to learn a rule based on those concepts).

- Complete the objectives.
- Organize the training by objectives (strategies).
- Develop media, job aids, criterion tests, and other course materials.
- Conduct and validate the course.

PSI/Rundquist reportedly provided a reliable remedy for redundancy, a factor that previously had led to unnecessary expense in these training programs. Task analysis identified certain "common core" skills and knowledge objectives that were being taught separately in each of three Navy training programs. PSI modules, used by all three programs, provided for reliably effective mastery of those core areas. The outcome was that PSI/Rundquist students were reported to learn well in 20 percent less time than previous students taught under the "lockstep" method.

To create effective criterion referenced unit tests, Werner and Bono (1977) suggested the use of a "table of specifications" approach. In this method, the content to be mastered is divided and plotted across one dimension of a table, and the "level" (e.g., what the student should be able to do within each content area) is plotted across the other. Examples of possible "levels" are, in order of increasing complexity: memory, comprehension, application, analysis, and synthesis. Each cell on the table, marking intersection of topic and level, then is assigned an appropriate proportion of unit test questions. These proportions should reflect the relative priorities of the various content/level combinations in terms of how they relate to the unit objectives. Werner and Bono considered essay or short answer (constructed answer or multiple-choice) unit questions to be appropriate. Because uniform grading of essay questions is difficult if not impossible, Werner and Bono recommended that essay questions be confined to use in cases where a particular type (content/level) of achievement cannot readily be tested using short answer items. When essay questions are used, the proctors should be trained so that they will be consistent in their evaluations of student performance.

Studies by Johnston and Pennypacker (1971) and Minkin, Minkin, Sheldon, Hursh, Sherman, Wolfe, and Dixsen (1975) indicated that evaluation through oral interview is as effective as evaluation through the use of written quizzes. According to one study supporting this viewpoint (Hursh, et al., 1975), a higher rate of unit mastery is demonstrated if assessment is at least partially oral, and students are allowed to discuss and defend their written answers with a proctor. Such discussions compensate for legitimate student difficulties, such as misinterpretation of quiz questions, and allow for clarification of answers.

3. Number and Length of Units

Born (1975) assigned different groups of students to master one, two, or three units of materials prior to mastery testing. He reported that requiring students to study more than one unit per mastery test caused no significant problems in final examination scores, pacing patterns, total study time, or withdrawals. However, differences in the pattern of time spent studying did appear among these three groups in that those assigned one unit

per quiz spent shorter periods of time studying than did those assigned two or three units per quiz.

Semb's (1974) study comparing the relative effectiveness of short versus long units yielded results that were contrary to Born's. He discovered a gain of between 10 and 20 percentage points when students were given 4 tests on short units, plus a review test, rather than one test covering the same total amount of material. O'Neill, Johnston, Walters, and Rasheed (1975) also found an inverse relationship between unit size and quiz performance when keeping quiz frequency constant and varying the size of units. Also, students studied longer for a large unit and then, following its completion, waited longer before beginning the next unit. Johnson and Sulzer-Azaroff (1975) experimented with reducing the size of their units each semester--final drafts of the units were 60 percent smaller than the initial drafts (the course was initially presented in 10 units and ultimately in 22). They reported increasing success as each of these reductions was made; the decrease in unit size led to increased student responsiveness and more positive student attitudes. They recommended that a 14-week, 42 class-session semester be broken into a minimum of 20 units. Nelson and Bennett (1973) similarly reported an increase in effectiveness through a decrease in number of pages per unit.

4. Model Formats for Units

Two studies appear particularly noteworthy for their use of fairly sophisticated unit formats. Miller and Weaver (1975) designed a relatively complex unit format wherein units consisted of the following sequence of components: (a) a brief explanation and description of the principle or concept to be learned; (b) a series of situational examples taken from familiar everyday occurrences to illustrate this principle or concept; (c) hints and prompts for the first half of the situational examples, with the amount of hinting gradually decreasing to a point where there were no hints; (d) a self-quiz with items taken from all of the above (statement of principle, examples with hints, and examples with no hints); and (e) review units combining the principle most recently learned either with previously learned principles or with principles yet to be presented. Miller and Weaver found this format to be particularly effective in increasing students' ability to generalize principles when presented with new examples.

Van Nostrand (1977) used a complex format for PSI materials to teach writing. Van Nostrand based his unit materials on a format model of "show and tell" that gave the learner progressively more responsibility for "showing and telling." The units were sequenced in such a way that they were both graduated and cumulative; solutions of relationships in later units depended on those in earlier units. The format for each unit was as follows: (a) a concept was described and illustrated; (b) the concept was applied to a problem that was then solved for the learner (a problem, in this case, was a simulated writing situation); (c) the learner was informed that the instructional goal was for him/her to put this concept to use; (d) the learner was asked to apply the concept to a problem similar to the one demonstrated earlier; (e) the learner was asked to apply the concept to a second similar problem; (f) the unit test was administered to determine mastery. Van Nostrand's (and Miller and Weaver's) format appears to have particular potential for use in achieving higher-level

objectives where learners must generate original products (e.g., where terminal objectives require synthesis, evaluation, or problem solving).

5. Delivery Systems

PSI materials vary so widely in quality, format, and even system of delivery from one implementation to another that little would be gained by an attempt to describe a standard. Hess (1977) noted that "since PSI presupposes neither the type of objective to be taught nor the type of learning activity to be employed, the typical PSI course simply reflects the academic orientation of the disciplines and size of the classes to which it has been applied most widely. [Thus] more and more examples of PSI, involving a variety of media types, kinds of objectives, and forms of active student responses are appearing."

a. Telephone and Cassette Tape

Roberson (1975) contended that PSI was highly appropriate for use in off-campus instruction since it was not dependent on large group lecture meetings and because all materials could be packaged and mailed. In his study, off-campus students were provided the same textbook and printed materials as on-campus students, and were administered unit tests by telephone. The student was called at a specified time and instructed to open a sealed envelope containing the examination for that unit. The student worked the examination in an allotted time period, after which the instructor or proctor called again and graded the examination over the telephone. In the case of non-mastery, deficiencies and problems were discussed and a new time for telephone contact arranged. The student then sent the completed exam back to campus for filing.

Roberson's home-study/telephone testing system was used with students of diverse background and from 22 to 50 years of age. The sealed-envelope technique for ensuring security of the examinations proved effective, and no problems beyond those encountered in on-campus implementation of the course were evident. An accurate account of all telephone conversations, along with a complete record of achievement scores and schedules for future telephone testing or tutoring, was maintained. Analysis of the number and length of calls indicated that an average of 40 calls per student were made for the 3-semester-hour course and that these calls varied in length from 1 to 35 minutes, with an average length of approximately 10 minutes.

Roberson noted that one positive feature of combining this delivery system with PSI was the personal contact it created with students who normally would fall under the more isolated correspondence/extension course domains. The telephone dialogue reportedly was particularly beneficial for older, more experienced students. According to Roberson, the use of prearranged scheduling of telephone communication served a major motivational as well as organizational function. Students tended to do the appropriate amount of studying to prepare for the scheduled telephone contact, and proctors were able to plan their other activities around the schedule. As a result of this PSI experience, Roberson concluded that "the potential for off-campus instruction afforded by self-paced courses using telephone communication is unlimited. Any individual with access to a telephone can enroll in such a course and have the same

direct communication with the instructor available to his on-campus counterpart."⁵

Brown (1977) and Cobb (1977) combined PSI with certain aspects of the audio-tutorial approach. Brown used cassette tape recordings as primary source materials. Cobb's Learning Through Listening program was designed to present PSI in an aural learning format wherein blind students could exercise the same level of "control over presentation" that sighted students are able to exercise when reading material independently. Major elements of this control are students' ability to selectively reread, control the rate, skip, preview, and otherwise control the flow of the presentation. Cobb reported that his four-track, indexed tape system reduced search time (e.g., students moving forward or backward in the materials) by over 70 percent, thus increasing significantly the students' control. Cobb noted that PSI had the important advantage of providing a ready source of research data "under the guise of an instructional program." He collected a large amount of routing data by monitoring the blind students' movements through the taped materials. Among other research objectives, he planned to identify confusion and fatigue patterns, preview and review activities, and individual differences in study approaches. He viewed his system as having important capabilities for collecting data and providing detailed routing information that, when analyzed, could be expected "to raise [important] questions about the learning process."

b. Interactive Video-tape, Sound-slides, and Television

Terman (1978) successfully used PSI for a very large enrollment course by creating an interactive video-tape format to provide the continual feedback generally supplied through peer-proctors. Brock, Delong, and McMichael (1975) in their task-oriented Naval training programs provided the option of visual formats in an effort to individualize instruction by permitting students to choose their preferred modes of learning. Students selected from a variety of available PSI module formats including written units, programmed instruction, or sound-slide programs. This program addressed the concern of Pask and Scott (1972) and Brainard (1972) that to be called "individualized," instruction must be designed so that it can be applied (or selected) based on the thinking and learning styles of the individual. "Holists," or global learners, presumably require some image of the entire system (best visualized, not verbalized) before learning strings of information, whereas "serialists" learn better if serial strings precede the "whole." Mismatching these groups by giving each group materials inappropriate to their learning style yielded posttest scores of 23 to 70 percent; matching materials with style yielded posttest scores of 93 to 100 percent.

⁵ Roberson's PSI experiment is particularly interesting in light of the remarkable community response to other telephone instruction systems. One such example is the DOLLY (Dial Our Listening Library Yourself) system in Charlotte, North Carolina. Originated in 1975 by a community college as a call-in service providing tapes of old radio shows, the program has been expanded to include other taped modules, some of them academic. By the time of a 1977 report, the DOLLY system was averaging 7,000 calls per week with 77 percent of the requests in the category of serious instruction. The sheer volume of calls experienced by this educational outreach system suggests the magnitude of needs not addressed by on-campus programs that possibly could be met through telephone instructional delivery systems.

Bell and Anderson (1978) used television in a PSI course. They reported that this system had two advantages: the student's learning time was not as "excessive" as that of PSI students using only written material (possibly because of the structuring effect of television delivery), and the use of television provided a superior instructional medium for those students who learned best through auditory rather than written approaches. Bell and Anderson viewed the use of television for PSI courses as correcting what they saw as two critical disadvantages of print-based PSI programs: (1) the majority of printed materials are confined to the presentation of factual, information-level content; however, the learner often needs to be led through a progression of increasing inclusiveness (e.g., from information to concepts to analysis to synthesis to problem-solving); and (2) a printed format does not provide the personal interactive quality of constructive feedback.

C. Mastery Requirement of PSI

Hursh (1976) noted that current data on personalized courses "suggest that the mastery criterion may be the most powerful of PSI components." He added that "almost all the other components are made necessary because of the presumed desirability of the mastery criterion." Not all researchers agree that the mastery requirement is the main reason for PSI's success; nevertheless, the mastery feature has been a primary focus in research attempting to analyze the psychological mechanisms responsible for the system's success.

1. The Function of the Mastery Feature

Bloom (1968), one of the major proponents of mastery learning, stated that the primary assumption of mastery learning is that "almost all students, provided with favorable learning conditions, learn well." Numerous proponents of mastery concepts have confirmed Bloom's claim that under appropriate conditions, where performance is held constant and the rate of learning is permitted to vary, most students are able to attain whatever instructional objectives are defined for them or by them. Recently, Bloom (1976) added the proposition that by providing students with the favorable learning conditions represented by mastery learning, differences in learning rate (e.g., amount of study time required to achieve mastery) may begin to converge over time.

Various ideas have been advanced as to why the "mastery" experience has such a significant effect on individuals. Bloom (1979) identified improvement in self-confidence as a major outcome of the mastery requirement. Research in instructional effectiveness has generally supported the hypothesis that the increase of student "time on task" is a major factor in the increase of learning effectiveness (The National Academy of Education, 1978). Swanson and Denton (1976) identified "recycling" as the key unique instructional feature of a mastery strategy. They defined recycling as the requirement that learners who fail to achieve stated performance objectives on initial attempts restudy the instruction until they fully-meet the objectives.

Keller (1972) justified the mastery requirement in terms of reinforcement theory. He stated that reinforcement is a critical condition of learning, and is achieved in learning situations where rewards are specified, behavior is necessary to the achievement of those rewards, and rewards are contingent on successful performance. In addition to the need for high-frequency, behavior-contingent reward, Keller added another Skinnerian principle, that learning is

best supported by minimizing aversive aspects of instruction such as the "punishment, threat, [and] the opportunity for extinction of behavior" that are often the consequences of non-mastery. White (1959) extended the Skinnerian theory of external reinforcement stimuli (that is, stimuli initiated by the environment) by proposing that mastery satisfies an "inborn internal drive to master the environment." White saw the desire for mastery as an internal part of the natural make-up of the individual (a viewpoint that is supported by other instructional theorists including Bruner and Ausabel).

Hess (1977) elaborated on the effect of PSI's mastery requirement:

- o It prevents the development of cumulative skill deficits in a curriculum presuming a sequential accumulation of skills.
- o It permits a student to experience the satisfaction of achieving an excellent performance.
- o It allays the concern of those who believe open admissions policies will erode academic standards.

A common element in most discussions of the psychological mechanisms that work in mastery learning is the notion of educational equalization. Cross (1976) summarized the educational equalization goal as being "to adjust the skills, experience and interests of all students...through instructional methods designed to produce elite performance, rather than to select students already demonstrating it." Calhoun (1976) reported that in his study of a PSI undergraduate psychology course, student grade point average was related to the rate of progress through the course, but that even the weaker students ultimately achieved mastery. Whitehurst and Madigan (1975) conducted a study of slow learners in a PSI undergraduate course and found that "a student with a poor academic history who frequently repeats quizzes in order to attain 'A' level of mastery does not learn less material than his classmates and may learn more in an absolute sense." Kulik, Kulik, and Cohen's (1979) meta-analysis of 75 comparative studies of PSI found that "PSI raises the performance of typical students (with SAT scores of 500) to the level previously associated with above-average students with SAT scores of 600."

Schimpfhauser and Richardson (1977) studied the question of "who benefits most?" from a PSI course. Medical students in a lecture/control group were divided according to high and low scores on a placement examination. At the end of the lecture series, those who had scored high on the placement exam also scored high on the National Board Biochemistry exam, and vice versa. However, in a PSI-taught group, the same two types of students (those who had scored low versus those who had scored high on the placement exam) scored at essentially the same level on the National Board exam. These results led Schimpfhauser and Richardson to conclude that the PSI "program materials and format seem particularly well suited to academically disadvantaged medical students." Research findings such as these, documenting the particularly positive effects mastery learning has on slower students, may partially confirm the philosophical stance of Gestalt therapist Fritz Perls that "learning is the discovery that something is possible."

2. Techniques for Enabling Mastery

According to Sherman (1972), any changes in the 100 percent mastery requirement recommended by PSI's originators are inadvisable and "waste one major advantage of the system." Sherman saw the 100 percent mastery criterion as representing "the expectation of excellence." Introducing such an expectation into a course is "a compliment, a challenge in response to which students act in a new way." Keller (1972) also insisted that "unit perfection as the basic condition of advancement... has value for the student that should not be underestimated. To accept even a 90 percent criterion of success is to return to a numerical rating that is meaningless in describing what a student does or does not know." In actual practice, however, the mastery criterion frequently varies with the instructor and the course, tending to range between 80 and 100 percent (Block, 1970).

a. Supplementary Study/Review

The Miller and Weaver (1975) and the Miller (1975) studies experimented with using supplementary study questions involving situational examples and hints in an attempt to extend and expand the material to be mastered. They found that this procedure increased students' capacity to generate correct answers to novel items on a later test requiring that they generalize their learning.

⁹ Werner and Bono (1977) advocated the addition of a final examination to the unit tests common in PSI courses. They stated that the addition of a final examination had the advantage of reducing peer pressure on proctors to advance students on unit tests that they have not entirely mastered. The existence of the final exam provided a natural reason for proctor adherence to the "spirit" of PSI unit testing (e.g., the notion of tests as learning instruments). A second advantage of using a final examination, as seen by Werner and Bono, was that it required students to review and integrate course material and thereby to advance beyond the fragmentation that can be characteristic of unit-by-unit learning.

Peters (1973) added a monitoring activity prior to administering unit tests as a spot-check method of verifying that a student was ready to take the test. He found that the time saved by avoiding the administration of tests to unqualified students more than compensated for the time spent on the monitoring activity.

Davis (1975) included review items from previous units and new items for the current unit in his unit tests. He found that using the review items had no observable advantage when students' final grades were contingent on final exam performance. However, when performance on the final exam was not the determinant of final grades, students who had been given the review items outperformed those who had not. In addition, students who had answered review questions were at a significant advantage when given a follow-up examination three to four months after course completion. Semb, Spencer, and Phillips (1976) similarly required review testing of past course segments, with the result that a five to six percentage point posttest advantage was evidenced by students who had been required to take review tests.

b. Need for Strategies to Orient Students to Mastery Concept

Robin (1975) noted that while behavior modification systems such as PSI grew out of healthy, empirically-based, and research-supported theories of reinforcement, they have maintained a narrow focus on "overt, easily specifiable behavior" despite current developments that have broadened the domain of behavioral research. Behavior therapists (e.g., Bandura, 1976) have gained increased sophistication in identifying covert "nonspecifics" that exert important effects on behavioral outcomes and introduce "subtle variables affecting course success." One such "nonspecific," the expectancy variable, appears particularly relevant to the mastery feature of PSI.

Robin's research focused on the effect of expectancy variables on outcomes in PSI. He pointed out that three key groups of individuals (students, proctors, and instructors) bring to the PSI course definite expectations about content, grading, tests, workload, and other characteristics of instruction. These expectations are based mainly on the individual's own experiences prior to encountering PSI. When these entering expectations are incongruent with the actual experience that follows, all three groups of individuals can be expected to experience some form of reaction that will affect ultimate performance and attitudes. Robin identified two features of PSI, the large number of unit tests and the 100 percent mastery requirement, as potentially the most disconcerting to students at the outset of a PSI course. Robin suggested that the sudden disruption of student expectations, caused by the introduction of unfamiliar and potentially threatening course regulations, can be one cause of procrastination, heavy withdrawals, and other recurrent problems PSI programs frequently encounter. Although PSI students' attitudes often seem to improve as they experience success, the initial disruption of expectations can cause slow starts or even total avoidance through withdrawal.

According to Robin, proctor expectations also have potential for negatively affecting course outcome, particularly if the proctors have not been sufficiently oriented to mastery concepts (e.g., if they retain the lecture-oriented expectation that they can make themselves useful and thereby popular with their peers by relaxing course standards and allowing their fellows to move to new units before full mastery has been achieved). Because of potential hazards such as these, Robin recommended that student, proctor, and instructor attitudes and expectations be assessed at the outset of a PSI course, and that orientation meetings be arranged to deal directly with altering these initial attitudes and expectations to be more compatible with PSI mastery principles.

Based on a similar concern regarding expectations, Swanson and Denton (1976) included in their study a mastery learning orientation phase that was implemented approximately four months prior to the beginning of a PSI course. During this orientation phase, students were taught how to use performance objectives, formative test results, remediation procedures, proctoring sessions, and review sessions to optimize mastery experiences. Swanson and Denton claimed that these orientations reduced the potential for Hawthorne effect and enhanced the transition of the groups into the mastery-based implementation phase of the program.

Brainard (1975) clarified the orientation issue by classifying PSI as a win-win approach to learning. The more typical, and thus the more familiar, approach found in traditional instruction is win-lose, wherein some students

are expected to achieve and others to fail. Students therefore may need preparation in the philosophy of win-win. He advised that orientation be provided through awareness-increasing programs based on Maslovian types of materials and theory. Noreen (1966) similarly stressed the advisability of using Maslow's constructs to help students (in this case adult basic education students) prepare to "change." Noreen investigated several adult basic learning settings and found that only some of them satisfied the Maslovian prescription for the "nurture of the growth urge" that he considered fundamental to PSI philosophy.

c Motivation Strategies

Numerous approaches to motivation have been attempted in PSI implementations. Wagner (1974) contended that the management of motivation in PSI courses should be focused on finding ways of ensuring that the system's natural reinforcing properties are fully utilized. Pascarella (1977) measured the amount of motivation individual students brought to PSI courses and used this measurement as a predictor of differential course outcomes. He found that the effectiveness of PSI on achievement and attitudes was highest for those students who were most highly motivated at the outset.

A study by Robinson (1972) provided evidence that both of these two factors, the natural reinforcement features of PSI and the intrinsic motivation levels of individual students at the course outset, exert significant influences on student outcome. In his study, two kinds of motivation-related variables were introduced. One extrinsic feature (test frequency) and one intrinsic feature (whether or not unit tests counted toward grades) were manipulated and the effects of these manipulations were compared in terms of total impact on student achievement. Strategies designed to enhance intrinsic, individual motivation were found to have a more significant influence on incentive than were strategies designed to change the extrinsic motivators inherent in PSI (e.g., the manipulation of test frequencies).

Various other experimenters have attempted to determine what external manipulations and adjustments to PSI have an impact on motivation. Rushton (1974) increased student incentive by permitting students who mastered a certain portion of the course to be exempt from the mid-term or the final exam. Whitehurst and Whitehurst (1975) compared the traditional use of a set PSI mastery criterion to a condition wherein each student was allowed to select his/her target criterion, in terms of a grade choice, and then work toward that criterion. They found that the mastery-criterion condition produced higher grades than the grade-choice condition, but observed no differences between the two groups on posttest scores or student course evaluations. Lea and Lockhart (1975) made essentially the same type of comparison, replicating the Whitehurst and Whitehurst finding that there are no motivation or performance differences between students in mastery-criterion versus grade-choice conditions. However Lea and Lockhart found a strong preference (as indicated by student behavior, not by student verbal reports) for the grade-choice condition. In addition, they found that students who were given a grade-choice option voluntarily chose to work toward the "A" criterion (equivalent to the mastery-criterion) in three times as many instances as they chose to work toward a lower criterion.

In contrast to the Lea and Lockhart findings, Johnson and O'Neill (1973) found that in courses where students were given a grade option (e.g., passing 12 units for an "A," 11 units for a "B," etc.) students tended to be willing to settle for grades less than "A." However, when only the A-option (or F) was offered, students tended to pass more units (Whitehurst, 1975). They also found that manipulation of the mastery criterion in PSI courses had a decided effect on student performance. Students who were given only the option of "A" level mastery (100 percent) tended to perform at that level. If the "A" level was defined as 90 percent, 90 percent was the average level attained. If "A" level mastery was defined as 60 percent, this again was the average level of student performance. Davis (1975) obtained similar results in comparing student performance on unit quizzes when both high (100 percent) and low (50 percent) criteria were offered. Semb (1973) found that the criterion set for passing quizzes was directly related to the level achieved by students, with higher mastery criteria leading to high quiz performance and lower criteria leading to low quiz performance.

Carlson and Minke (1975) compared the effect of gradually increasing the mastery requirement (from 60 percent to 90 percent across units) to the effect of maintaining a constant mastery requirement in each of two ranges (80 percent minimum and 90 percent minimum). The results indicated that a gradual increase toward higher mastery requirements produced fewer non-successes than did a constant application of a fixed high (90 percent) criterion. Students in the gradual-increase criteria group had the highest overall probability of passing early unit tests; however, on later units, the low-fixed criterion group (80 percent) had the highest probability of success. When rate of progress was compared, the 80 percent fixed-criterion group progressed fastest, the gradual-increase criteria group progressed at an intermediate rate, and the 90 percent fixed-criterion group showed the slowest rate of progress.

3. Concerns Pertaining to the Mastery Feature

a. Low-Level Objectives

Beyer (1976) stated that because of the mastery feature, PSI courses "too often become vehicles for teaching only low-level facts, definitions, and generalizations while neglecting higher order cognitive skills, concepts, and affective objectives." Werner and Bono (1977) recommended that separate enrichment activities, parallel with but not critical to the mastery materials, be provided to deal with this hazard. These activities could involve less definable objectives and, because they would be supplementary and optional, could be exempted from the mastery requirement.

Hursh (1976) rejected the claim that PSI's mastery feature promotes low-level objectives, noting that the system has been used in the humanities as well as in the "hard and social sciences." Hursh, Wildgen, Minkin, Minkin, Sherman, and Wolf (1975) compared a no-treatment control group with a PSI group on a test requiring mastery at the level of being able to generalize and apply principles and procedures (higher-level objectives). While the control group scores declined slightly between pre- and post-test administrations, the PSI scores nearly doubled. Hursh concludes that "while it seems intuitively obvious that PSI can be applied to 'higher order' objectives, and that some instructors currently use PSI for such purposes, it is important that an empirical basis be provided for such applications." He suggests that further

attention should be given to developing methods to ensure inclusion of higher-level objectives for mastery in PSI.

b. Over-Reliance on Testing

A second concern with the mastery feature of PSI is that it tends to place heavy reliance on diagnostic and assessment tools. Horton (1979) saw the mastery requirement as outpacing the state of the art in testing. This heavy reliance on tests was seen by Silberman (1978) as a partial cause of some students developing a "beat the system" approach to the course. Silberman cited an inclination on the part of many students to rely on strategies such as (1) taking several quizzes for a particular unit in hopes that one quiz would be easier, (2) comparing answers with other students after taking quizzes in an attempt to learn answers to all questions, or (3) assuming that a particular question would not reappear on future quizzes and thus failing the same question two or three times. He added, however, that "fortunately by the time students have done all this quiz taking, they have pretty well mastered the material in the unit." He also found that in cases where tutors became aware of such systems of student cheating, they handled the situations well and understood the need for correcting student attitudes toward unit quizzes.

c. Recycling Through Materials

Cox and Dunn (1979) noted that the practice of recycling students when mastery of a particular unit had not been achieved was appropriate for some individuals but not for others. While some students were willing to relearn materials they had previously completed, other students were more likely to rationalize their inadequate quiz performance, and to fail to recognize the value of restudying the material. Cox and Dunn suggested the construct of locus-of-control (Rotter, 1966) as a useful index for predicting which response a particular individual is likely to have to being required to recycle through unit material. They noted that optimum individual treatments could be assigned on this basis.

d. Ability Differences

A fourth objection concerning the mastery element of PSI involves the relationship between mastery and the realities of individual ability differences. Cox and Dunn criticized the "reluctance of mastery learning advocates to screen students on noncontent related abilities [in order] to establish how realistic it is to expect a particular student to succeed in a particular course." They saw this reluctance as being related to overly-optimistic expectations regarding the magical cure capability of mastery modeling techniques. They stated that "there really is no certainty that all abilities can be productively taught or modeled," and thus advocated a balance between the mastery learning philosophy and the practical realities of individual abilities.

4. The Relationship of Mastery to the Psychology of Individual Change

Carl Rogers (1969) said, "Experience which is perceived inconsistent with the self can only be assimilated if the current organization of self is relaxed and expanded to include it." Bandura (1976) studied the effect of self-concept on an individual's willingness to attempt a task. He identified

certain characteristics and processes as being functional in an individual's actual acquisition and retention of new behavior patterns. Contrary to the common view that change can be entirely motivated by the attractiveness of its consequences, Bandura found the process of change to be more highly complex because it is so deeply affected by individual perceptions of self. Thus an individual's outcome expectancy (defined as his/her estimate that a given behavior will lead to a particular attractive outcome) is separate from an individual's efficacy expectation (the person's belief or nonbelief in the possibility that he/she can successfully produce the behavior required to achieve that desired outcome). An individual can believe that certain outcomes are possible but not believe that he/she personally has the ability to perform the activities necessary to reach those outcomes. A student's willingness to attempt mastery of a particular learning task can be expected to be highly influenced by his/her perceptions that such mastery is indeed within reach. Also individuals seem to be motivated both by anticipation of reward and by dissatisfaction with their current status and abilities.

Another dimension of the complex issue of individual change was addressed by Small (1970) in a study of the effect of self-concept on the achievement of adults enrolled in basic arithmetic. She found that her sample of adults exhibited lower self-concept than would have been predicted from randomly selected population scores and that those students with the lowest self-concepts tended to use a higher number of practice trials before achieving mastery on a computer-assisted instruction program. Data further indicated that students with lower self-concepts obtained greater achievement, took less time, made fewer trials and fewer errors when reinforced through praise on a 100 percent reinforcement schedule. However, students with higher self-concepts achieved higher gains when reinforced with praise on a 30 percent random reinforcement schedule than when reinforced on the 100 percent schedule. Thus with higher self-concept students the increase in reinforcement frequency seemingly led to a decrease in total gain. Small's findings suggested that there is a negative relationship for some types of learners between over-reinforcement and the need/motivation to change. A full reduction of the tension of "dissatisfaction with current status and abilities" may be counterproductive. Creating a balance between comfort and discomfort may be highly critical when setting mastery goals that will challenge but not overwhelm the students.

D. Self-Pacing in PSI

1. Advantages Associated with Self-Pacing

Many PSI researchers (e.g., Carroll, 1963; Keller, 1968; Kulik, Kulik and Carmichael, 1974; Lloyd, 1974; Sherman, 1974; Whitehurst and Whitehurst, 1975) consider the self-pacing feature of PSI to be one of the more critical. Self-pacing allows the instructor to hold quality (e.g., mastery-level) constant while allowing time and rate to vary.

Most researchers found self-pacing to be a positive feature. Some argued that no limit should be placed on a student's pace through a PSI course; e.g., Keller (1968), who asserted that "self-pacing permits a student to move through a course at a speed commensurate with his ability and other demands upon his time." Lloyd, McMullen, and Fox (1974) and Atkins and Lockhart (1976) found that student performance was equally high even if the pace was set by students,

and a comparative study by Putt (1977) showed that more of the self-paced students achieved mastery in a physics course. Hess (1977) emphasized that "if a mastery criterion is maintained, and if learners vary in the rates at which they learn, then learners must be permitted different amounts of time to achieve that criterion."

Those in favor of fully self-paced PSI frequently linked this feature with the eventual development of self-directed learning habits. Buterbaugh and Fuller (1975) claimed that sharing the responsibility for learning with students by allowing them to pace themselves increased the students' involvement in the learning process. Sherman (1972) insisted that it is dangerous to vary or manipulate the self-pacing element of PSI since the addition of "all sorts of new, ingenious, and additional contingencies...without any knowledge of the subtle operation of contingencies, the law of effect, or basic information concerning reinforcement principles" can negate the advantages of the self-pacing feature. Sherman saw certain of the recurrent student problems with self-pacing (e.g., procrastination) as indicative that those students had higher than ordinary needs for experience in self-management; experience that can be provided by a self-paced course.

Johnson and Rushkin (1976) stated that the procrastination problem may be due to student inability to schedule time and that this inability may be attributed to past educational experiences where the student was paced by instructors. They claimed that, if such is the case, the problem of procrastination is symptomatic of non-constructive dependencies that need to be corrected. Green (1971) supported this viewpoint and said, "If someone has been prodded to work all his life, it may take him some time to learn without the prod." He saw the PSI experience as having possibilities of leading students to unlearn dependency on instructor-pacing and to relearn new self-regulation skills; this in itself he viewed as a valuable learning advancement. Mack and Littlejohn (1977) extended this notion by saying "when the student discovers that he/she has become involved with the learning process, [e.g., through taking personal responsibilities for maintaining the pace of learning] this likely will change his or her patterns of response to instruction."

A study by Surber (1977) showed that even though a self-paced group procrastinated while an instructor-paced group worked at an even rate throughout the semester, both groups scored similarly on pre-, post-, and follow-up tests and were equally satisfied with the course. No differences were found between the two groups in the number of units completed, in the grade distribution, or in course withdrawal rates. By the end of the course, the average number of units completed by each group was the same (self-paced groups completed 14.77 and instructor-paced groups completed 14.95). However, there was a statistically significant difference between the two groups in terms of the number of quizzes that had to be readministered for students to attain mastery. Students in the self-paced group had a significantly lower need to repeat quizzes (4.1 percent) than did students in the instructor-paced group (7.2 percent). The researchers concluded that, in the instructor-paced groups, students were taking quizzes before they were adequately prepared to achieve mastery.

2. Problems Associated with Self-Pacing

Other research on PSI has suggested that self-pacing may not be necessary for effective learning to take place, and may in fact be a deterrent. The self-pacing feature generally has been associated with the procrastination problem commonly encountered by PSI implementers. This problem frequently results in increases in the number of withdrawals and incompletes. According to Hursh (1976), PSI's mastery requirement often comes into conflict with the self-pacing feature; students reportedly often put off course work until too late in the course period to allow themselves adequate time to master the material before the fixed deadline imposed by standard university scheduling.

Compared with lecture courses wherein pace is set by instructors, PSI courses typically have a higher rate of student withdrawal (e.g., Born, Davis, Whelan and Jackson, 1972; Keller, 1968). Kulik, Kulik, and Cohen (1979) reported that out of 27 investigators who compared frequency of withdrawal from PSI and conventional classes, 17 found higher withdrawals from PSI and 10 from conventional; 3 of these PSI and 2 of these conventional classes had significantly higher withdrawal rates. The second outcome of the procrastination problem, the large numbers of incompletes, poses difficulties mainly in settings where schedules are fixed. According to Hursh (1976), a number of early PSI studies show that a disproportionate number of students fail to complete PSI courses within the given time allotment. By combining the means from three such studies (Born and Herbert, 1971; Lloyd and Knutzen, 1969; and Wagener and Motazed, 1971), Hursh concluded that an average of 27 percent of students enrolling in PSI classes received incompletes.

Reiser and Sullivan (1977) found that an instructor-paced group of students passed quizzes at a steadier rate than did a self-paced group. This was demonstrated by the fact that only 23 percent of the instructor-paced students compared to 76 percent of the self-paced students went for as long as two consecutive weeks without successfully passing a quiz. Reiser and Sullivan also found that the number of students withdrawing from an instructor-paced PSI group was half that of students withdrawing from a student-paced PSI group (33 versus 66 percent). They concluded that instructor pacing can reduce student withdrawal rate by producing steadier quiz-taking behavior.

Another dimension of the problem associated with self-pacing is the heavy time demands it places on students. In a number of instances, students have reported that the work requirements and time demands of a PSI course are significantly greater than for lecture courses. Kulik and Jakska (1977), however, cited a recent study at the University of Utah, in which PSI materials were placed in a special center and study time was monitored and tabulated. The average amount of study time for students in the PSI section was 45.5 hours while time requirements for a parallel lecture course totaled 49.2 hours (19 hours for lecture attendance plus 30.2 of study time).

3. Attempts to Correct Problems Inherent in Self-Pacing

Sherman (1974) and Leidecker (1972) suggested that student procrastination in self-paced programs can be dealt with by improving the structure of units and the interest level of the materials, and by using smaller units, particularly at the beginning of a course. They noted that such steps could create student involvement and provide reinforcement using natural, existing features of PSI.

Seven studies that instituted minimum-rate-of-progress contingencies found a reduction in procrastination problems, with no adverse effects on other student performance measures (Atkins and Lockhart, 1976; Coldeway and Keys, 1976; Henneberry, 1976; Lloyd, 1971; Malott and Svinicki, 1969; Miller, Weaver and Semb, 1974; and Sutterer and Holloway, 1975). One of these studies (Coldeway and Keys, 1976) compared the effect of minimum-rate contingencies on the performance and pacing of two groups of students, each having a different type of educational history. One group of students had been moved from an instructor-paced PSI course to a student-paced PSI course; the other group had been moved from a lecture course to a student-paced PSI course. The group from an instructor-paced PSI course had the most significant gains in both pacing and performance when minimum-rate-of-progress contingencies were introduced (e.g., loss of points, grades, or course credits contingent on failure to maintain the minimum rate of progress).

Hursh (1976) cited seven studies that investigated point systems designed to improve student pacing without lessening the mastery requirement. Strategies fell into two basic categories: (a) those offering a fixed number of bonus points for all unit quizzes mastered prior to a particular date, and (b) those offering, on a decreasing scale, a varying number of points for quizzes completed depending on how late in the semester they were completed. Both systems were found to be successful in reducing procrastination (Bijou, Morris, and Parsons, 1976; Bitgood and Segrave, 1975; Buford, 1976; Burt, 1975; Powers, Edwards, and Hoehle, 1973; Riedel et al., 1976; and Semb et al., 1975).

Hursh pointed out that one part of the procrastination problem was related to the artificial semester schedules used in college settings. However, he also reported that in experiments where semester limitations were removed, the results were similarly disappointing. He attributed this in part to the fact that removing all time limitations placed heavier reliance on the ability of subject matter to control student behavior. The absence of negative consequences for non-study, particularly at the beginning of the course, removed the "pay-offs" of study and opened strong possibilities that poor study habits and/or other competing demands on student time would lead to student procrastination.

Hess (1977) agreed that students benefited by being able to progress through a course only as rapidly as they were able to, and to study for as much time as they actually needed for the achievement of mastery. But he pointed out that self-pacing, based on time actually needed to master the materials by students with varying abilities, is entirely different from self-pacing based on student priorities. Hess suggested a system of "fading" pacing limits that would at the outset provide the student with structure and thus facilitate the student's experience with both success and time management. After the course had been in progress long enough for the student to have experienced a reasonable and realistic pacing style (e.g., one that would lead to successful completion of the course), the external limits on pacing could be gradually removed and students could be shifted from external management to self-management as their skills became sufficient for achieving success within this system.

This compromise approach suggested by Hess is particularly interesting in light of research findings regarding the impact of "starting pace" on student tendencies to maintain a reasonable pace throughout a PSI course. Edwards and

Powers (1973) studied the relationship between a student's starting pace and the likelihood of the student completing a PSI course. They found that students who started working at the first opportunity tended to complete the course (93.5 percent of this group completed). The greater the number of weeks that passed without a student starting to work, the less the likelihood that the student would finish the course. Of those students who waited until week four or five to take their first unit test, only 60-65 percent completed the course. Figure 2.1 shows the Edwards and Powers findings relating the percentages of students completing the course to the weeks in which they took their first mastery test. Edwards and Powers concluded that "since the percentage of students who finished the course decreased substantially as a function of their starting time, it would seem imperative to devise a system wherein early starting is highly reinforced." The findings of Edwards and Powers are in agreement with those of Lloyd and Knutzen (1969) and Sheppard and MacDermot (1970) who also found that initial study rate corresponded highly with course outcome; students who began early made the highest overall gains in performance.

Opdahl (1976) studied strategies for constructive pacing interventions based on his belief that PSI as a teaching system is "advantageous for most students, but presents difficulties for students who have not performed well with traditional teaching methods." His research attempted to isolate the self-pacing aspect of PSI courses as a possible deterrent to the success of academically deficient students, and to attempt to correct this problem by teaching such students necessary study skills and self-management methods. In explaining the reason for his research, Opdahl pointed out that according to some studies (e.g., Born and Whelan, 1973) students who fall behind and then withdraw from PSI courses often tend to be those with lower grade point averages, the effect being that their withdrawal leaves a larger proportion of higher grade point average students in the remaining class. Opdahl attempted to teach students to succeed in a self-paced course by using a procedure designed to maintain or shape the pacing behavior of individuals. On the basis of observed individual habits, students were moved into situations that provided varying levels of external intervention intended to influence their pacing. Students were kept informed throughout the study as to how their weekly progress compared to the weekly progress necessary for course completion. By talking with students, Opdahl determined that the students could not calculate for themselves some of the progress statistics he provided (e.g., relative versus necessary rates of progress). Thus, he speculated, low grade point average students "may not be able to assess realistically their standing in a self-paced course because these skills are lacking." He found his methods for shaping students' pacing behaviors to be effective in reducing procrastination.

A study by Lu (1976) investigated whether or not procrastination in PSI courses could be alleviated through use of one of two behavior modification techniques. The two attempted techniques were praise by proctors for early completion of units and point rewards for early completion of units. In both of these experiments, procrastination was reduced from over 90 percent to between 17 and 30 percent, based on proctors' records of students' testing dates and rates of progress. Comparisons of differences between pretest and posttest scores showed the group that received reinforcement gained more than the one that did not. Two problems were encountered with this method. First, it was difficult to deliver the reinforcement when class attendance was not required. Second, it was found that the reinforcers had a saturation effect; by the fourth phase of the project, the point reward system had less effect than during the second phase.

Percentage
Completing
Course

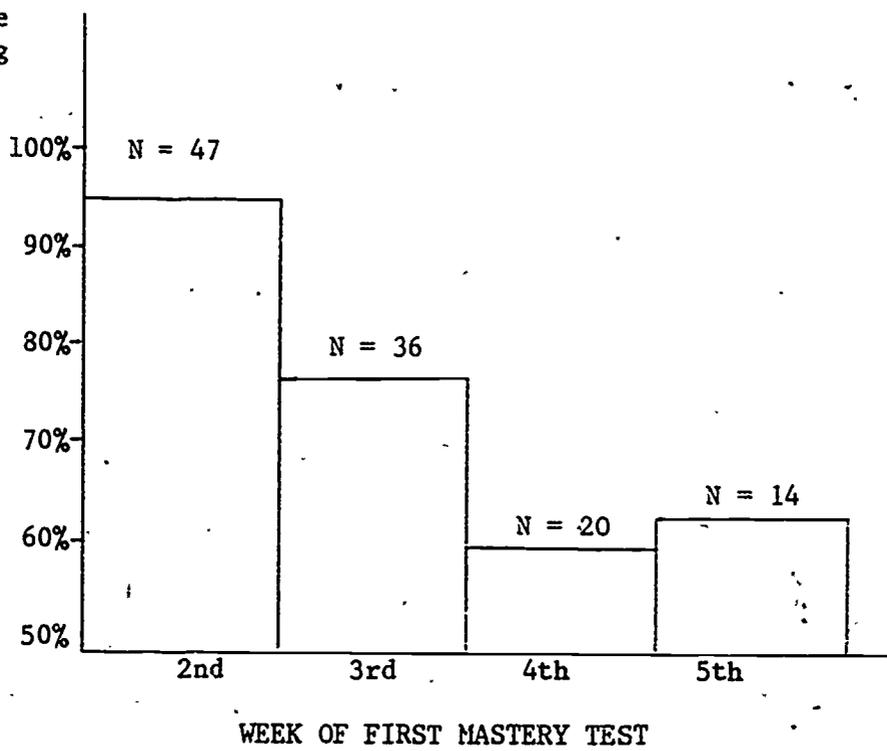


Figure 2.1. STUDENT COURSE COMPLETION VERSUS WEEK OF FIRST MASTERY TEST

Swenson (1974) attempted to deal with the problem of procrastination by providing PSI enrolled students "self-charting forms" for recording their weekly progress. His objective was to find a means for reducing tendencies of some students enrolled in semester-long self-paced courses to postpone work until the end of the semester and then attempt to cram an unreasonable number of units into the last portion of the course. "Cramming" behavior was reduced through use of these self-charting forms, particularly when a point contingency based on progress also was used. Because this strategy was seen as being based on the use of logical consequences, it was not considered to represent a return to instructor-pacing. This method had its greatest effect in increasing the amount of non-graded, optional work completed by students. This was in contrast to a more typical PSI implementation (e.g., Born, et al., 1972) where optional work was offered without pacing incentives and the optional work generally was not attempted by students.

Green (1972) attempted to deal with the problem of student procrastination in a PSI physics course by using the following strategy. He delivered what he termed "fun" lectures and made attendance at these lectures contingent on students having passed a certain minimum number of units. He also published a recommended schedule of dates for passing units that would yield a steady rate of work over the course of the semester. In addition he offered an early final exam for those students who finished the units early. He made note of student progress on a wall chart that was displayed in the class and kept up to date as students passed units. Green reported that this plan for motivating steady pacing through the PSI course led to relatively steady progress and to completion of course requirements as scheduled. He also noted that these manipulations were within the philosophy of PSI and therefore made no major alterations in the mechanisms for the growth toward self-management that PSI sets in motion.

Silberman (1978) attempted to influence student planning and self-pacing through the scheduling of proctor time. He found that flexible scheduling of proctoring sessions led to inappropriate time demands on proctors, and that these unreasonable demands were, to a large degree, caused by the student procrastination problem. When the number of hours and the times proctors were available for consultation were not scheduled, Silberman observed that students tended to wait until the last week of the semester and then attempted to take a large number of mastery tests in order to complete the course. This created a high increase in demand on proctor time, which was even more of a problem because the proctors themselves were students and had their own course requirements to meet before the end of the semester. In addition to using the scheduling of proctor hours, Silberman found it helpful to publish a series of mid-course deadlines to relieve some of the end-of-the-semester overload.

E. Peer-Proctors in PSI

Most PSI courses use student proctors to administer tests, to evaluate certain aspects of student performance, and to generally enhance the social and personal aspects of the learning experience. Sherman (1977) saw the proctor function as representing an ideal opportunity for the teacher to "teach standards, values, and criteria rather than impose them or abandon them." He saw the proctoring element of PSI as providing possibilities for decreasing student dependency on the professorial authority figure, and replacing this with reliance on self and peers. Keller (1968) noted that the use of peer proctors was designed specifically to provide personalization of instruction.

Farmer, et al. (1972) claimed that students who received peer proctoring progressed more rapidly through course materials than did students with no proctoring, and that their final examination performance also was superior. Student performance has been found to be positively affected by either the use of "external" proctors (advanced students, not members of the class [Calhoun, 1975]) or the use of "internal" proctors selected from within the course itself (Alba and Pennypacker, 1972).

The balance of this section consists of a collection of findings intended to address the following questions:

- How are proctors selected?
- What roles are proctors given?
- What systems are used for organizing proctoring activities?
- What proctor training is provided?
- What are the observed benefits to proctors?
- What alternatives to proctors have been attempted? With what results?

1. Proctor Selection

According to Werner and Bono (1977) there are two types of proctoring systems, each based upon a different proctoring philosophy and each leading to a different means of selecting proctors. The first type of proctoring system uses "external" proctors; these are often recent graduates of the course they are to proctor. Systems using external proctors generally provide some type of payment (such as money or course credit) for the services the proctors provide. Werner and Bono recommended that external proctors be chosen on the basis of three important criteria: "competence, interests, and sociability." The second type of proctoring system involves proctors "internal" to the course; these are students currently enrolled in the course who are progressing more rapidly than their peers. According to Werner and Bono, internal proctors may be selected in one of two ways: (a) those students who are moving ahead in the course become that course's proctors, or (b) any student having mastered a given unit may become a proctor for that unit.⁶ These researchers claimed that both systems have been used effectively, and have in fact been combined within the same course with positive results.

Henneberry (1977) cited the June 1974 PSI Newsletter, which reported that more than 80 percent of all the PSI courses then being offered used "external" proctors. Henneberry (1976) expanded Werner and Bono's selection criteria for external proctors to include high ratings in: (a) previous performance in the course (or some other demonstration of complete content mastery), (b) interest

⁶ Each of these two selection modes has differing effects on the proctoring system and on the psychological mechanisms being called into play through that system. Some light has been shed on the psychology and the effects of these two different modes of selection. Further discussion of "internal" proctors is included in the following subsections.

in being a proctor, and (c) level of maturity. He claimed that most papers examining proctor selection and proctor characteristics have primarily addressed performance and demographics (e.g., sex, major, grade average, etc.). Henneberry attempted to go beyond this to look at personality characteristics as they related to proctor effectiveness. He was especially interested in the notion, proposed by educational therapists, that teachers and students may profitably be matched in terms of a particular teacher's personal ability to teach a particular type or group of students. Henneberry studied three questions: (a) How are persons who apply to be proctors different from those who do not? (b) How are students who are selected to be proctors different than those who are not selected? and (c) How are proctor characteristics related to proctor effectiveness?

In selecting his proctors, Henneberry included a battery of personality tests:

- The Marlowe-Crown Sociability Desirability Scale (MC-SD).
- Rotter's Internal-External Locus of Control Scale (I-E).
- The Spielberger Anxiety-Trait Scale (STAI-X2).
- The Suinn Test Anxiety Behavior Scale (STABS).
- The Henneberry Course Anxiety Behavior Scale (CABS).
- The Edwards Personal Preference Scale (EPPI).

Students who applied to be proctors were compared with students who did not apply. Results indicated no statistically significant personality differences between the two groups. However, there were significant academic differences. The proctor candidates were those who finished the PSI course early (70 percent versus 63 percent), had significantly higher grade point averages (3.24/4.0 versus 2.75/4.0), higher posttest scores (89.5 percent versus 81.6 percent), and higher average gain quotient (.82 versus .73). Comparing students who were eventually selected as proctors to students not selected also showed no significant personality differences. However, again, the students selected as proctors tended to show evidence of greater academic success.

In Henneberry's study, proctor effectiveness was evaluated using two criteria, the average gain quotient achieved by the proctor's students, and the average overall rating given to each proctor by his/her students on a proctor evaluation scale. When average gain quotient was used as the effectiveness criterion, the grade the proctor received was not seen to be related to that proctor's effectiveness. This finding, in conjunction with another somewhat contradictory finding that higher proctor grade point average resulted in lower student gain, combined to indicate that high achievement in the PSI course and/or high overall academic record is not a reliable determinant of effectiveness of proctoring. When proctor effectiveness was evaluated using student ratings of proctors, the results were different than those provided by outcome performance measures. Students seemed to prefer proctors who did not try to make themselves self-important, did not try to pressure and direct the student, needed approval and acceptance, and avoided conflicts and arguments. Henneberry concluded from these student preferences that proctor effectiveness

should be evaluated based on performance (e.g., average gain quotient) rather than on student ratings.

While Henneberry dismissed academic accomplishment as a reliable proctor selection criterion, he replaced it with a list of personality factors that he found to significantly affect the proctoring outcome:

- Flexibility. A proctor who is somewhat flexible will be more effective than one who is rigid and incapable of adapting when change is appropriate.
- Sense of Personal Adequacy. A proctor who has a sense of personal adequacy, who does not avoid conflicts, and who is not intimidated by peers will be more effective than a proctor who continually acquiesces or feels uneasy when differences of opinion or roles create conflict with peers.
- Ability to Cope With Test-Taking Anxiety. A proctor who is less anxious about tests is able to function better in a test-giving situation with test-anxious students. A proctor who is anxious about tests may transmit this anxiety to the test-giving situation.
- Heterosexuality. A proctor who is comfortable interacting with members of the opposite sex will be a more effective proctor for students of the opposite sex.

A summary of results of this study is provided in Table 2.2. Henneberry concluded that selection of proctors should be based on assessment of personality using structured tests, role-play situations, or structured interviews with proctor candidates. He noted that, although these personality factors may be a more useful criterion for proctor selection than academic performance, there may be a cutoff point of academic performance below which such personality factors could no longer be predictive of proctor success. He concluded that the relative validity of these various means of assessment is yet to be determined, and that more research is needed in this area.

Neves (1976) extended the notion of the inappropriateness of student evaluation of proctors through a study that examined the relationship between the popularity and the leniency of a given proctor. He found that students tended to choose the more lenient proctors. However, Neves also found that students who had been tested by a given proctor tended to return to that same proctor even if the proctor had failed them on previous mastery tests. The implication is that students are able to adjust to a proctor who is more suitable to the task of proctoring, although they may be inclined, if given the choice, to select a proctor who is overly lenient and thus less suitable to the task.

2. The Proctor Role

The role of the proctor sometimes is limited to the testing for mastery that occurs at the end of each self-paced unit of study. In such systems the proctor administers unit tests and discusses incorrect answers with the students. In addition to the testing role, the proctor's responsibilities sometimes are extended to include tutoring of students over difficult

Table 2.2

PEARSON PRODUCT-MOMENT CORRELATIONS USING AVERAGE
STUDENT GAIN QUOTIENTS AND AVERAGE
STUDENT RATINGS OF PROCTORS

Proctor Variable	Gain Quotient	Student Ratings
Proctor Grade Point Average	-.31a	.22
Proctor Grade in PSI Course	-.16	.17
Number of Days to Finish	-.34a	.13
Student Grade Point Average	-.49b	-.29
E.P.P.I.		
Achievement	-.04	-.24
Deference	.02	.17
Order	-.41b	.16
Exhibition	.21	-.32a
Autonomy	-.01	-.21
Affiliation	.09	.21
Intraception	-.12	.14
Succorance	.01	.07
Dominance	.07	-.36a
Abasement	-.30a	.42b
Nurturance	.07	.05
Change	.10	.04
Endurance	-.17	.09
Heterosexuality	.35a	-.08
Aggression	.22	-.22
Consistency	.14	-.17
CABS	-.20	.29
STABS	-.34a	.11
MC-SDS	-.18	.32a
I-E	-.18	.09
STAI-X2	-.12	.19
a P < .05		
b P < .01		

segments of the written materials, charting and assessing progress of students to aid them in planning their study time, maintaining student records, and providing course-management and revision information.

Hursh (1973) increased the proctor role to include discussions between proctors and students regarding items missed on quizzes.⁷ With one group of students, the proctors discussed incorrect answers on the first five quizzes but did not continue to hold these discussions on the second five quizzes. With the other group of students, the proctors did not discuss incorrect answers on any of these ten quizzes. On an additional seven quizzes given to both groups, all students were given the choice of whether or not to have the proctor discuss the incorrect answers with them. Students chose the discussion option 237 out of 238 times. When students were not allowed to discuss and revise their quiz answers, they needed to retake 18 percent of their quizzes. When students were allowed to discuss their answers, they needed to retake only three percent of their quizzes, when otherwise they would have needed to retake 35 percent of them. The implications of this study are not completely clear, but the clarification/discussion-based scoring system may merit further consideration and research; particularly as it addresses the potential PSI hazard of heavy reliance on tests, which may be only imperfect measures of mastery or non-mastery of unit material.

3. Proctor Systems

The proctor role varies considerably depending upon the proctor system used. Coldeway (1974) compared an experimental proctor system to both a standard PSI system and a standard lecture system. He identified four key factors that appeared to be important to the effectiveness typical of PSI implementations:

- A clear specification of expected student behavior.
- Frequent assessment of student performance and feedback for improvement.
- Opportunity for remediation.
- Set mastery criteria.

Using these key PSI success factors as a basis, he implemented a variation in the proctor system.

In Coldeway's experimental group, students were placed in subgroups of three (based on their own selection or on random assignment). Immediately following the formation of the subgroups, students were told that all members of each subgroup must take each unit examination at the same time and that each subgroup was responsible for the progress of all its members. All three

⁷ When the proctors discussed incorrect answers, they did so by giving prompts, discussing relevant information, and asking leading questions until the student correctly answered the question, or until it became obvious that the student was not able to do so. Students who were able to correctly answer questions during these discussions were given credit as though they had answered those items correctly to begin with.

students in a subgroup were required to master each unit before the subgroup was allowed to continue to other units, and subgroup members were required to do all remediation for other members of the subgroup (including giving make-up examinations, scoring examinations, and reporting examination scores to proctors).⁸ Performance was measured by a final examination score and by the total points accumulated in the course for each of the three groups. Students in any group could earn additional points by doing optional assignments such as participating in experiments, attending discussion sessions, abstracting articles, and writing proposals. Graduate assistants graded and returned the optional written assignments, and conducted the optional discussion sessions.

The experimental-PSI group and the standard-PSI group did not differ on performance measures. The number of points earned on final examinations and the number of points earned through optional assignments was slightly higher for the experimental-PSI group than for the standard-PSI group, but this difference was non-significant. Both of the PSI groups performed better and rated the course more favorably than did the lecture group. The standard-PSI group lost 7 of 30 students through withdrawal; all of these students had fallen behind the pace of the majority of the other students. Additionally, one student received a "D." However, no students withdrew from the experimental-PSI subgroup, and none received a grade lower than "C." Coldeway cited the absence of withdrawals in the experimental-PSI program as one clear advantage of the system. He indicated that this was especially encouraging "given previous reports of PSI courses with up to 15 percent withdrawal rates" (Kulik, et. al., 1974).

Ninety percent of the experimental-PSI students and 86 percent of the standard-PSI students wrote favorable comments on course evaluation questionnaires. Coldeway interpreted these findings as indicating that the use of small groups within the standard PSI-type format did not negatively affect the course outcome. In fact, the high ratings given by students in the experimental-PSI system led him to suggest that students did not find the peer pressure or group contingencies to be strongly aversive.

One of Coldeway's primary reasons for studying this subgroup variation in PSI was to find strategies to increase student interaction and discussion and thereby to increase the cohesiveness of the full group. Proctors observing the experimental-PSI three-member groups indicated that students in these groups often were seen discussing the course material outside the testing area. The proctors also reported that students in the experimental group often initiated discussions with a proctor about material covered in the course or other topics that related to the course content. Coldeway noted a further advantage in that the experimental-PSI approach was more economical in terms of proctor time; it required fewer proctors per student because the subgroup testing reduced the time proctors normally spent waiting for students to complete examinations. Students in the subgroup system also profited in that proctors were more available to them for testing at convenient times and the waiting periods typical of some PSI offerings were reduced.

⁸ Two of the subgroups had to be reorganized early in the quarter when members of these groups complained to their proctor that not all the group members wished to work at the same pace through the course materials. The reorganization resulted in increased compatibility among the group members.

On the other hand, Coldeway observed that the three-member group system could have negative effects if it were used with a larger number of students than could be monitored adequately. He noted that there is a greater potential for cheating when students are allowed to reexamine each other, especially when the full group is held back until all of its members have achieved mastery. Also, the formation of pace-compatible groups may be difficult in a larger scale implementation. Coldeway also advised against subgroups of more than three because "it is doubtful that groups larger than three would be efficient."

Goodall (1972) reported another experimental proctor system, in which he was the system "manager" and the only one who had taken the course previously. He acted as a chief proctor and gave oral examinations to the first four students ready to pass a unit. When these first four students had passed the unit, they became proctors for that unit for the balance of the course. All other students then passed that unit by taking an oral examination from these four proctors. A written examination was administered after the proctor or manager administered the oral exam, as an assurance of the quality of work the proctors were doing. Goodall noted that this internal system of proctor selection allowed "a maximum number of students to be able to take advantage of the additional learning experience involved in explaining the materials to someone else." Goodall also reported on a second PSI proctor system in which an "A" grade could be earned only through meeting a requirement of 15 hours of tutoring; 5 of these hours could be earned by being tutored by someone else, and the balance had to be earned by tutoring other less advanced students. Goodall noted that, in his previous encounters with programmed instruction, he learned the programmed materials with no difficulty but found that he had little or no retention after completing each section. However, he found his retention of the materials in the PSI courses to be excellent after he had the opportunity to teach them.

Sherman (1970, 1971) also used an internal system wherein the proctors were class members who had satisfactorily completed unit tests. Initially he used this system because he was unable to obtain money or credit to use as reward for the work of the proctors. Therefore, he used for proctors the first ten students to pass the first unit on the first try. These students then were responsible for grading, guiding, and interviewing other students, and were given a proctor's manual to assist them in these functions. The students who were not able to be proctors on the first unit could become proctors on subsequent units by taking the unit test before the first unit proctors did and by passing this test on the first attempt. The advantages of this system were: (a) money for paying proctors was not required, (b) the awarding of credits was not an issue, (c) proctors were freshly acquainted with the material, and (d) procrastination was less of a problem. Sherman saw the one disadvantage to this system as being that the instructor was "required to maintain direct tutorial involvement." However, he found that all proctors continued to obtain mastery scores on unit tests, and that 33 percent of his students were able to qualify and function as proctors at some point during the conduct of the course. He said that "apparently the student as a proctor is under the control of some natural reinforcers as well as some 'arbitrary' reinforcers; the student is possibly more often under the control of 'arbitrary' reinforcers." He saw this as causing a difference between the learning experience of the proctors and the learning experience of the student.

Beyer (1976) conducted a study of the literature to identify the potential and the limitations of PSI for use in community and two-year colleges. One of the most serious limitations of PSI that Beyer identified was that the self-pacing and written material features of PSI seemed to limit opportunities for student-to-student interaction in groups. Although Beyer saw PSI as generally limiting student interaction, he noted that opportunities for group interaction do exist within the PSI structure without violating either the mastery or self-pacing principles. One of his suggestions was that some units be worked on with partners in order to create greater group interaction.

Another interesting experiment with extending the proctor role was conducted by Sides (1972). In this study, four kinds of proctors were used. "Interviewing" managers were used to assist students in orally preparing their unit materials prior to written exams. "Project" managers were used to assist students in preparing self-management projects as a laboratory exercise. "Teaching" assistants were used to hand out critical information, relay comments and complaints to the instructors, and conduct meetings with the interviewing managers to assure that the same information was being passed from the instructor to all students. "Testing" managers were used to test each student's mastery through written quizzes. All four types of managers were selected from students who had either completed the course or who were currently enrolled. The students in this study moved gradually toward maximum testing within the fourth testing week, then their test-taking dropped off. Sides stated that there were some difficulties during this study with factors such as friends proctoring friends and grading too leniently, too few test forms (which allowed for memorization of test questions), and too little testing space (which allowed "cribbing" between students). This was one of the most elaborate and difficult to manage proctoring systems cited in the literature and may have incurred difficulties for those reasons; this highlights the importance of manageability to the ultimate success of a PSI proctoring system.

4. Proctor Training

Proctor training in PSI implementations seemingly ranges from very minimal, content-oriented review of the materials to be proctored to full scale proctor training programs similar to teacher training. To a great extent, how much training the proctors should receive depends upon the goals of the particular program. Generally, the larger the proctor role within the program, the more extensive the training that is considered necessary.

In a study of structured and unstructured peer tutoring, Meldahl (1976) suggested that there is a connection between the extensiveness of peer proctor training and the amount of structure in the planned peer proctor activity. She cited, for example, a Johnson and Bailey (1974) variation in which the peer proctoring was more highly structured in that the proctors were taught to give praise after correct student responses. Meldahl addressed what she saw as a need for investigating how effectively peer proctors would function if trained to use teaching strategies that are more typically used by regular classroom teachers. She expected to find that proctoring interactions would be increased with those proctors who had received special instructions prior to beginning their proctoring responsibilities; however, this hypothesis was not supported by her study data. Meldahl suggested a number of explanations for the outcome of her study, such as delayed effect, inadequate instructions, and student immaturity. Nevertheless, her study seems to indicate that the

proctoring relationship itself--the pairing--is perhaps more a cause of proctor effect than is extensive training. The value of being proctored by peers seemingly exists with or without special instruction.

In apparent direct contradiction of some of Meldahl's findings, Saba (1975) found that students tutored by trained proctors showed significantly higher rates of learning and quality of learning than did students tutored by untrained proctors (see Tables 2.3 and 2.4).. The training for proctors in Saba's program was focused primarily on human relations/communications skills. His study was in an attempt to answer the question: "Is there a significant difference between the effectiveness of proctors trained in human relations skills in comparison to proctors without this training?" In this study, the proctors to receive training, and their students, were randomly selected from an educational psychology class; they were then paired randomly.⁹ The proctor training consisted of a five-day, two hours per day workshop composed of the following sequence of activities:

- Discussion of the characteristics of effective teachers (based on Hamachek, 1969).
- Experiential exercises to foster awareness of personal interaction (using ideas by Brown, 1971).
- Discussions, demonstrations, and role playing (using Carkhuff's model as presented by Gazda, et al., 1973) to improve the human relations skills of "facilitation and action." The scale of empathy was the focus of the "facilitation of learning" practice. (Empathy is here defined as "the ability to communicate to another person that he/she is understood.")
- Practice of Flander's interaction analysis technique for rating teacher/student interaction, while viewing videotapes of actual classroom situations.
- Evaluation of trainees (all achieved at a functioning "facilitative level" of 3.0 on a 4.0 scale).

In support of Saba's results, Lazar (1976) insisted on the importance of proctor skill training and orientation. She added that "constant monitoring" of proctors is necessary throughout the course. Her observations, however, were based on her experiences using proctors in a teaching assistant role in writing instruction. Thus these "proctors" were required to be able to correct and explain problems in student writing samples. This use of proctors is well beyond the more traditional PSI proctor role of scoring simple multiple-choice or fill-in questions.

An additional note on the subject of proctor training is suggested by Davidson's (1970) study of adult basic education instructors. She found that responses to an attitude scale completed by the 46 instructors suggested that

⁹ It should be noted that the educational psychology class provided a setting where human relations training skills were likely to be valued positively from the outset.

Table 2.3

THE AVERAGE NUMBER OF TESTS TO MASTERY AND THE DIFFERENCE BETWEEN THE AVERAGES FOR STUDENTS OF TRAINED AND UNTRAINED PROCTORS

Unit	Average Number of Tests Required to Reach Mastery		Difference
	Trained	Untrained	
1	3.31	4.00	0.69
2	1.92	2.73	0.81
3	1.23	1.64	0.41
4	1.17	2.30	1.13 ^a
5	1.33	1.82	0.49
6	1.00	1.13	0.13
7	1.17	1.00	0.17
8	1.00	1.00	0.00

^a Significant at .01 level.

Table 2.4

AVERAGE NUMBER WRONG PER UNIT TEST AND THE DIFFERENCES BETWEEN THE AVERAGES FOR STUDENTS OF TRAINED AND UNTRAINED PROCTORS

Unit	Average Number Wrong Per Test		Difference
	Trained	Untrained	
1	3.60	4.05	0.45
2	2.19	2.60	0.41
3	0.38	1.41	1.03 ^a
4	0.18	2.49	2.31 ^b
5	0.78	3.36	2.58 ^a
6	0.00	0.63	0.63
7	0.50	0.00	0.50
8	0.00	0.00	0.00

^a Significant at .05 level.

^b Significant at .01 level.

most of the instructors were directly transferring previous notions and experience with teaching/supervising/parenting and were not aware of the need to behave differently when filling an instructional role with other adults. This problem could be expected to occur in other instances when attempts are made to use peer proctor systems with adult classes. Where peer proctoring at elementary, secondary and postsecondary levels can succeed (at least according to Meldahl [1967]) with or without proctor training, this may be due to the fact that the proctors involved at these levels have not had long histories of parenting, teaching, or other forms of relating to others from the role of responsible "superior." In programs where the students and proctors are adults, the issue of unlearning patronizing or authoritarian helping skills and relearning skills more appropriate to adult-oriented proctoring tasks may prove to require further attention and training.

5. Proctor Benefit

The fact that the proctoring experience provides benefits to the proctor has been demonstrated by some of the studies cited in previous subsections (e.g., the experience of Goodall referenced in the discussion of proctoring systems). Benefits to proctors have been identified in the literature in both the educational dimension and the interpersonal dimension. Siegfried (1976) reported on a controlled experiment in which he claimed to demonstrate that the educational experience of being a proctor is sufficiently valuable to justify awarding academic credit. He argued that a semester of proctoring taught a student more than did a one semester upper level economics course and that credit therefore should be given. Tietenberg (1976) disagreed with this plan based on noncomparability of course content, but agreed that proctor learning through the proctoring experience was a factor worthy of consideration. He viewed the potential proctor benefits as being balanced somewhat by proctor costs, stating that "proctoring takes more of a student's time than taking an upper level elective." On the subject of proctor costs he pointed out that although the students may benefit from the self-pacing feature of PSI in terms of gaining more freedom to regulate their time, the proctors in a PSI course lose some of their freedom to regulate their time, and in fact often are made vulnerable to unregulated demands on their time.

Morgan and Toy (1970) studied the effects of tutoring on the learning of both the students and the tutors. In this study, 32 students (of which half were controls) from grades 2-5 were tutored by 26 students in grades 8-12 (half were controls). The control groups received no tutoring and gave no tutoring. Tutors in the experimental groups spent 3-4 hours per week in a "warm, friendly, and accepting" tutorial relationship with their assigned students. The increase in learning ranged from 3-5 months for those being tutored and from 5-9 months for those doing the tutoring.

Charconnet (1975) reported an attempt to secure community participation and remedial instruction for children in a particular neighborhood. The primary source of proctors in this situation was the neighborhood adults, most of whom were "genuinely retarded in respect to educational achievement." The proctors were given training in group dynamics and in methods of teaching reading. During the course of teaching the children to read, the adults themselves showed significant progress in reading skills, increasing their reading levels by as much as three to seven years. Additionally, these proctors displayed remarkable zeal in their commitment to their teaching activities.

Charconnet explained the dynamics of proctor learning in the following way. "[A tutor] must acquire new knowledge, or consolidate the knowledge he already has, in order to transmit it. He is obliged to grasp a problem thoroughly before he tries to explain to his fellow pupils. What he knows must be well ordered in his mind so that he may give it in lucid form, at the same time observing his pupils so as to discover the best way of entering into contact with them, and so as to find the right 'tone' making for free and easy communication." She added that the experience of serving as proctor enhanced the individual's sense of worth, as well as creating in him/her a more active attitude toward learning. Thus she saw the proctor experience as a means of overcoming the notion, held by many students, that the student is "a mere passive receptacle for words dispensed by a teacher, who is the sole custodian of knowledge." The proctoring role requires that the individual discover and use his/her own resources, and total dependency becomes impossible. This in itself was identified by Charconnet as being an important form of learning. Moreover, she stated, since the proctor is likely to gain more from the proctoring experience than is the student, it is a mistake to keep proctors in that role for too long. She thus recommended that the role of proctor be shared.

Charconnet saw the peer proctoring situation as ideal for increasing communication and self-expression between students. She stated that it is possible to conceive of systems based on peer proctoring in which exchange takes place between persons "differing widely in age, background, culture, race, and sex." Her positive views on this subject were supported by Gartner, Kohler, Conaway, and Riessman (1971) who also indicated that the teaching or helping relationship is an effective "means of bringing down the barriers raised by culture, background, race, and sex."

6. Alternatives to Proctors

A number of experiments have used computers to perform various portions of the proctor role. Hilgendorf (1978) used the computer to generate unit tests to provide immediate student feedback. His reason for using computer-generated testing was that he had a large enrollment and only a limited number of teaching assistants. Anderson (1977) claimed that the use of computer-generated testing was the solution to the need for frequent diagnosis and evaluation in PSI programs, and Gjerde (1977) saw the computer as an attractive option for the test-scoring function.

Several PSI researchers, however, indicated that this type of substitution for proctors could be deleterious to PSI as a system. They cited in particular certain critical features of the proctoring situation that seemingly would be difficult to preserve were the proctor function to be performed by computers. For example, Beyer (1976) pointed out that in the title Personalized System of Instruction, the term "personalized" did not refer to "personal" content matter but rather to the "personal" contact on a one-to-one basis between student and proctor. He estimated that, in general, students in PSI courses have at least ten hours of one-to-one contact with a private proctor during a PSI course. This, he noted, is considerably more contact time than students would have in a similar lecture/discussion version of the same course. This contact, which Beyer considered one of the most important distinguishing features of PSI, would be removed if computers were substituted for proctors. Certain of the adult learning literature stressed social contact as being critical to adult learners, suggesting that Beyer's emphasis on the "personal" aspect of PSI may be particularly important with adult populations.

Bent (1974) also promoted "personal" proctoring based on reasons internal to PSI as a system. Bent modified traditional PSI to increase the role of the proctoring/examination feature in his PSI chemistry course because he viewed the period of time during which the proctors graded tests in close consultation with students as "the most productive time spent during the entire course. Thus in his course, the major "teaching" was seen to occur during the individual proctoring session when the focus could be on the particular learning needs and difficulties experienced by the individual student in mastering a particular unit. Such valuable natural occasions for individualized "teaching" would be lost were computers to take over proctoring functions.

Edwards (1972) and Goodall (1972), viewed the proctor as being a natural source of feedback and critique regarding portions of the course in need of revision. Edwards said that, as a result of proctors' comments and criticisms, "several beneficial features have been added to the courses." This feedback function of proctors may be lost when computers are used to perform the proctor function. However, Cobb's (1978) use of the computer to collect data for analysis of student movement through a PSI course also provided valuable revision information, an outcome that may counter to some degree the objections raised by Edwards and Goodall.

F. Motivational Lectures in PSI

1. Some Pros and Cons of Motivational Lectures

The relatively minor role that the motivational lecture has played in PSI implementation to date is not particularly surprising considering the ambiguity of this feature as it was described by PSI's originators. Keller (1972) noted that the lectures should be:

- optional and therefore not include necessary course content;
- made available to students contingent on completion of a set portion of the written units;
- announced in advance, with a catchy title, in order to encourage a "flurry of test-taking to qualify for the event."

He explained simply that the lectures should be limited to 20-30 minutes and that there should be no more than 8-10 of them per semester. Other than the general notion of "motivation and inspiration," no particular need or objective was assigned this element of PSI by its originators; it apparently was intended to be considered flexible and adaptable.

Keller noted that even when the desired "flurry" of test-taking in preparation for lecture attendance did occur, students frequently did not attend the lectures. He suggested that student attendance at lectures could perhaps be improved by such procedures as (a) increasing the number of hours per week during which unit tests can be taken and graded, (b) placing a ban on test taking during the time that a lecture or demonstration is in progress, and (c) making the lecture extremely interesting. Keller added that the high interest level necessary for the lecture to guarantee student attendance places heavy demands on the instructor, particularly in light of the relatively low gain that he/she is likely to attribute to this effort.

Lloyd, Garlington, Lowry, Burgess, Euler, and Knowlton (1972) found that attendance at motivational lectures declined rapidly when no contingencies were in effect to encourage attendance. Attendance tended to increase when lecture periods were used to award bonus credits or to provide information regarding quiz content or quiz schedules. When permission to attend lectures was made contingent upon having completed a set number of course units (as was suggested in the early prescriptions for PSI) attendance decreased even further than under conditions where all students were allowed to attend regardless of the number of completed quizzes. The contingency for lecture attendance did not result in an increase in mastery unit completion. Phillips and Semb (1976) found lecture attendance to be high only when the lecture preceded an examination. However, they found no performance advantages resulting from these preexamination lectures.

Williamson, Sewell, and McCoy (1976) experimented with various combinations of PSI and traditional lecture methods to determine what effect an increase in the lecture feature would have on PSI outcomes. They found that the group given weekly one-hour lectures (more than the standard amount of lectures in PSI) and a mid-term examination in addition to the standard PSI activities scored significantly higher than did those who had been instructed using standard PSI only. They concluded that both added factors, the increased use of lectures and the administration of mid-term examinations, were effective as enrichment methods to use with PSI.¹⁰

Another line of investigation concerning the value of the motivational lecture as a useful feature of PSI attempted to discover under what conditions and in what ways the lecture feature can be made to serve more useful functions. Hursh (1976) argued against the use of lectures as motivational aids, claiming that "the results of maintaining such a vestige of the lecture-readings-examination system are almost universally unsupported in terms of effectiveness." He went on to say that most studies he had reviewed found the optional lectures to be so poorly attended that they were abandoned in subsequent renditions of the course. He suggested, however, that "information transmittal may not be the only reason for lecturing." He proposed that individual instructors analyze the function of lectures within the context of their own particular course and then design their course to capitalize on whatever function the lecture is most uniquely able to fulfill. As an example, he discussed a concern identified by some PSI teachers regarding whether the lessening of student-instructor interaction may not result in the elimination of the instructor's effect as a role model. If such is thought to be a problem in the context of a particular course, a constructive objective for the lecture could be to provide opportunity for the instructor to interact with students such that students are provided a role model of a professional, a craftsman, a scholar, or the like.

Hoberock, Koen, Roth, and Wagner (1972) reported an instance where the motivational lecture feature of PSI was used to address a necessary and otherwise unmet need in a PSI course in engineering. Three of the four PSI courses they studied made very slight use of lectures, averaging only one to three lectures per semester. Lectures that were given in these three courses were well attended and were judged to add interest to the courses. In the fourth course,

¹⁰ In this experiment, all classes were instructor-paced rather than student-paced.

however, a major variation in the standard lecture function was observed. This difference was attributed to the fact that the lecture in this case was designed to serve a definite function that was necessary to the overall course objectives and that could not be performed through any of the other features of the PSI format. The motivational lecture was used to meet the course objective that students develop "a conversational ability with technical material so as to [be able to] effectively explain it to nontechnical managers." In order that this skill be learned, it was necessary for the professor to orally model and exemplify appropriate successful conversational skills. The lecture format was seen as a uniquely appropriate medium for this particular instructional activity. These lectures were well attended and well accepted by students.

2. Use of Alternate Delivery Approaches

Some PSI implementers have experimented with various delivery approaches for the motivational lectures. For example, Roper (1977) developed a PSI quantum mechanics course in which the optional lectures were video-taped. Students were allowed to use the appropriate video-cassette when they arrived at the unit completion point required for it to yield maximum benefit to them; their viewing of the taped lectures at these optimum points in time was thought to enhance the content-reinforcing advantage of the lectures. This variation in the delivery approach removed the difficulties normally introduced in PSI when contingency requirements for lecture attendance are impeded by the realities of the self-pacing feature. Additionally, it allowed students to review lectures, and made possible various types of media-dependent demonstrations and visualizations.

Anderson (1972) varied the motivational lecture feature by using cassette tape recorders to provide training in problem solving. Anderson reported that, through use of the tape recorders, essentially all of the students gained necessary parallel skills that enhanced their abilities to use the PSI mastery materials and to retain the performance levels they had achieved. He also noted that his innovation resulted in increasingly positive attitudes.

According to Charconnet (1975), instructional delivery systems such as slide/cassette, radio broadcast, closed circuit television, and newspaper have been effectively used abroad in situations where students were too isolated to congregate in a single setting. This suggests some interesting possibilities as to how the lecture portion of PSI might be made more transportable and accessible to otherwise isolated students.

G. PSI Systems

The development and organization of a PSI program requires an integration of the various aspects of the five features of PSI that takes into consideration the program goals, the population to be served, and the available resources. Choices of procedure within the five operational areas of PSI (materials, mastery, self-pacing, proctors, and motivational lectures) can be based on the literature, but little research has been devoted to the investigation of possible contexts for PSI as a system. Nevertheless, research on the individual features of PSI suggests that the PSI system can be applied to a variety of purposes and objectives within a variety of contexts. The literature also

suggests that possibilities exist for innovative uses of PSI in alternate and even difficult contexts, and that PSI may be a viable option for use with student populations other than those enrolled in colleges and universities. Following is a brief review of literature related to research that considered the relative importance of the five operational areas of PSI, and that considered PSI in the larger context of a total instructional system.

1. The Relative Importance of PSI Components

Much of the research related to modifications to one or more of the components of PSI has met with some resistance from PSI's originators and others who maintained the somewhat purist viewpoint that any modifications of the PSI system were likely to decrease its effectiveness (e.g., Sherman, 1972; Calhoun, 1976). According to Ruskin and Ruskin (1977), PSI as an intact system has been found to have a high probability of success, but as changes are made (e.g., eliminating proctors from the instructional process, introducing pacing contingencies), the "success rate seems to drop significantly." They noted that the five features of PSI apparently function as interactive, interdependent parts of a total system; the alteration of one part should be expected to affect the whole, positively or negatively. They concluded that a thorough understanding of how and why PSI has been effective in past implementations is essential before any alterations in the system are made, including the adaptation of the system to a distinctively different student population.

Other researchers have attached various relative values to components of PSI. For example, according to Kulik, et. al. (1976), and Williams (1976) the most effective components of PSI appeared to be (a) the use of small units of materials accompanied by frequent mastery testing, and (b) the use of clearly defined objectives in combination with a mastery requirement. These researchers claimed that if either one of these two essential features of PSI was included, student performance on mid-term and final examinations could increase regardless of what other, nonideal characteristics the remainder of the instructional program exhibited. They also claimed that although the effects of immediate feedback and peer proctoring appeared to be conducive to better performance, these PSI features are less supported by available research than are the two factors previously mentioned. It also appeared to Kulik and Williams that student self-pacing and the format for mastery evaluation (e.g., written versus oral) had not proven to be highly significant to actual gains in student performance.

Caldwell (1978) and Acker (1976) considered the mastery criterion to be the most important component of PSI. Zeilik (1974) found support for ranking mastery as the primary feature of PSI when he studied student perceptions of PSI components. The students perceived unit mastery tests, and the immediate correction of those tests, as the most important component of their learning success. Fernald (1975), however, found that the student self-pacing feature of PSI had the most influence on student test scores in an introductory psychology course.

According to Ruskin and Ruskin (1977), features of PSI may need to be evaluated by measuring gains other than content mastery. For example, questions such as how self-pacing affects student motivation and student self-direction are perhaps more important than content mastery when evaluating the relative usefulness of the self-pacing feature. When evaluating the peer proctor

feature, measures of possible increases in oral communication ability may be a more proper means for estimating the positive effects of the use of proctors. Ruskin and Ruskin identified long-term effects on positive attitude toward learning as an additional issue that needed to be considered when evaluating the relative usefulness of various PSI features. Hedges (1975), Stice (1975), and Allen (1976) identified similar long-term effects on study habits, study methods, and study attitudes.

2. Some Attributes of PSI Systems

Two particular attributes of PSI as an instructional system appear to merit particular consideration. Following is a brief discussion of PSI and the teacher role, and PSI as a research setting.

a. Effect on Perceptions of Teacher Role

One significant attribute of a PSI system involves the effect (e.g., perceived threat) it can have on teachers. The expectation that the teacher's role in PSI is a decreased one is not uncommon. It is, however, contrary to the observations of researchers such as Semb and McKnight (1977) who viewed PSI as placing particularly heavy demands on teacher experience and expertise. Although the instructor's responsibilities in PSI courses are different from those of instructors in more conventional classrooms, Semb and McKnight saw merit in the argument that a PSI course depends as much, if not more, upon the instructor "than it does upon any of the features of the PSI package." Experience has shown that the attitude of the teacher implementing PSI can positively or negatively affect the outcome of the program. Semb and McKnight extended this point by saying that "this is perhaps true of any instructional system, but it becomes even more pronounced when an instructor must adopt an elaborate set of procedures such as those which define PSI." This viewpoint is supported by the research of Kelly and Chapman (1977) who found that students enrolled in PSI courses tended to be more favorable toward those courses when their instructors were enthusiastic.

Cross (1975) found dramatic increases in community colleges' use of pacing methods, programmed instruction, skills centers, team-teaching, peer tutoring, and cooperative education programs between 1970 and 1974. The use of peer tutors and programmed instruction approximately doubled, although less than a quarter of the respondents indicated they were using more integrated programs such as PSI. Cross interpreted these results as showing a predominant trend toward individualized instruction and an increased willingness on the part of teachers to share the responsibility of educating students without feeling replaced or threatened. These findings suggest that the introduction of PSI into such settings without threat to or resistance from instructors may be increasingly possible. Nevertheless, perceived teacher-threat must be considered during organizational phases of PSI programs.

b. PSI as a Means of Researching

PSI appears to provide a particularly promising setting for studying individual learning. Since the various steps and student responses to learning activities are highly visible in PSI, the system provides opportunities for in-depth observation of the individual learning process (e.g., by collecting study data via the charting of study patterns and problems as was

done by Cobb [1978] in his earlier cited research). Proctors also can be used as valuable data collection agents. Their observations and records of interactions with students can provide source material for case studies of adult learning processes. Hess (1977) attributed part of the attractiveness of PSI to its "close relationship to the applied analysis of behavior, which has resulted in unusual attention to research designs appropriate for measuring instructional effects upon individual learners." The possibilities for studying individual learning by using PSI as a natural laboratory for such study have been largely unexplored by researchers to date.

3. The Design of PSI as a System

a. The System Approach and PSI

Hess (1976) used a general model of individualized instruction to identify the distinctive contribution of PSI to the solution of instructional design problems. Various other researchers from the field of instructional design have studied PSI for similar purposes, investigating various potentials for using PSI as an instructional systems design tool. Koen (1970) saw personalized systems of instruction as a teaching design strategy wherein elements of learning can be "carefully chosen and interrelated to maximize learning." Koen (1973) described a three-level design for developing instruction by constructing PSI units on the following levels: equal difficulty units, logical units, and reinforcement units. These three types of units were intended to serve differing purposes within an instructional sequence such that learning was progressively consolidated so as to be better retained. Koen also advocated the systematic reduction in the number of study aides available to students as the PSI course progressed.

Carter (1967) considered useful the design features of PSI identified by Koen (e.g., the possibility of alternating among three levels, each serving a different purpose) and saw the promise of such efforts for addressing the need for designing systems of instruction that effectively teach adult basic education (ABE) students. According to Carter, ABE students need to be provided with experience in "concept building"; thus instructional planning needs to emphasize the potential of sequential (building blocks) versus isolated learning activities.

Scott (1975) used a systems design approach to PSI development. He established learning hierarchies for increasing student perceptions and increasing student performance in the subject area of drug analysis. As is the case with all learning hierarchies (e.g., those recommended by Gagné for particular use with the learning of intellectual skills), activities were put in a sequence that presupposed that one element required mastery before the next element could be attempted. Edwards (1976) also saw design possibilities with PSI and attempted to optimize stimulus control, small steps, and self-pacing to the degree that these were useful in implementing a hierarchical learning sequence. Brock (1975) combined PSI and job-task-analysis in an attempt to design effective Navy training. Job-task-analysis is known to place heavy demands on the effectiveness of instruction similar to those placed by learning-task-analysis; the system of instruction is expected to provide for all prerequisite skills such that the student becomes fully able to succeed on a particular targeted performance task. For such demands on the instruction to be met, it becomes necessary to ensure that full mastery of all necessary enabling skills has occurred before moving to the learning task that will be dependent on those

skills. Brock found PSI useful as a design tool within such highly accountable instructional settings.

b. Design Considerations for PSI

A collection of design considerations introduced by PSI researchers and by adult learning specialists is shown in Table 2.5. This listing is intended to represent exceptional and/or unique design concepts rather than to be representative of all design ideas presented in the PSI literature.

c. Diagnostic/Prescriptive Testing and PSI

Beyer's (1976) recommendation that PSI be adapted to individualized formats through diagnostic/prescriptive placement of students within PSI courses introduced a considerable design challenge. Two models discussed by Hashway (1979) may be useful to the investigation of individualization potential in PSI instruction. The first model, Individually Prescribed Instruction (IPI), was formalized by Robert Glaser and his associates (Glaser, 1968, 1971; Glaser and Cox, 1968; Glaser and Klaus, 1962). As described by Hashway, IPI was organized into well-defined objectives and their associated units. Each unit was composed of specific skills that must be mastered to achieve competence in the subject covered by the unit. The skills needed to begin each component or unit were defined. Then, the entire sequence was organized into a learning network or structure. As the student successfully completed each component, he/she had mastered the prerequisites for one or more of the components to follow (Dyer, 1960; Gagné, 1965; Gagné and Paradise, 1961).

Three levels of testing were used in IPI: placement, unit (pre- and post-), and curriculum-embedded. Placement tests were used to determine where a student entered the learning network. A unit pretest was administered to each student as he/she began a unit. Unit pretests were in-depth tests of the skills that comprised the unit. Unit posttests, which were equivalent forms of the unit pretests, were then used to test mastery of all skills within the unit. Curriculum-embedded tests monitored the student's progress within the unit; these were criterion-referenced tests that evaluated mastery of each skill as the student was learning the skill.

The sequence of events in the IPI model was as follows:

- ° The placement test was administered to all students who entered the program, and initial determination of the student's knowledge/skill levels was made based on the results.
- ° A unit then was selected in an area where the student was not proficient but did have the prerequisite abilities.
- ° A unit pretest was administered to determine whether the student already had mastered the unit, thus indicating an error in the placement procedure.
- ° If the pretest results showed a lack of mastery of one or more of the skills in the unit, a learning prescription (a specific course of study) was developed for one of the skills within the unit.

Table 2.5
DESIGN CONSIDERATIONS

CONSIDERATIONS	RECOMMENDED BY
1. All unimportant, redundant, or irrelevant content should be eliminated because students likely will spend time attempting to master all content presented to them.	1. <u>Johnson and Sulzer-Azaroff (1975)</u>
2. PSI is highly appropriate in instructional situations that are student-oriented.	2. <u>Osterman (1977)</u>
3. PSI is highly appropriate in instructional situations that require that a large amount of routine instruction be covered.	3. <u>Osterman (1977)</u>
4. PSI is a highly appropriate system of instruction in situations where the degree of student involvement needs to be high.	4. <u>Osterman (1977)</u>
5. There is a convergence of evidence that "engaged time" or "time-on-task" should be maximized by whatever means proves effective.	5. <u>Report of the National Academy of Education (1978)</u>
6. PSI courses should be individualized through use of diagnostic tests for appropriate placement of students within the course.	6. <u>Beyer (1976)</u>
7. The issue of readability needs to be considered when PSI is used with students who are poor readers.	7. <u>Beyer (1976) and Glick (1973)</u>
8. When recycling students through content that they have not mastered, it is more effective to use alternate materials and activities than to cycle students back through materials they have previously studied.	8. <u>Swanson (1976)</u>
9. Making some provision for recording student responses is necessary if meaningful data are to be collected for revision of materials.	9. <u>Hess (1977)</u>
10. Learning in PSI can be designed to take place in two steps and tested accordingly. The use of short answer items on unit tests (suitable to simple objectives) can be combined with the use of essay questions on the final exam (appropriate for the testing of more complex objectives).	10. <u>Tietenberg (1973)</u>

- After the student completed the learning tasks, he/she took a curriculum-embedded test.
- If the student did not pass the test, another learning prescription was developed, and if the student did pass the test, he/she went on to the next skill in the unit.
- When all components in the unit were successfully completed, the student took a unit posttest. If the student did not pass this test, a new learning prescription was devised, and if the student did pass the test, he/she proceeded to the next unit.
- When all units were mastered, the student exited the program.

Hashway concluded that "the IPI model clearly made available quantities of information about the student, the instructor, and the course." However, a major problem remained (Nitko, 1968, 1970). Cognitive factors that were not part of the instructional model were not taken into account and "the psycho-social background of the student also was not recognized." Hashway described a variant of the IPI model, the Expanded Individualized Prescriptive Instruction (EIPI), designed to overcome this weakness. The EIPI model attempted to treat the student holistically, as more than a list of test scores.

The EIPI model had three phases: placement, counseling, and intervention. The first two were concerned with proper pupil placement. The third phase, the actual intervention, was an attempt to correct student deficiencies. During the placement phase, a summary report of each student's status was prepared. Cognitive skills, cognitive style, and psychological characteristics were considered through the administration of tests in each of these three areas. (The summary report of test results could be computer-generated.) During the counseling phase, another placement report was prepared and the student entered a counseling module. The interpretation of test results, and the counseling toward the formulation of goals and options from which to choose, were directed toward maximizing student commitment and success. Counselors had the summary test results, but also could consider the student's life history and other relevant data. The student and the counselor together arrived at a learning intervention strategy.

Either of these models, the IPI model or the EIPI model, likely could be useful in providing for the individualization Beyer (1976) concluded to be necessary within a PSI system. Such individualizations may prove even more necessary when PSI is used with adult populations where the relative similarity of student entry level cannot be assumed (as it sometimes can be in college settings). A contingency plan for wide-range individualization of PSI content and unit materials may be highly advisable in adult program adaptations.

d. Designing to Enhance PSI's Behavioral Impact

One feature of PSI that could be optimized through creative design is the behavioral effect this system has been observed to have on student locus-of-control. There is evidence that a student's degree of self-control over study increases as a PSI course progresses. This effect has been seen to carry over into other courses in which PSI students are simultaneously involved. Tietenberg (1973) conducted a survey of student perceptions of

their educational experience in PSI versus lecture courses. The PSI course received higher ratings on all dimensions related to locus-of-control. Students reported that the PSI course outranked the lecture course in each of the following characteristics: (1) taught me to pursue subject on my own; (2) stimulated me to discuss the subject in general conversation; (3) increased my appreciation of the subject; (4) taught me new ways to understand and evaluate problems; and (5) had overall educational value for me.

Sherman (1977) stressed PSI's value in increasing the student's assertiveness over his/her own learning activities. He questioned the validity of any educational system wherein the student remains dependent on the instructor until the point of graduation. He stated that "what is needed is a procedure for the gradual transfer of control from the teacher to the student, at a rate commensurate with the student's demonstrated ability to make appropriate judgments." He viewed PSI as having design possibilities for this broader purpose. Sherman cited Geis (1977) as describing how the feedback system inherent in PSI provides an ideal mechanism for allowing designers to base the process of material design, development, evaluation, and revision on actual student response and achievement. Sherman suggested that, within the PSI system, it is possible and constructive to gradually decrease the amount of instructor prescription and concurrently increase the amount of student prescription as to goals and objectives for course study. The feedback available in PSI should be provided in a measure that is responsive to the student's increasing ability to form appropriate judgments regarding plans for his/her own further study. Sherman also proposed that the responsibility for control over time contingencies be passed from instructor to student in a gradual system of constantly increasing student responsibility. Learning time management is itself a valuable form of learning in that "the adult eventually must manage, or mismanage, time for himself."

The gradual transfer of control from instructor (or instructional system) to student also has been studied through several experiments that increase student control of curriculum selection (with the resultant increase in student control over the course of learning). Burr (1976) offered high school chemistry at three levels using self-paced PSI, Wortman (1976) offered a variety of minicourses in psychology using PSI, and Ludwig (1975) offered interdisciplinary electives taught with PSI. Since a developed PSI course can be implemented with little difficulty as compared to the effort involved in a lecture course, it is reasonable to view PSI as a possible mechanism for gradually increasing the course offerings available to students; thereby increasing student control over the directions of study.

Thus two forms of transfer of control can become possible through PSI, the transfer of control within a particular course, and the transfer of control regarding overall course selection. Both types of transfer of control may have positive effects on student behavior and student attitudes towards self-assessment, self-sufficiency, and self-direction.

e. Design Toward Higher Level Objectives

According to Sherman (1977), PSI holds considerable promise in the area of designing instruction toward higher-order objectives (as defined in earlier discussion). Sherman admitted that most PSI materials to date

deserve some criticism because of their primary adherence to low-level objectives. He saw this as a difficulty, however, that is inherent only in the implementations of PSI and not in the system itself. The tendency to select low-level objectives in PSI is at least partially attributable to the fact that such objectives are more easily constructed and tested. Sherman saw PSI's combination of proctor and written materials as providing a unique opportunity for "teaching and analyzing something beyond rote, recognition, and recall." It stands to reason, however, that to realize whatever potential PSI has in terms of teaching for higher level objectives, higher demands will be placed upon the design activities. Some successes along these lines (e.g., exemplary implementations such as Van Nostrand, 1977) serve as evidence that possibilities do exist, however difficult they may be to attain.

4. The Practice of PSI as a System

A number of studies have been conducted to consider the operational logistics of PSI courses. A number of the operational choices that must be made when organizing a PSI program were discussed earlier in this chapter, each under the discussion of the single feature of PSI that that choice was most likely to affect (e.g., the use of internal versus external proctors, the adherence to 100 percent versus 80 or 90 percent mastery). Additional selected operational considerations are discussed here.

McGaw (1975) provided some practical suggestions regarding the design and operation of PSI systems. He suggested that PSI be implemented in five stages: (a) assessment of entry behavior, (b) specification of course objectives, (c) selection of resources and learning activities, (d) establishment of course procedures, and (e) evaluation of student performance including short-term and long-term effect on performance and on attitudes toward learning in general.

Johnson and Sulzer-Azaroff (1975) recommended that PSI be scheduled in two-hour time blocks three times a week since the more standard 50-minute class period was too short to be effectively utilized. They also suggested that at least two rooms be used for a PSI course, one for administration of mastery quizzes and one for proctoring and studying sessions. This arrangement would reduce noise and distraction. Johnson and Sulzer-Azaroff suggested establishing course policy at the outset of a PSI program since students needed an understanding of complete course procedures and course policies. They recommended that details of the PSI system, proctor system, daily course procedures, grading system, and suggested study schedules and procedures be presented in a separate readiness unit to be given to students at the outset of the course and to be subjected to the same mastery requirements as other units. Teaching the PSI system prior to using it to teach content would appear further justified by other considerations introduced earlier in this chapter (e.g., the advantages of early success as this relates to ultimate success).

Werner and Bono (1977) made two specific points regarding the operation of PSI at a systems level. First they recommended that PSI programs include firmly established course policies. They warned that any exceptions to these policies be made only on a "case-by-case basis with the awareness that such exceptions may provide an invitation to students to challenge other aspects of your course." Their second systems-level recommendation was that enrichment activities be integrated into PSI courses using all portions of the content

that do not need to be fully mastered. Enrichment activities would be either illustrative of, or supplementary to, critical course information, and would be individualized as much as possible; group activities would be planned as appropriate. Werner and Bono recommended that the psychology of PSI be addressed and promoted by these enrichment activities wherever possible. They offered the following specific suggestions for accomplishing this.

- Use unit study questions to lead up to an enrichment activity and to help students feel prepared for that activity.
- Utilize the concept of "learning by doing" so that the student becomes more than a passive observer during the enrichment activity.
- Allow some latitude in required quality of student response to an enrichment activity (if the activity contains critical information, the material should be put in unit form and taught in PSI format).
- Use proctors to question students about the enrichment activity or to explain difficult parts of the activity.
- Praise and encourage students for participation in the enrichment activity; keep any criticism of students to a minimum.

Two other considerations for organizing a total PSI program are the establishment of a recording system and the planning for the opening session. For establishing a recordkeeping system, Johnson and Sulzer-Azaroff (1975) suggested a simple system of 8½ x 11 inch folders for each student in which completed quizzes and other information are collected. Born and Herbert (1971) found a cumulative progress record to be useful; the unit numbers were recorded on the abscissa and the dates of the course on the ordinant creating a graph that, when attached to the student's folder, provided a convenient means of recording progress and possibly even for enhancing it. Suggested rate lines were drawn on these cumulative records to provide students with pacing guidance. Shepherd (1977) recommended that the recordkeeping in large PSI courses be relegated to a computer. He instituted a Fortran program to serve this function in his own program and for use in other PSI implementations.

Henneberry (1976) found program initiation to be extremely critical; students' starting pace was predictive of all subsequent progress and performance. The fact that, even on initial unit tests in PSI courses, student performance has been found to be generally superior to that of students in traditional courses (Riedel, Harvey, LaFief, and Finch 1976) could provide a basis for improving students' starting pace. Henneberry cites other program initiation considerations to include proctor orientation, provision for secure storage of unit tests, and arrangement for backup services such as secretarial assistance. Once the PSI system is in operation, these and other details can cause difficulty if they are not already in place.

Chapter 3

Review of Literature on Adult Learning

This chapter provides findings from a review of literature on adult learning. No attempt was made to conduct an exhaustive review, rather, the review was limited to a cross section of literature considered likely to have implications for development and implementation of a PSI program for nontraditional adult learners. Section A outlines some general qualities of adult learners, and their implications for development of instructional materials and strategies. Section B briefly discusses some characteristics of nontraditional adult learners and several subpopulations considered promising for PSI implementation.

A. Some Characteristics of Adult Learners

This section presents a summary of pertinent research findings regarding some of the characteristics of adult learners. Subsection 1 discusses those characteristics that motivate the adult learner to approach the learning situation (e.g., enroll in a course, attend a class), subsection 2 discusses the general characteristics that the adult learner brings to the learning situation, and subsection 3 summarizes some findings regarding individual differences and how these differences appear to relate to the implementation of a PSI program. Subsection 4 summarizes the implications of the prior subsections by discussing research findings regarding what is required for the adult learner to remain in and profit from the learning environment.

1. Why the Adult Learner Approaches the Learning Situation

Houle (1961) conducted a study, involving in-depth interviews with adult students, to discover why adults engage in continuing education. He found that his subjects could be fitted into three categories. As Houle pointed out, "These are not pure types: the best way to represent them pictorially would be by three circles which overlap at their edges. But the central emphasis of each subgroup is clearly discernible." The three types were:

- The goal-oriented learners who use education for accomplishing fairly clear-cut objectives. The learning occurs in episodes, each of which begins with the realization of a need or the identification of an interest. The learning method varies and generally is any method perceived as being the most appropriate or most available.
- The activity-oriented learners who take part because they find in the circumstances of the learning a meaning that has no necessary connection--and often no connection at all--with the content or the announced purpose of the learning activity. These learners are seeking social contact and their selection of an activity is based essentially on the amount and kind of human relationships the activity is likely to provide.
- The learning-oriented adults who seek knowledge for its own sake. Most learning-oriented adults are avid readers and have been engrossed in learning for as long as they can remember.

Tough (1971), in his research to determine what motivated adults to begin a learning project, found that his subjects overwhelmingly anticipated several benefits from learning. Some of the rewards were immediate: satisfying a curiosity, enjoying the subject itself, enjoying practicing a skill, or enjoying the activity of learning. Others were long-term: producing something, imparting knowledge and skill to others, understanding what will happen in some future situation, etc. Tough considered pleasure and self-esteem to be critical elements in his subjects' motivation.

Miller (1972) noted that intellectual curiosity, a lusting after knowledge for its own sake, seemed by far the weakest motivation for an adult to come into a learning situation. He indicated that extrinsic drives (the two most common of which are the need for human relationships and group belonging, and the desire for status recognition) were completely legitimate motivations for adults to enter education programs. He noted that many people appeared to enroll in programs at least partially because they were lonely and wanted the warmth of relating to others on a level that did not threaten too much closeness. Others came in response to a wish to approximate an image they had of the intellectual; a wish arising, perhaps, out of the very real connection between schooling and upward social mobility, and continually reinforced by the sham worlds created by advertising and the mass media.

Miller further noted another general category of motivation that he described as an interest in rationality, or the adult's desire to talk things over. He said that this was not a desire to learn something in the ordinary sense of learning, but rather the adult's wish to clarify thoughts, talk about worries, and untangle ideas.

Cross and Zusman (1977) noted that the following six factors appeared to motivate adults to seek continuing education.

- ° The desire to achieve practical personal goals, such as getting a new job, advancing in a current job, or improving income. The desire to improve one's personal lot in life remains the primary motivation for adult education. Those who do not have good jobs would like to get them; those who have fairly good jobs would like to advance; those with low incomes would like more money. Education is seen as the primary route to upward socioeconomic mobility, and vocational/professional education was the first choice of the majority of learners and would-be learners.
- ° The desire to achieve personal satisfaction and other inner-directed personal goals, such as personal development and family well-being. The use of education for personal satisfaction is a luxury most people wish they could afford. While the majority of potential learners were interested in nonvocational subjects such as hobbies, home and family living, and personal development, such subjects rarely were cited as first choice. The exception occurred among older people who were more likely to use education for leisure-time pursuits.
- ° The desire to gain new knowledge, including the desire to learn for its own sake. This abstract idealized motivation for learning is so socially acceptable that it was noted by most people as being an

important motivation for learning. Behavioral verification of this motive is difficult to obtain since almost any subject could be studied because the act of studying it or knowing more about it is satisfying. Nonvocationally oriented learners, however, were more likely to say they were interested in knowledge for its own sake than were career-oriented learners. Apparently the average adult learner did not regard traditional liberal arts courses as the foundation subjects that would satisfy his/her need for new knowledge. Only a few adult learners expressed strong interest in traditional, discipline-based subjects; predictably, they were the individuals with high levels of education.

- The desire to achieve formal educational goals (degrees, certification, etc.). The pursuit of degrees was strongly associated with level of educational attainment and with desire for job advancement. Younger persons and those with one to three years of college were very likely to be degree-oriented, whereas the desire for credit or certification dropped off sharply for those over 55 who were no longer interested in career advancement. While working for credit usually was not given as a primary motivation for education, a desire for some formal recognition was in keeping with the pragmatic orientation of most adult learners.
- The desire to socialize with others and/or escape from everyday routine. A surprising number of adults surveyed (over one-third) were frank in admitting that escape was, for them, a reason for pursuing coursework. It was rarely offered as the primary motivation; nevertheless, there were certain groups of people for whom education provided an escape and an opportunity to meet new people. Such learners were quite likely to be interested in hobbies and recreational subjects, and they were likely to be people who lack other social outlets (e.g., the elderly, women confined by home and family). Unfortunately, many of those most eager for social contact lacked the mobility to participate in group learning activities.
- The desire to achieve societal goals. The desire to learn to be a better citizen was not a strong motivation for learning, although about one-fourth of the surveyed potential adult learners included it as one motivation among others. Those experienced with the marked fluctuations in demand for extension and noncredit courses have, however, observed some apparent societal motivation in demand for courses on such subjects as energy or ecology. Little information was available regarding the reaction of people to particular social concerns that are influenced by nonformal educational networks such as television and the popular press.

Overall, Cross and Zusman's six factors characterize adults as pragmatic learners, interested in education mainly because of its perceived practical utility.

2. What the Adult Learner Brings to the Learning Situation

Living is an opportunity for learning, but how people use their opportunities depends upon what they bring to each event and what they make of each experience. It is the meaning attributed to each event, not the event

itself, that influences a person's reaction to it. People do not necessarily learn from experience; only from reviewing the meanings that they attribute to it. The source of a person's attitudes is his/her personal knowledge and past experience evaluated within a personal system of beliefs and values. These combine with individual strategies, tactics, and skills as the individual negotiates personally viable meanings onto his/her environment (Thomas and Harri-Augstein, 1977).

The above appears particularly appropriate when considering what the adult learner brings to the learning situation. Skills and knowledge directly related to the skills and knowledge to be learned are only a part--and likely a minor part--of the attributes that effect learning. Verduin, Miller, and Greer (1977) noted that if a teacher wishes to change the behavior of an individual to some desired new behavior, the teacher must modify the way the individual perceives his/her particular part of the world. Because perception influences behavior and learning, it is most important to give careful consideration to those things that determine or affect perception: beliefs, values, social and psychological needs, attitudes, self-experience (self-concept), etc.

The National Association for Public School Adult Education (NAPSAE) (1967) provided a list of characteristics that distinguish adult learners, in general, from childhood learners. This list adequately summarizes similar lists prepared and discussed by a number of sources. These characteristics are as follows:

- o Adult learners are likely to be more rigid in their thinking. Through their years of living they have acquired a "set pattern" of behavior, and set ideas of what is right and wrong, fact and fiction. This pattern has to be "unset" for learning to take place.
- o They usually require a longer time to perform learning tasks. While adults' capacity to learn may have remained essentially unchanged as age has progressed, the older they become the slower is their reaction time and the less efficient are those senses, such as sight and hearing, upon which learning depends.
- o Adults have needs that are more concrete and immediate than those of children. They are impatient with long discourses on theory and like to see theory applied to practical problems.
- o They require more and better light for study tasks. This is particularly true for adults over thirty-five years of age.
- o Older adults have restricted powers of adjustment to external temperature changes and to distractions. They require a more constant and ideal environmental condition in order to work efficiently.
- o They have greater difficulty in remembering isolated facts, although their comprehension of difficult reading materials shows little or no change from childhood.
- o They suffer more from being deprived of success than do young learners, and they are motivated more by the usefulness of the material to be learned.

- o They are less willing to adopt new ways, or even to try new ways of doing things than are young learners, but they are less distracted by social interests, and tend to be steadier in the pursuit of learning tasks.
- o They have more compelling responsibilities competing with education for their time, and since they are typically evening "after work" students, they are more likely to be less alert when they come to class.
- o They have more experience in living, and this gives them the advantage of being more readily able to relate new facts to experience. They have insights and see relationships not discerned by children.
- o Returning to school has been a momentous voluntary decision for them, and their attendance often represents a considerable sacrifice. Having made this important and commendable decision, they expect (and deserve) to be treated as adults.
- o Adults are more realistic. Because they have lived longer, they have a different perspective of life. They no longer see life through rose-colored glasses, but as a set of realities.
- o Adults do not comprise a captive audience. They attend voluntarily and if not interested, are inclined to stop attending.
- o Adults enjoy having their talents and information utilized in a teaching situation.
- o Adult groups are likely to be more heterogeneous than youth groups. Differences increase with age and mobility. Therefore, adults come from a wider variety of backgrounds and intelligence levels than do youth.
- o Adults often attend classes with a mixed set of motives--educational, social, recreational--and, sometimes, out of an overdeveloped puritanical sense of duty.
- o Adults are sometimes fatigued when they attend classes. They appreciate any teaching devices that add interest and a sense of liveliness (e.g., variety of method, audiovisual aids, change of pace, sense of humor).

NAPSAE also listed a number of characteristics typical of adults who are in need of basic education. Many of these characteristics are not confined to the "disadvantaged," but are found in varying degrees in all levels of society. This list is presented in full since, as with the above list of adult characteristics, it summarizes lists variously presented in the literature. These characteristics, along with a brief discussion of each, are provided below.

- o Lack of self-confidence. Because disadvantaged adults have rarely experienced success either as children in school or in their work since leaving school, they often feel inadequate and unable to learn and compete.

- o Fear of school. This fear usually stems from a student's unpleasant past experience with school.
- o Living in a condition of economic poverty. There is a high positive correlation between the level of education and the level of income. Students may live in crowded conditions with neither space nor quiet for studying. Poor nutrition may result in student apathy and short attention span. Incidence of physical handicaps may be higher than normal.
- o Probably below average in scholastic aptitude. While many undereducated adults are of average ability, and some are of superior ability, more seem to be below average in academic learning.
- o Culturally deprived. Many people living in slum areas of big cities have never been further than a few blocks from their homes; they are completely unaware of the existence of nearby libraries, museums, and other free sources of cultural enrichment. Those who do know about such places often are afraid to enter them.
- o Values, attitudes, and goals differing from upper and middle class norms. Undereducated adults usually have a value system widely different from that of adults of the upper and middle classes. They frequently show indifference or even hostility toward social institutions such as education.
- o Weak motivation. Motivation of undereducated adults is low because of their life history of failure to achieve the recognized American values of success, efficiency, practicality, work, equality, and freedom. They are easily discouraged and frequently exhibit an attitude of almost complete resignation.
- o Unusually sensitive to non-verbal forms of communication. Because of limited vocabulary and limited skill in articulation, most undereducated adults are forced to do much of their communication on the non-verbal level. They are extremely sensitive to non-verbal cues, and tend to judge more by action than words.
- o Feeling of helplessness. When students doubt their ability to learn, their thinking process is blocked or retarded. Feelings of anxiety and helplessness result. Some signs of helpless feelings in students are: hostility expressed toward subject matter; persistent bewilderment or blocking, in spite of several explanations; absence of participation and attention; procrastination or "forgetting"; and inability to start or continue the work alone.
- o Varying levels of intelligence. Undereducation does not necessarily imply low intelligence.
- o "Live for today" philosophy. Many adults from lower socioeconomic background have little concept of long-range planning in their lives. The idea of doing something today for a possible benefit several months or years from now is foreign to them.

- o Hostility toward authority. Because of possible unhappy associations with representatives of authority (e.g., policemen, the "boss" on the job, parents who treated them with cruelty or indifference), any authority figure is likely to arouse either hidden or overt hostility. In the students' past experience, teachers often have been such authority figures.
- o Unacceptable behavior. Ways of behaving that are acceptable--even praiseworthy--in the home or neighborhoods of undereducated adults often are unacceptable to middle class teachers. "Offensive" language, "immoral" ways of life, and "acting out" behavior (e.g., breaking the law, violence) often are incomprehensible to middle class society.
- o Reticence. Many undereducated adults have difficulty expressing their feelings, discussing their needs, and standing up for their rights. When their teacher asks them questions about themselves, or about the subject matter, silence does not necessarily mean they do not know the answer or are not willing to give it. Silence may mean that they are shy about speaking up in groups. It may mean that no one has ever before shown an interest in them as individuals, and they do not know how to respond. It may mean that in other situations when they expressed their feelings or stood up for their rights, the reaction they received from others caused them to regret their openness.
- o Use of defense mechanisms. The higher the degree of illiteracy in adults, the more likely they are to attempt to hide their undereducation by the use of defense mechanisms (e.g., carrying a book or newspaper, carrying pencils in a conspicuous place, not having eyeglasses when asked to read, citing an "injury to writing hand" when asked for written response, exhibiting an extremely well-developed oral expression with a reasonable vocabulary).
- o Need for status. Use of the students' first names and nicknames tends to arouse their antagonism and resentment.
- o Tendency to lose interest. Undereducated adults, like average adult students, likely will leave a classroom situation which does not fulfill their needs.

In a somewhat different approach to defining what the adult learner brings to the learning situation, Knowles (1977) stated that andragogy (the technology for the education of adults) is based on at least four crucial assumptions about the characteristics of adult learners that are different from the assumptions about child learning on which traditional pedagogy is premised. Following is a statement of and a brief discussion of each of these assumptions.

- (a) As people mature, their self-concepts move from being dependent personalities toward being self-directed human beings. Society defines the normal role of children as that of learners; this is their full-time occupation, the source of their rewards and self-fulfillment. On the whole, this role is defined as a more or less passive one of receiving and storing up the information adults have

decided children should have. But something dramatic happens to people's self-concept when they define themselves as adults. They no longer see their normal roles in society as that of full-time learners. They view themselves increasingly as producers or doers; their self-concepts become those of self-directing personalities. The adults see themselves as being able to make their own decisions and face their consequences, to manage their own lives. And at that point they also experience a deep need to be perceived by others as being self-directing. For this reason, adults tend to avoid, resist, and resent situations in which they feel they are treated like children--being told what to do and what not to do, being talked down to, embarrassed, punished, or judged. Adults, then, tend to resist learning under conditions that are incongruent with their self-concept as autonomous individuals.

Often there is another ingredient in the self-concept of adults that affects their role as learners. They may carry over from their previous experience with schooling the perception that they are not very smart, at least in regard to academic work. This fact about the adult psyche has several consequences for adult education. In the case of some adults, the remembrance of the classroom as a place where one is treated with disrespect is so strong that it serves as a serious barrier to their becoming involved in adult education activities at all. But even adults who overcome this barrier typically enter an educational activity expecting to be treated like children, and this expectation is frequently so strong that adult students often put pressure on their teachers to behave toward them in this way. Once a teacher puts adult students into a dependent role, however, he/she is likely to experience a rising resistance and resentment. On the other hand, when adult students are first exposed to a learning environment in which they are treated with respect, are involved in mutual inquiry with the teacher, and are given responsibility for their own learning, the initial reaction is usually one of shock and disorganization. Adults typically are not prepared for self-directed learning; they need to go through a process of reorientation to learning as adults--to learn new ways of learning. Once adults make the discovery that they can take responsibility for their learning, as they do for other facets of their lives, they experience a sense of release and exhilaration; they then enter into learning with deep ego involvement.

- (b) They accumulate a growing reservoir of experience that becomes an increasing resource for learning. To children, an experience is something that happens to them; it is an external event that affects them, not an integral part of them. If you ask children who they are, they are likely to identify themselves in terms of who their parents are, who their older brothers or sisters are, what street they live on, and what school they attend. Their self-identities are largely derived from external sources. But to themselves, adults are their experiences. They define who they are and establish their self-identity in terms of their accumulation of a unique set of experiences. So if you ask adults who they are, they are likely to identify themselves in terms of what their occupations are, where they have worked, where they have traveled, what their training and

experience have equipped them to do, and what their achievements have been. Adults are what they have done.

Because adults define themselves largely by their experience, they have a deep investment in its value. And so when they find themselves in a situation in which their experience is not being used, or its worth is minimized, it is not just their experience that is being rejected; they feel rejected as persons.

These differences in experience between children and adults have at least three consequences for learning: (1) adults have more to contribute to the learning of others--for most kinds of learning, they are themselves a rich resource for learning; (2) adults have a richer foundation of experience to relate new experiences to (and new learning tends to take on meaning as we are able to relate it to our past experience); (3) adults have acquired a larger number of fixed habits and patterns of thought, and therefore tend to be less open minded.

- (c) Readiness to learn becomes increasingly oriented toward the developmental tasks of their social roles. It is well accepted in our culture that children learn best those things that are necessary for them to know in order to advance from one phase of development to the next. Each of these developmental tasks produces a "readiness to learn" which at its peak presents a "teachable moment." For example, parents generally accept the fact that they cannot teach a child to walk until the child has mastered the art of crawling, his/her leg muscles are strong enough, and he/she has become frustrated at not being able to stand up and walk the way everybody else does. At that point, and only then, is the child able to learn to walk; for it has become the child's developmental task.

Recent research suggests that the same phenomenon is at work during the adult years. Adults, too, have their phases of growth and resulting developmental tasks, readiness to learn, and teachable moments. But whereas the developmental tasks of youth tend to be the products primarily of physiological and mental maturation, those of the adult years are the products primarily of the evolution of social roles. Havighurst (1956) divided the adult years into three phases--"early adulthood," "middle age," and "later maturity"--and identified ten social roles of adulthood: worker, mate, parent, homemaker, son or daughter of aging parents, citizen, friend, organization member, religious affiliate, and user of leisure time. The requirements for performing each of these social roles change as we move through the three phases of adult life, thereby setting up changing developmental tasks and changing readiness to learn.

For example, in people's roles as workers, their first developmental task is to get a job. At that point they are ready to learn anything required to get a job, but they definitely are not ready to study supervision. Having landed a job, they are faced with the task of mastering it so they will not get fired from it; and at that point they are ready to learn the special skills it requires, the standards they are expected to meet, and how to get along with their fellow workers. Having become secure in their basic job, their task becomes

one of working up the occupational ladder. Now they become ready to learn to be a supervisor or executive. Finally, after reaching their ceiling, they face the task of dissolving their role of worker and are ready to learn about retirement or substitutes for work.

- (d) The time perspective changes from one of postponed application of knowledge to immediacy of application, and accordingly the orientation toward learning shifts from one of subject-centeredness to one of problem-centeredness. Adults enter into education with a different time perspective than do children, which in turn produces a difference in the way they view learning. Children tend to have a perspective of postponed application of most of their learning. "For example," Knowles stated, "most of what I learned in elementary school I learned in order to be able to get into high school; and most of what I learned there I learned to prepare me for college; and most of what I learned in college I hoped would prepare me for a happy and productive adult life." To a child, education is essentially a process of the accumulation of a reservoir of subject matter, knowledge and skills that might be useful later in life. Children tend, therefore, to enter any educational activity in a subject-centered frame of mind.

Adults, on the other hand, tend to have a perspective of immediacy of application toward most of their learning. They engage in learning largely in response to pressures they feel from their current life situation. To adults, education is a process of improving their ability to deal with life problems they now face. They tend, therefore, to enter an educational activity in a problem-centered frame of mind.

Cross and Zusman (1977) approached the description of what the adult learner brings to the learning situation by emphasizing the learner's needs. Their profile of learner needs is the result of their efforts to catalog the needs and interests of nontraditional adult learners. They stated that the most common method for arriving at a catalog of the needs of learners has been to ask adults who are participating in adult learning activities, and those who say they would like to participate, what they want and need. Cross and Zusman noted that large numbers of adults throughout the country have been polled, largely through "needs assessments" by state planning agencies, regarding their interests in further education, and that we now have a great deal of data about certain dimensions of learner needs. The investigated variables are strikingly similar from study to study. This permits us to develop a catalog of the needs and interests of adult learners, at least insofar as they have been identified by the designers of needs assessments.

Cross and Zusman stated that past typologies of learners have consisted largely of demographically described groups such as women, ethnic minorities, and senior citizens. However, demographic groupings inevitably show more variation of learning needs and interests within categories than between them. The problem of making program evaluations and decisions on the basis of convenient statistical groupings is especially serious as we move into planning for the enormous diversity of backgrounds and goals represented by adult learners. Thus it seems the time has come to look at profiles of learner needs and profiles of program responses rather than at demographic groupings of people and typologies of programs.

The following summarizes Cross and Zusman's findings across studies with respect to learner needs.

- (a) Administrative accommodations: needs for alternative schedules.
Because most adults had job or home responsibilities, adult learners required study schedules that did not interfere with those responsibilities. Most adults could spend, at most, only 10-15 hours per week studying; most adults could not study during the typical work-day hours when most traditional programs are offered. A majority, or near majority, of potential learners preferred evening study schedules, presumably because evening study would not interfere with their work schedules.

A substantial minority of potential learners, however, preferred daytime schedules. This was especially true for those not in the labor market, such as retired persons and women with school-age children.

Few adults wanted to study on the weekend, even though weekend schedules would have avoided work schedule conflicts for most. Weekend study schedules were the preferred choice of only two to seven percent of potential learners. However, somewhat larger percentages of adults said that weekend sessions were acceptable times for learning, even though this may not have been their preferred schedule. Adults with higher levels of education and those who were already participating in continuing education activities found weekend schedules acceptable more frequently than did other adults. But the data showed that even these individuals preferred to study sometime between Monday and Friday.

Few studies asked respondents if they would be willing to schedule learning activities in concentrated sessions during summer vacation months or several times a year. However, in those studies that did give respondents the option of such schedules, very few desired them. Most employed adults apparently did not want learning activities to interfere with valued leisure time either on weekends or during vacation periods.

- (b) Administrative accommodations: access to learning locations.
Traditional educational institutions (e.g., high schools, college campuses, and adult learning centers) were the preferred learning sites of half to two-thirds of all potential learners in the state surveys. Relatively few potential learners preferred to learn in off-campus locations such as home, or even work/business sites, even though such locations would have reduced the obstacles to learning presented by home and job responsibilities. The desire of people to cling to the familiar surfaced time and time again in the data on adult preferences.

Educational buildings were preferred as learning sites not only because of their general convenience but also no doubt because of their familiarity. Most potential learners did not favor a college site. But preference for learning location was closely tied both to level of formal schooling and to level of desired further education.

College campuses were seldom preferred, particularly by those with low levels of schooling, the elderly, or Mexican-Americans. By contrast, public high schools and/or adult learning centers were favored by substantial proportions of these potential learners.

Among those few adults who preferred to study at a community center (YMCA, museum, etc.), hobbies and social science subjects tended to be the most frequent subject choices; however, subject choices were scattered. Older adults, who were disproportionately represented among potential learners interested in hobbies, were more likely than others to favor a community site.

Two major conclusions emerged from the data on needs and preferences with respect to location. First, convenience of learning location was cited by adult learners as an important consideration. At odds, however, with that general conclusion was a second finding. Most people tended to cling to the familiar, sometimes sacrificing convenience in order to achieve credibility or familiarity. Most people preferred to learn in a "school building," usually the highest one which they were eligible to attend, and they had rather traditional expectations about what was taught there. The eagerness of educators to respond to the perceived needs of nontraditional learners frequently was met with suspicion and lack of interest on the part of the very people who stood to benefit. It appeared that some of the new conveniences of nontraditional education would have to gain credibility through familiarity before they would be endorsed by a basically conservative clientele. Nevertheless, well-educated (and, usually, more self-confident) learners were more willing than less experienced learners to entertain new ideas about locations.

- (c) Teaching/learning considerations: needs for appropriate learning methods. No one method of learning was preferred by a majority of potential learners; national and state studies of adult potential learners consistently reported that adults' choices of learning methods were varied. Although lectures or classes lead all other methods in both preferences and practice, substantial majorities of people preferred other approaches. Among the learning methods preferred or accepted most frequently were classes or lectures, on-the-job training, and short-term conferences or workshops; all relatively familiar modes of adult learning. Among the methods least often named by respondents were the newer, less traditional, media-based methods: correspondence study, television, and radio or tapes.

The lecture or classroom method had greatest appeal to those with college educations, high income, and high-status occupations. In California, for example, nearly 50 percent in these groups found classroom learning an appropriate method. Adults desiring college degrees also favored classroom learning. Among students in extended degree programs in the Medsker et al. study (1975), small classes were the most satisfying mode for sizable majorities of the students; and potential clientele for the media-delivery State University of Nebraska (SUN) program (1974) ranked lectures above other learning sources such as books, television, or tapes.

Methods, of course, are related to schedules, locations, and subjects. If held in the evening, classes were a relatively favored method, but day classes were less acceptable than some other modes. Those preferring the lecture method were more likely to want to pursue college or business-related subjects. But the evidence suggested that even those interested in traditional subjects ordinarily taught by lecture-discussion methods were open to and interested in a variety of teaching/learning methods.

On-the-job training was the nontraditional method most often favored by potential learners. In most studies, it was the second preference (after classes) for the samples as a whole and the first choice of particular subgroups, such as the less educated. On-the-job training was especially favored by the disadvantaged.

Because on-the-job training often is offered by an employer at no cost to the employee and during regular working hours, it would eliminate the two barriers to learning most frequently mentioned by potential learners: lack of time to learn and cost of program. Yet, in one study, on-the-job training was the most preferred method of 21 percent of would-be learners, while only 5 percent chose the employer's workplace as their preferred location for learning. The same disparity between on-the-job method and employer site appeared in other studies. One hypothesis to explain this apparent discrepancy was that although a substantial number of adults favored the on-the-job method, many of these learners may have wanted to learn a new job in which they would like to be employed. In any case, this finding suggested that employer-sponsored on-the-job training may not fully meet the training interests, or overcome the learning obstacles, of adults favoring on-the-job learning. This may be particularly true for women not currently in the labor market.

Independent study was the most preferred method of only a small proportion of potential learners. On the other hand, when respondents were asked to name all appropriate learning modes, and when the category was defined as "independent study . . . in consultation with an instructor," the percentage of potential learners who responded that they could learn by this method increased substantially. Interest in individual study as a learning mode generally increased with higher levels of education and income.

Media-based instruction such as educational television, radio, video- or audio-cassettes, or newspapers, has been heralded as a convenient means by which adults' learning needs and interests can be met. Yet only a handful of would-be learners in the studies (generally between one and three percent) preferred such modes.

Findings for respondents favoring correspondence study were comparable to those for media-based instruction, although the level of expressed interest in this method was sometimes slightly higher, probably because of its familiarity.

Given the ability of nontraditional methods to reduce or eliminate many of the barriers to adult learning (such as inaccessible learning

sites, scheduling conflicts, and costs for child care and transportation), why did not more adults favor such nontraditional methods? Two factors, lack of familiarity and lack of personal contact, appeared to be the main reasons for the lack of enthusiasm for nontraditional learning methods. Many potential learners desired the feedback, personal contact, and reinforcement of learning by teachers and peers that classroom learning offers, and that individual study and media-based methods do not.

- (d) Teaching/learning considerations: motives for learning. Most state needs assessments asked adults about both subject preferences and reasons for learning. Following is a brief examination of these two factors.

Adults often expressed interest in learning several subjects. Among the subjects most frequently mentioned by potential learners were vocational/professional, hobbies and recreational, and home and family subjects. Many also named general education and personal development subjects. When potential learners were asked to name their first-choice subject, however, they became highly pragmatic, serious, and occupationally oriented. About half of all potential learners named as their first choice vocational or professional subjects. Indeed, would-be learners were more job oriented than were adults currently engaged in adult education programs.

The most frequently chosen vocational/professional subjects were business skills or administration, trades or technical subjects, and nursing. Interest in vocational fields generally declined as education level rose. Interest in vocational/professional subjects also varied by sex and age. Congruent with sex-role stereotypes, men were somewhat more interested than women in most vocational/professional subjects, except those linked to traditionally "female" occupations such as business skills (e.g., typing, shorthand), nursing, and education. Interest in vocational/professional subjects dropped sharply after about age 55, when potential learners became more interested in pursuing avocational and general knowledge topics. Generally, no more than one-fourth, or one-fifth of potential learners named general education fields as first-choice subject preferences. Among the general education subjects, psychology (especially personal psychology) and other subjects oriented to personal concerns were popular. Some educators suspected, however, that much of the popularity of courses like psychology was based on misconceptions of the actual content of academically based courses. Many people who signed up for psychology courses may have been in search of how-to-do-it courses that would help them in daily personal interactions with family and co-workers.

Hobbies, home and family living, and personal development subjects had a very wide appeal among potential learners, although not a very strong appeal. Relatively few potential learners picked those fields as first-choice subjects, but majorities expressed an interest in those areas. Interest in learning hobbies was especially high for older potential learners (those 60 years of age or older).

Knox (1976) noted one additional factor of importance in considering adult learners: adults bring to the learning situation the ability to learn. Both practitioners and their adult clients are sometimes concerned about trends in learning ability during adulthood. Adults, however, tend to underestimate their learning ability by overemphasizing their early school experience and underemphasizing their recent informal learning experiences.

Much of the earlier data on psychological development in later years, based on cross-sectional research, suggested that intelligence declines regularly with age. However, a number of longitudinal studies indicate great stability during much of adulthood and even an increase in intellectual abilities for more able adults and for familiar topics (Eisdorfer, 1972; Guilford, 1967; Knox, 1976).

Eisdorfer (1972) found that average older men were able to learn new verbal materials quite well when the task was presented at a reasonable rate. If the rate became too rapid, older persons tended to do less well than young people. Eisdorfer initially assumed that this resulted from the decreased ability of older persons to formulate answers. However, after continued research, he concluded that older persons could learn rapidly, but could not be pressured. He speculated that this tendency to hold back responses and appear not to learn illustrated belief in the old adage, "It is better to keep quiet and appear stupid than to open your mouth and prove it." Eisdorfer suggested that, as individuals age, they increasingly expect and fear loss and failure. The cost of striving has become too high for many: the benefits of success are less important than the impact of failure. Thus, the older person, motivated primarily by fear of failure, may withdraw psychologically from a competitive situation.

Landsman (1963) stated that a theory of use and disuse appeared compatible with longitudinal data on intelligence changes. He proposed that those mental or physical functions that are kept in use throughout the life span maintain themselves, or at least decline more slowly. This position represents the human being as a continuous output system rather than as a limited capacity system. In the same sense that continuous physical work throughout the lifetime results in better physiological health and longevity, similarly, continuous mental activity results in a healthy intellect in later years. According to Landsman, Americans have sought to avoid intellectual activity just as they have tried to avoid physical activity. Years in the same job are counted as rungs in the ladder to retirement; jobs become more routine and require less creativity. This forebodes a shorter intellectual life. Landsman suggested that planning for mental activity in later life should not be thought of as a diversion for the useless, but as a requirement for the intellectual survival of the aged.

Knox (1976) summarized the findings of much of the recent research on the effects of aging on the learning process as follows:

Almost any adult is able to learn almost any subject given sufficient time and attention. However, there is an increasing range of individual differences in learning abilities, at least through the fifties. When older adults can control the pace, most of those in their forties and fifties have about the same ability to learn as they had in their twenties and thirties. Older adults experience the greatest difficulty with learning tasks that are

fast-paced, unusual, and complex. Level of formal education is far more associated with learning ability than is age.

Short-term memory of moderate amounts of meaningful material tends to be relatively stable during most of adulthood. Long-term memory is even less affected by age, and the small amount that is forgotten can usually be regained by practice.

When an adult studies a topic, some prior learning facilitates new learning, some interferes, and some is unrelated. When prior learning interferes, the older adult may take longer to master a learning task because it is necessary to unlearn the interfering materials as well as to learn the new material. Older adults tend to experience more interference from conflicting prior learning, but they also obtain more assistance from facilitative prior learning, which largely reflects extent of experience with the topic instead of age itself.

Older adults especially learn most effectively when they set their own pace, when they take periodic breaks, and when the distribution of learning episodes is fitted to the content. Much of the decline in educational performance by older adults reflects a decline in speed instead of a decline in learning power. Older adults tend to reduce speed and emphasize accuracy. Sufficient time and personal pacing can help reduce age differences in learning performance.

Different research approaches have produced varying conclusions about the problem solving and critical thinking abilities of older adults. Cross-sectional studies found that age leads to a decline in problem solving ability, longitudinal studies found no change until age 70, and anecdotal evidence indicated that older, more experienced practitioners are more effective in the solution of complex and subtle problems. Memory deficits, and reliance on formerly effective concepts and strategies, may prevent some older adults from generating novel solutions. Cross-sectional studies showed small declines in critical thinking with age, but longitudinal studies found significant increases.

Individual differences in ability to learn complex tasks increase with age; many older adults are distracted by irrelevant information and learn complex tasks less well than younger adults. Creativity mainly reflects physiology and personality and is little related to age, although test results on creative intellectual output parallel findings from productivity studies.

In conclusion, Knox states that most adults can learn almost anything they want to, given time, persistence, and assistance.

3. Individual Differences Among Adult Learners

While the previous subsection placed emphasis on the general characteristics of nontraditional adult learners, it of necessity noted some of the considerable individual differences. This subsection is devoted specifically to individual differences as they may relate to the development and implementation of a PSI program for nontraditional adult learners. For purposes of the present research, no in-depth review of differential psychology appeared justified. No attempt was made to thoroughly review the extensive literature on individual differences; rather, the review presented herein is focused on

what appeared to be pertinent findings that supported the primary task of reviewing PSI and adult learning literature for the purpose of identifying appropriate strategies and populations for a PSI program.

Howe (1977) stated that individuals differ enormously in their ability to learn. In fact, differences between individuals in the skills and capacities they possess often are so striking and apparently fundamental in nature that it is easy to forget that most elements of such capacities actually have to be acquired through learning.

Howe noted that although systematic differences between people in a range of learned abilities are easy to demonstrate, the investigation of individual differences in learning is beset with serious difficulties. A major problem is that it is rarely possible to equate differences in the observed capacities with any simple learning process. A variety of additional factors contribute to measured performance in most learning situations. For instance, motivational influences, attentional variables, listening and reading ability, perseverance, fatigue, and perhaps most important, previous learning may contribute to determining level of performance on tasks ostensibly designed to assess ability to learn. Thus the superior performance of one individual over another on a task purporting to assess learning ability may be due in part to a difference in the availability of prerequisite skills that affect ease of learning in the new task, or to any of a number of other factors.

Broschart (1977) highlighted some of the difficulties in relating learning theory to individual differences. He noted that we have abandoned the assumption that a single learning theory can account for the universe of learning behaviors, and have turned our attention upon the learner and individual learning characteristics. It becomes necessary, then, to discuss learning in terms of life stages; as learning occurs for individuals at different ages and at different times throughout the lifespan. Some investigators have put forward the view that different learning theories and models for practice might well be appropriate for differing stages of individual growth and development. Life stage is not simply a function of age; some investigators suggest that generation and cohort differences are even more significant than age differences in the development of a concept of life-stage behavior. Thus our attention is drawn to the view that any discussion of lifelong learning must deal not only with "learning" but also with the notion of "lifelong."

Broschart observed that we can stipulate four gross age-related lifespan periods. Each of these stages is different; each exhibits a different individual with characteristics, capacities, and needs that change from day to day. The identified stages are gross in the extreme. We are already conscious of the great range of change that occurs throughout the first stage, that of birth through the adolescent period. An equally intensive examination for change should be considered for the later stages (adolescence to young adulthood, the middle-aged period, and the old-age period). If we are to evolve a concept of learning for the lifespan, we must confront and encompass all of the ages of the individual.

Clark (1978) noted that research on learning opportunities generally seeks to determine which of the many factors that combine to enhance or inhibit learning are important. Most approaches to research generally begin with a list of the various factors thought to be operating when an individual or

group makes a decision to engage in learning. Clark presented a mapping of one such list of factors thought to affect the teaching/learning situation. He noted, however, that the problem of adult learning is more elaborate than the map implies. Not only are there many factors that are important in adult learning, but individual factors interact or combine with other factors to influence the amount and quality of a student's participation and learning. Cronbach and Snow (1977), for example, make a compelling argument that researchers can no longer assume that short-term experiments, using homogeneous subjects and one or two independent variables, are sufficient to gain an adequate understanding of adult learning. There seems to be no single factor (type of instruction, setting, format, delivery device) that is best for all adults. What is necessary is to deal with alternative types of learning opportunities for different kinds of learners, with different purposes, in different settings.

Tobias (1978) noted that the field of education is currently filled with attempts to inspire educators to implement and researchers to study individualized instruction, but that despite this persistent interest there are few systematic attempts to adapt the method of instruction to student characteristics. She noted that research on individualized instruction has not yet produced guidelines for selecting the instructional treatment best suited to an individual's aptitudes. The research has produced ~~some worthwhile~~ clues, but the bulk of the work on the viability of the aptitude-treatment interaction construct remains to be done.

Snow (1977) stated that work on aptitude-treatment interactions has shown that interactions, both among individual difference variables and between individual difference variables and instructional conditions, can be so complex as to push generalizations beyond our grasp. He then stated that aptitude-treatment interaction does not make theory impossible; it simply makes general theory impossible. Individual difference variables operating in aptitude-treatment interactions show the essential importance of detailed description of both specific instructional situations and specific groups of people. An information processing approach provides a means of analyzing both specific situation and specific individual variables. But the kind of theories that result are quite specific, limited in both time and place. There are theories that apply to the teaching of arithmetic in grades 1-3 in Washington and Lincoln schools in Little City, but perhaps not to the two other elementary schools in that town. The conclusion, then, is that while instructional theory may be possible, it should concern itself only with narrowly circumscribed situations: small chunks of curriculum for small segments of the educational population. Such theories would be intended to generalize more across time in one place than across places, but they would be somewhat time bound as well. They would share concepts and methodology but they would be very specifically tailored to particular situations.

Cronbach (1967), in his discussion of how instruction can be adapted to individual differences, listed five patterns of educational adaptation to meet individual needs. These were:

- Alter duration of schooling by sequential selection.
- Train to criterion on any skill or topic, hence alter duration of instruction.

- Determine for each student his/her prospective adult role and provide a curriculum preparing for that role.
- Provide remedial adjuncts to fixed "main track" instruction.
- Teach different pupils by different methods.

Cronbach stated that the last category was the most interesting since all other devices alter administrative arrangements rather than instructional technique. Cronbach noted that classroom teachers informally adapt instructional method to the individual, picking up some cues from the pupil's test record and daily work, and other cues from rather casual observation of his/her social interactions. The teacher forms an impression of the pupil from the cues, usually without an explicit chain of reasoning, and proceeds on this basis to alter the instruction. The adaptation too is intuitive, not following any explicit theory. These adaptations are usually beneficial, but the method is inefficient, and occasionally may be harmful.

Cronbach (1955) stated that he knew of no research on impressionistic adaptation of instruction, but that something could be learned from studies in which counselors have been asked to predict a student's grade average. Various biases appeared in the estimates, but the most significant finding was that the counselors over-differentiated; they tended to expect too much from the persons who tested high, and too little from those who tested low. The study used a regression line, an actuarial formula that starts with the group average and ranks differential information as a correction factor, giving the latter just as much weight as it deserves. The counselors gave considerably more weight to differential information than the regression formula did. Certain reasonable assumptions, entered into a decision-theoretic model, lead to the conclusion that the poorer the differential information, the less the teacher should depart from the treatment that works best on the average (Cronbach, 1955; Cronbach and Gleaser, 1965). Cronbach added a comment that appears to be a particularly pertinent cautionary note: he stated that modifying treatments too much produces a worse result than treating everyone alike.

Cronbach concluded his discussion by suggesting that students can be diagnosed quasi-mechanically with the aid of a computer, which can use empirically validated rules to suggest activities appropriate to the student's interests and abilities. He stated that it seemed likely that even with the sort of multivariate testing a computer can provide, we will have to build up adaptations slowly, on the basis of only a few differential variables. While in principle a unique instructional diet could be matched to the student's idiosyncratic intellectual metabolism, nothing is to be gained by introducing unvalidated modifications. And it will be a long time before we have adequately validated rules of adaptation that take into account even a half-dozen differential variables. He then stated that our greatest hope for fitting the instruction to the individual lies in the development of theory that finally marries the differential and experimental approaches to learning.

Carroll (1967), in commenting on Cronbach's discussion, predicted that the study of instructional methods and individual differences would be extremely difficult and frustrating, even though it is "most interesting" psychologically. He noted that research may never produce a set of conclusions sufficiently solid to be adopted in educational practice. Or, even though differentiation of instructional method may be possible in an actuarial sense, the net gains

may not be of impressive magnitude. The cost of differentiating instruction may be too high to suit the practical school administrator, particularly if it involves elaborate and expensive equipment or extensive teacher retraining. In this case, we may have to fall back on some of the other ways of adapting to individual differences. Carroll suggested that although teaching different pupils by different methods is the "most interesting" psychologically, there are degrees of interestingness and there are plenty of interesting problems implicit in the other expedients. For example, there is perhaps somewhat more to be said in favor of providing remedial adjustments to fixed "main track" instruction than Cronbach seemed to indicate. When a group of pupils enter a classroom, at whatever grade level, they already differ in many respects. Undoubtedly they differ in aptitude; that is, they have different patterns of aptitude. But even aside from such differences, they may simply be at different points on the learning curve. Adaptation to this kind of individual difference merely means starting with each pupil where he is on the learning curve and taking him from there.

Cronbach and Snow stated that aptitude-treatment interactions exist. Carroll (1967) noted that to assert the opposite is to assert that whichever educational procedure is best for Johnny is best for everyone else in Johnny's school. Even the most commonplace adaptation of instruction, such as choosing different books for more and less capable readers of a given age, rests on an assumption of aptitude-treatment interaction that it seems foolish to challenge. The substantive problem before us, according to Carroll, is to learn which characteristics of the person interact dependably with which features of instructional methods. This is a question of awesome breadth. In principle, it calls for a survey of all the ways in which people differ. It requires that individuality be abstracted into categories or dimensions. Likewise, it calls for abstractions that describe instructional events in one classroom after another. The constructs descriptive of persons and instructional treatments form innumerable aptitude-treatment interaction hypotheses. It is impossible to search systematically for aptitude-treatment interaction when the swarm of hypotheses is without order. The summary presented by Cronbach and Snow only starts toward the high ground from which perspective may be gained.

Cronbach and Snow further stated, according to Carroll, that among aptitude-treatment interaction hypotheses that might be tested, it is to be expected that the majority will be false. That is to say, when a person variable and a treatment variable are paired speculatively, the interaction effect is likely to be negligible. Even if a speculation is sound, fine-tuning of the treatment conditions is needed to bring the relation squarely into the investigator's view. Until then, the phenomenon is sure to wander in and out of view, as relevant uncontrolled conditions vary haphazardly from one "replication" to the next. Nor can we hope to establish generalizations that will hold up in every similar educational setting. The inconsistencies among studies that purport to study "the same treatment" are not simply signs of poor technique, which will abate when educational research "becomes fully scientific." Real effects vary from one setting to another because of unanticipated interactions. The classroom dynamics, the personality of the teacher, and the specific instructional materials have their effect even when the blueprint for a "treatment" is being followed meticulously. A generalization will almost never prove to be true in more than, say, 75 percent of classrooms of a type (e.g., first grade classrooms in urban settings). Such a probabilistic truth is informative

as a source of practical policies and as a basis for insight. But we cannot be content to set policy for the individual classroom in terms of an Iron Law that has a 25 percent chance of working out badly for that class. School practice will have to be flexible and sensitive to here-and-now data, simply because so many conditions moderate the effects of any educational plan. While results in aptitude-treatment interaction studies often have been negative, this does not deny the hypothesis. Most studies used samples so small that a predominance of "chance results" was rendered inevitable. What the results deny is the hope that a few years of research on a limited scale will produce both a solid theory and a set of practically useful generalizations about instruction. Learner-treatment interaction is an essentially new scientific problem, and reaching consolidated understanding in such matters often requires decades.

Arter and Jenkins (1979) discussed the Differential Diagnosis-Prescriptive Teaching (DD-PT) model, the dominant instructional model within special education. This model involves the assessment of psycholinguistic and perceptual motor abilities that are presumed necessary for learning basic academic skills and, based on the differential pattern of ability, strengths, and weaknesses indicated by the assessment, prescribing individual remedial activities. Underlying the model are several assumptions regarding psychological abilities and their relationship to academic skills, the measurement of these abilities, and their susceptibility to modification through training. These basic assumptions are:

- Educationally relevant psychological abilities exist and can be measured.
- Existing tests used for differential diagnosis are reliable.
- Existing tests used for differential diagnosis are valid.
- Appropriate prescriptions can be generated from differential diagnosis to remediate weak abilities.¹¹
- Remediation of weak abilities improves academic achievement.¹¹
- Appropriate prescriptions can be generated from ability profiles to improve academic achievement, with no direct training of weak abilities.¹¹

Arter and Jenkins conducted a comprehensive review of research related to each assumption and concluded that all six assumptions, and the validity of the model, are suspect. They concluded that students do not appear to profit from current applications of DD-PT, and suggested that continued advocacy of the model cannot be justified.

4. Adult Learner Characteristics: Implications for Program Development and Implementation

This subsection presents a brief overview of findings and opinions regarding some of the implications of adult learner characteristics for program

¹¹ Assumptions (d) and (e) relate to the form of DD-PT that involves the direct training of weak abilities. Assumption (f) relates to an alternate form that emphasizes the stronger abilities.

development and implementation. Many of these implications are obvious from the descriptive information provided in the three previous subsections, and will not be noted here. Five key activities recommended for those responsible for adult education are considered in this subsection. These activities are:

- Providing an optimum learning climate.
- Adjusting to a heterogeneous student body.
- Addressing the student's need for immediate success.
- Assuring that real and perceived student needs are being met.
- Reducing fear of failure.

A listing of what appear to be superior conditions of learning and principles of teaching adults concludes this subsection.

a. Providing an Optimum Learning Climate

Bligh (1977) noted that most teaching innovations have failed to improve the effectiveness of teaching because such innovations have over-emphasized the acquisition of information. Innovations in the socioeconomic methods and contexts of teaching have, he contends, been neglected. After reviewing recent innovations (e.g., use of film, television, programmed instruction, slide-tapes, computers, radio and correspondence courses, PSI) Bligh concluded that, with a single exception, these innovations failed to achieve the major purposes of postsecondary education. He listed PSI as the single exception, noting that it is an exception precisely because of its social, interactive element. According to Bligh, the learning setting frequently is one where students are all at the same stage in the same subject, meeting with a tutor at a predetermined hour for a fixed length of time. They discuss a prearranged, imposed topic, with fear of being judged as their dominant motive. Current ideas in psychology and sociology, he suggested, might lead us instead to encourage diversity in group composition, spontaneous expression of thoughts and feelings, a mutually supportive group climate, evolution of group norms by consensus groups small enough to enjoy personal interactions, and democratic styles of leadership. In short, innovations relevant to the major purposes of postsecondary education consist of changes in the way people meet and talk to each other. Innovation requires a change in attitude, away from an authoritarian paternalism and toward the relaxed laughter that comes when people work together on a common task. He indicated that if any presentational innovations other than PSI provided this latter learning environment, he was not aware of it.

Knowles (1977) summarized suggestions offered in the literature for providing an optimum learning climate. He noted that the adult self-concept has strong implications for the social climate of the adult learning environment. The psychological climate should be one which causes adults to feel accepted, respected, and supported; in which there exists a spirit of mutuality between teachers and students as joint inquirers; and in which there is freedom of expression without fear of punishment or ridicule. A person tends to feel more "adult" in an atmosphere that is friendly and informal, in which he/she is known by name and valued as a unique individual, than in the traditional

school atmosphere of formality, semi-anonymity, and status differentiation between teacher and student. The physical environment must also support the adult's self-concept. Meeting rooms should be arranged informally and decorated according to adult tastes. Acoustics and lighting should provide for declining audiovisual acuity, and furnishings should be adult-sized and comfortable.

Knowles noted that in andragogical practice, care should be taken to determine what symbolizes childishness to particular groups of adults, and to remove those factors from the environment. For some--particularly undereducated adults--it is a school building, in which case social agency facilities, churches, commercial properties, or private homes probably would be environments more conducive to learning. For others a podium on a stage makes them feel they are being talked down to, in which case a small table on the floor would provide a more appropriate work space for the teacher. Many adults associate chairs placed in rows with childhood regimentation and passivity, and find seating in small circles or around tables more conducive to adult relationships. A few adults report that blackboards are a symbol of childishness to them, which may help to explain the growing popularity in adult education of newsprint pads on easels.

b. Adjusting to a Heterogeneous Student Body

Since adult learners differ widely in interests, age, and ability, some grouping into more homogeneous groups may be desirable. Knowles (1977) noted that the concept of developmental tasks provides some guidance regarding the grouping of learners. For some kinds of learning, homogeneous groups according to developmental task are more effective. For instance, in a program on child care, young parents would have quite a different set of interests from the parents of adolescent children. For other kinds of learning, heterogeneous groups clearly would be preferable. For instance, in a program of human relations training in which the objective is to help people learn to get along better with all kinds of people, it would be important for the groups to include people who varied in occupation, age, status, sex, and perhaps other characteristics. Knowles stated that, in his own practice, he adopted the policy of making provision in the design of any adult learning activity for a variety of subgroups so as to give the students a choice; he found that they quickly discover colleagues with similar developmental tasks.

c. Addressing the Student's Need for Immediate Success

NAPSAE (1967) suggested that teacher trainees should learn the importance of helping their adult students experience success during the first, and every, class session. One way to accomplish this is to make sure that the learning activities the adult students initially engage in are not too difficult for them. If, for example, they are given reading material which is too advanced for their reading skill, they will experience that all-too-familiar feeling of failure in the classroom. However, if they are given material which they can read with ease, they will be more likely to enjoy a feeling of self-confidence, which will encourage them to try more difficult material in future class sessions.

Knox (1976) discussed the need for immediate success by noting that for adults, especially those without much recent experience in educational programs, the initial encounter with a learning episode typically has a major impact on

success and persistence. Those who facilitate adult learning confront two challenges during this intake, or orientation, period. One is to help the learner to feel accepted and welcome in the program, and the second is to assist the learner to achieve at least one important educational objective. Such an initial social and educational success can do much to offset some of the difficulties that typically accompany most efforts to change.

Knox stated that, although those who would be most anxious in an unfamiliar educational activity seldom participate, many adults who do enroll do so with an apprehension of the unknown and a fear of failure. One of the basic needs of most people is to maintain and enhance their self concept. For many adults, the image of the student role based on their earlier school experience is a subservient one which seems incompatible with their image of responsible adulthood. For older adults, this image is often combined with an erroneous belief in a major decline in learning ability with age. An effective facilitator who helps an adult learner to have an initial success experience can do much to increase the learner's sense of educational efficacy and to build his/her confidence.

It should be noted that while, as indicated by the two above sources, the initial success likely is critical, making the "success" unrealistically easy could be counterproductive.

d. Assuring that Real and Perceived Student Needs are Being Met

Atwood and Ellis (1973) summarized one of the more perplexing adult education requirements by stating that, since adults generally participate voluntarily in educational programs, it is extremely important that the participants see the programs as directly related to their needs. This compounds the adult educator's problem. On one hand, if a program is not recognized as being helpful in meeting the adult's needs, there will be little participation. On the other hand, addressing the program only to those needs recognized at the moment may make it shallow or superficial, since adults frequently must be assisted to recognize their real needs. The adult educator, then, should be able to diagnose the educational needs of students and to assist the students in recognizing those needs as well.

Knowles' (1977) discussion of the organization of curriculum and the design of learning experiences partially addressed this concern, and may be summarized as follows:

The organization of the curriculum. The original basis of organization for the curriculum of youth education was the seven subjects--the trivium (grammar, rhetoric, and logic) and quadrivium (arithmetic, music, geometry, and astronomy) of the medieval schools. Although the number of subjects has proliferated since the Middle Ages, the subject matter concept of curricular organization still remains relatively intact. But with the emergence of the insights of andragogy, the curriculum--which in adult education is increasingly referred to as the "program"--of adult education is coming to look less and less like the curriculum of youth education.

Because adult learners tend to be problem-centered in their orientation to learning, the appropriate organizing principle for sequences of adult learning is problem areas, not subjects. For example, instead of offering courses on "Composition I" and "Composition II," with the first focusing on grammar and the second on writing style, andragogical practice would offer "Writing Better Business Letters" and "Writing Short Stories." In the adult courses, matters of grammar and style would be treated in the context of the practical concerns of the learners. Even the broad curricular categories used to describe what adults study have departed from the traditional categories of the academic disciplines. In the Handbook for Adult Education (1960), for example, such labels were given to the "program areas" as "Education for Aging," "Community Development," "Human Relations and Leadership Training," and "Liberal Adult Education."

The design of learning experiences. The problem-orientation of the learners implies that the most appropriate starting point for every learning experience is the problems and concerns that the adults have on their minds as they begin. While the opening session of a youth education activity might be titled "What This Course is All About," in an adult educational activity it would more appropriately be titled "What Are You Hoping to Get Out of This Course?" Early in the session there would be a problem census or a diagnostic exercise through which the participants would identify the specific problems they want to be able to deal with more adequately. This is not to suggest that a good adult learning experience ends with the problems the learners are aware of in the beginning, but that is where it starts. There may be other problems that the teacher or institution expect to deal with; these are put into the picture along with the students' problems, for negotiation between teacher and students.

Miller (1972) discussed meeting the students' needs from the point of view of overcoming adults' resistance to change. He noted that for any general learning task, we might suppose that there are many identifiable psychological forces, some encouraging the student to change in relevant ways, others acting negatively either to lead him/her out of the field altogether or to resist change. Planners and teachers seldom have much control over the presence of positive forces, but they can do a good deal to identify and try to remove the resistant forces.

In many adults, according to Miller, resistances often take such forms as these: the student is not involved and thus is unable to see the learning task as personally important or significant; the student's objectives have little to do with the instructor's objectives; or the student's fear of failure results in an unwillingness to attempt certain kinds of changes. . . . Students may find change itself threatening, not only because they might fail in achieving the desired behavior, but because their habitual behavior is part of them and consequently valued. People tend to see any attempt to change them as an attack, which inevitably arouses defensiveness.

If instructors do not deal adequately with the resistances, the group easily disintegrates or lapses into passivity. One can see, too, why adult students generally tend to prefer methods that permit them to be passive; such a state arouses none of the conflicts that may lie beneath the surface, waiting to be revealed by the challenge of real learning achievement.

The most challenging question, according to Miller, is what can be done in organizing the experience itself which will reduce the resistances to change inherent in learning. Some things are relatively direct; for example, making the materials as relevant as possible to the concerns of the students increases the chance for individual involvement. But we have available to us another resource that often is overlooked or used without much skill: the forces of the learning group itself, arising out of its attractiveness for the members of the group, and the quality of their interaction.

Miller noted that at least two conditions are necessary for harnessing group forces. The first is that the opinion of the group as a whole must matter to the individuals who compose it; technically speaking, it must be a cohesive group. Often informal groups of students achieve cohesiveness, but the emerging group goals emphasize social rather than learning tasks. Thus, the second requisite for the successful use of group forces is that the group develop shared values which are hospitable to educational change in the desired direction.

Bligh (1977) stated that the causes of dropout are primarily social, and that some innovations relevant to achievement of students' initial aims are therefore social in nature. They are concerned with the relation of students to other people and their self-adjustment, rather than their relation to academic subject matter.

It is true that academic difficulties and failure are common causes of student dropout, but they are not the most common causes, and are frequently only the symptoms of underlying social problems. The poor correlation between students' failure and their intelligence, scholastic aptitude and other measures of ability has suggested (Miller, 1972) that other factors influence academic performance, and that grades are overrated as the primary cause of student dropout.

Factors mentioned by students as sources of difficulties at college include 'social isolation,' inadequacy or remoteness of teaching staff, difficulty in budgeting time between work and social interests, financial problems, etc. The causes of student failure are not the reverse of the determinants of success. The former are social factors, the latter cognitive. The most important variables related to academic success are motivational. Even some of these, such as the desire for recognition and prestige within a college value system, are social in origin. A student's interest in his/her subject could be pursued at the expense of satisfying social desires, but his/her interest is most reliably initiated and cultivated through personal interaction. The innovations required to give students recognition and to generate their enthusiasm in a subject have an interpersonal element in a way that visual aids, programmed learning, computer-aided learning and so on do not. Similarly, there is reason to believe (Entwistle, 1974) that the degree of academic success is related to the way students organize their work. Since no single

method of organization will work for everyone, students need assistance individually or in small groups. Thus, innovations to raise the level of success require changes in the social organization of postsecondary education.

Mezirow (1975), in his research on adult basic education programs, offered some striking insights into relationships between student dropout rate and program content. He noted that two-fifths of the teachers included in his sample estimated that 10 to 24 percent of their students drop out by the sixth week of class. Another 17 percent placed the drop out rate in their classes during the first 5 weeks in the 25-49 percent range. Since students continue to drop out after the initial weeks of class, these estimates of attrition are conservative. One startling finding is that 54 percent of black teachers report a dropout rate of less than 10 percent. Only 31 percent of white teachers reported this measure of success.

Black basic education teachers reported greater emphasis on such non-traditional subject areas as consumer and health education, racial heritage and coping. It seemed likely that emphasis on these subjects might explain more of the variation in dropout rates than race alone. Consequently, an index of nontraditional emphasis was constructed which resulted in the classification of all basic education teachers into three categories ranging from low to high on nontraditional emphasis. As suspected, black basic education teachers who scored high on the nontraditional index reported lower dropout rates than did black teachers who scored low on the index. Significantly, white teachers who scored high on the nontraditional index reported lower dropout rates than whites who scored low, but the dropout rate for high scoring white teachers was greater than for high scoring black teachers.

Mezirow noted that teachers who emphasize content of direct relevance to the lives of adult students (consumer and health education, racial heritage, coping skills) are more likely than others to be successful in retaining their students. The data also suggest that race has a modest independent effect on retention. Black teachers retain their (mostly black) students better than whites, although whites who emphasize nontraditional subjects are more successful than whites who do not.

Flaherty (1978), in her analysis of self-perceived learning needs of undereducated adults, concluded that many of the students enrolled in adult basic education programs in New Jersey at the time of her survey wanted to learn life skills. Prior research involving observations of teachers in cities across the country (e.g., Mezirow, 1975) has shown that adult basic education teachers seldom incorporate life skills into their teaching. Flaherty (1977) noted that relatively few students in her sample recalled having learned any life skills in class. Only a tenth, for example, reported that they had learned how to fill out job applications while two-thirds expressed interest in learning this competency; and only six percent said they had learned at least one government and law competency although nearly three-quarters, on the average, wanted to learn such competencies. Another study (Darkenwald, 1975) showed that dropout rates were lower among students whose teachers placed emphasis on life skills.

When asked to choose, however, the adult basic education students in Flaherty's survey preferred the basic skills to life skills by more than a two to one margin. Nearly half indicated reading or language skill as the subject

or skill they most wanted to learn, and another quarter chose math. Flaherty noted that, "while the choice of academic subjects may reflect past school experiences or the fact that a large number of the students were preparing to take the GED test, the preference is clear and must be recognized. One barely literate man told an interviewer, 'If you teach me to read, I'll be able to do all those things.' This is an incisive and insightful statement; one that adult educators would do well to take to heart. The question of whether the adult basic education curriculum should focus on the life skills, as many programs across the country are beginning to do, or on the basic skills, as has been done traditionally, must be given careful consideration. The danger of the life skills approach is an over-emphasis on the content of the knowledge areas at the expense of basic skills development. The basic skills are just that--'basic.' They apply to and are required for competence in all aspects of modern life. Teaching the 3R's sporadically or superficially can in the end only serve to undermine a curriculum intended to increase functional literacy."

Flaherty noted that the above did not imply that the life skills approach is totally without merit. On the contrary, a skillfully prepared curriculum constructed around certain life skills--especially occupational knowledge, consumer economics, and perhaps government and law--could well be preferable to the traditional basic skills approach. More than half of two of Flaherty's sample subgroups--those under 20 and those with special education background--preferred job or life skills to basic skills. Relevance and practicality seemed to have been of primary importance to these students. The young adults expressed especially high interest in occupational knowledge, whether or not they were unemployed. Flaherty noted that a curriculum that presents reading, language, and math skills in the context of job-related skills such as having a job interview, writing a letter of application to an employer, and reading a paycheck stub might be quite effective for such learners, particularly if it accompanies an occupational training program. It is likely, however, that such students would benefit from supplementary learning activities in the basic skills, especially if they are slow readers or if they are preparing to take the GED test. The developmental nature of the basic skills demands a degree of continuity and thoroughness if students are to master them.

The effectiveness of a curriculum in developing functional literacy skills can, according to Flaherty, be measured by the degree to which the students who learn from it are able to learn new skills and make decisions after they have left the formal learning situation. Emphasis on facts and skills that can change with time may enable students to better cope with life now, but functional literacy requires more than this. Undereducated adults need, and apparently want, to learn skills which enable them to learn new facts when they become available and to adjust to new skills when they are required. Reading, thinking, communication, and computation--the universal, basic skills--are essential to development of this ability.

Flaherty stated that the major advantage of a basic skills emphasis in adult basic education is that continuous and thorough development of the skills is an integral part of the curriculum, but that this often is achieved at the expense of relevance to real life. She noted that, on the basis of this and other research, there seems to be a need for basic skills curriculum materials that contain practical applications. Reading selections; math problems; exercises in, and examples of, correct expression; and writing

assignments might be drawn from the requirements for adult living. Reading material should be informative, math computations should be useful, and language exercises should enable students to communicate effectively in the situations in which they find themselves in their daily lives. The priorities placed on the 42 competencies presented to the respondents in Flaherty's survey might serve as guidelines for what content and applications would be most useful to adult basic education students.

Flaherty stated, "It is apparent that the New Jersey adult basic education students were most interested in learning those skills that they thought they knew least about. Further, they expressed a predominant interest in learning useful topics and skills; they had little desire to learn subjects that were 'just interesting.' This reflects the urgent nature of adults' learning projects, and supports the generally accepted theory that adults enroll in education programs to fulfill immediate needs. An awareness of the goal-oriented learning posture of adult learners (at least those voluntarily enrolled in education programs) is essential to the effectiveness of an adult educator. Adult students have no time to waste. They generally want to learn the knowledge and skills they need to reach their goals, and have little interest in re-learning what they already know or in spending valuable class time in irrelevant activities."

According to Flaherty, this was not to say that teachers of undereducated adults should teach their students only what they say they want to learn and no more. The role of the teacher also involves opening up new vistas to students. Flaherty highly recommended the practice of asking students what they most want and need to learn. She commented that the individual interview situation is a most effective, albeit time-consuming, means of assessing students' learning needs. Where the luxury of this personalized assessment is not practical, group discussions or questionnaires can serve in its stead. Although adult educators might think they can assess their students' needs without systematic student input, it is quite likely that, as Grabowski (1976) suggested, their assumptions will be contradicted and new insights into their students' needs will be gained through this type of needs assessment procedure.

Flaherty stated that the results of her study indicated that students possessing certain characteristics tended to have certain kinds of learning needs, and by and large the needs identified for specific groups were predictable. However, it is important not to overgeneralize. She stated, "There was a tremendous amount of variance in priority placed on certain competencies that was not explained by the variables included in the research. What this means is that each adult basic education student is an individual with his/her own goals, aspirations, responsibilities, concerns, and problems. Thus, there is a need for flexible curricula that are conducive to individualized or personalized instruction. And since a significant number of persons attending adult basic education classes apparently have little felt need for life skills, the traditional 3R's approach should not be totally discarded.

Further, according to Flaherty, "there is no evidence to support the idea that a particular group of life skills objectives 'comprise adult functional competency' (Adult Performance Level Project, 1978). Clearly, there is not and can never be any one set of objectives which 'comprise' basic literacy or functional competency. Taken to the extreme, the life skills approach assumes that any adult merely needs to be programmed correctly in order to function

'competently.' One can, however, reject such an assumption while recognizing that the many life skills objectives can be useful in suggesting ways of relating basic education more directly to the demands of daily living.

e. Reducing Fear of Failure

NAPSAE (1967) commented on methods of reducing student fear of failure. They stated that teacher trainees must be helped to understand that they must avoid at all costs use of ridicule or sarcasm with undereducated adults. The need for warm, uncritical acceptance of the undereducated students' slowness in learning, of their offbeat and perhaps dirty clothing, of their sometimes shocking language, cannot be over-emphasized with trainees. Informal but neat dress on the part of the teacher is one way he/she can help students feel relaxed about their own informal garb. By commenting on what the student has done right, rather than pointing out mistakes, the teacher can alleviate the student's exaggerated fear of making mistakes and having them exposed or ridiculed. "Accentuate the positive" is a slogan every teacher of the undereducated would do well to bear in mind every day.

Knowles (1977) provided some positive and practical steps that may be taken to alleviate adult students' fear of failure. He stated that probably the greatest incongruity between traditional educational practice and the adult's self-concept of self-directivity is the act of a teacher giving a grade to a student. Nothing makes an adult feel more childlike than being judged by another adult; it is the ultimate sign of disrespect and dependency, as the one who is being judged experiences it. For this reason, andragogical theory prescribes a process of self-evaluation, in which the teacher devotes his energy to helping the adults obtain their own evidence about their progress and weaknesses toward their educational goals. In this process, the strengths and weaknesses of the educational program itself must be assessed in terms of how it has facilitated or inhibited the learning of the students. So evaluation is a mutual undertaking, as are all other phases of the adult learning experience.

In fact, what is happening in practice is that precisely the same procedures that are used for the diagnosis of learning needs are being employed to help the learner measure his gains in competence. For instance, by comparing his performance in solving a critical incident at the end of a learning experience with his performance in a similar critical incident at the beginning of the experience, a learner can quite precisely measure the changes produced by the experience. Knowles stated that, because of the similarity of these two processes, he found himself now thinking less and less in terms of the evaluation of learning and more and more in terms of the rediagnosis of learning needs. And he found that, when his adult students perceive what they do at the end of a learning experience as rediagnosing rather than evaluating, they enter into the activity with more enthusiasm and see it as being more constructive. Indeed, many of them report that it launches them into a new cycle of learning, reinforcing the notion that learning is a continuing process.

This shift from evaluation to self-evaluation or rediagnosis, according to Knowles, places a heavy burden on the teacher of adults. The teacher must set an example by being open to feedback regarding his/her performance, must establish a supportive climate in which hard-to-accept information about one's performance can be looked at objectively, and he/she must be creative about inventing ways in which students can get comprehensive data about their performance.

f. Superior Conditions of Learning and Principles of Teaching

Knowles (1977) provided a reasonably comprehensive list of conditions of adult learning and teaching principles likely to produce the conditions discussed above. This list, along with Knowles' introductory statement, is presented in full since it adequately summarizes similar information presented by a number of sources.

"It is becoming increasingly clear from the growing body of knowledge about the processes of adult learning that there are certain conditions of learning that are more conducive to growth and development than others. These superior conditions seem to be produced by practices in the learning-teaching transaction that adhere to certain superior principles of teaching as identified [in Table 3.1]."

Srinivasan (1977) explored three approaches (problem-centered, projective, and self actualizing) to nonformal education that have been developed to (1) strengthen the problem-solving capacity of learners, (2) equip learners with coping skills to deal more effectively with their environment, and (3) develop the individual's inner potential and strengthen the positive awareness of self. The examples used were drawn from nonformal education programs in Thailand, Ethiopia, Bangladesh, Ghana, Turkey, the United States, and the Philippines. She stated that perhaps the simplest way to differentiate between the self-actualizing approach and other approaches is to compare the functions of teachers, learners, and materials or stimuli and by analyzing principal concerns or "areas of emphasis." Such a comparison reveals a progression from a subject-centered or didactic model at one end to a learner-centered and expressive model at the other. Arranging them along a continuum as in Figure 3.1 helps to more clearly understand the differences among them. It should be borne in mind that as points along a continuum, these models should be considered as merely abstractions; in reality a curriculum based on any one of these types could encompass at least some elements of other types.

B. Some Dimensions of the Population of Nontraditional Adult Learners

The total population of nontraditional adult learners for whom an adaptation of PSI might be productive would appear to include, at one time or another, almost the entire adult population.

Coolican (1975), through her own research and by synthesizing the outcomes of a number of major recent investigations, described the learning activities of adult Americans as follows.

- ° Almost every adult undertakes learning as a consciously pursued activity in any given year. (She defined "learning" as a deliberate effort to pursue a skill or a knowledge objective, as opposed to informal or coincidental socialization, adaptation, or information indexing.)
- ° Most learning is initiated for practical reasons related to knowledge and skill needs for job, home, family, or recreation.
- ° The major planners of adult education are the learners themselves. Self-planned, self-initiated, and self-achieved learning accounts for approximately two-thirds of the total learning efforts of adults.

Table 3.1

CONDITIONS OF ADULT LEARNING AND
PRINCIPLES OF TEACHING LIKELY TO PRODUCE THOSE CONDITIONS

CONDITIONS OF LEARNING

PRINCIPLES OF TEACHING

The learners feel a need to learn.

1) The teacher exposes students to new possibilities for self-fulfillment.

2) The teacher helps each student clarify his own aspirations for improved behavior.

3) The teacher helps each student diagnose the gap between his aspiration and his present level of performance.

4) The teacher helps the students identify the life problems they experience because of the gaps in their personal equipment.

The learning environment is characterized by physical comfort, mutual trust and respect, mutual helpfulness, freedom of expression, and acceptance of differences.

5) The teacher provides physical conditions that are comfortable (as to seating, smoking, temperature, ventilation, lighting, decoration) and conducive to interaction (preferably, no person sitting behind another person).

6) The teacher accepts each student as a person of worth and respects his feelings and ideas.

7) The teacher seeks to build relationships of mutual trust and helpfulness among the students by encouraging cooperative activities and refraining from inducing competitiveness and judgmentalness.

8) The teacher exposes his own feelings and contributes his resources as a colearner in the spirit of mutual inquiry.

The learners perceive the goals of a learning experience to be their goals.

9) The teacher involves the students in a mutual process of formulating learning objectives in which the needs of the students, of the institution, of the teacher, of the subject matter, and of the society are taken into account.

Table 3.1
(continued)

CONDITIONS OF LEARNING

PRINCIPLES OF TEACHING

The learners accept a share of the responsibility for planning and operating a learning experience, and therefore have a feeling of commitment toward it.

The learners participate actively in the learning process.

The learning process is related to and makes use of the experience of the learners.

The learners have a sense of progress toward their goals.

- 10) The teacher shares his thinking about options available in the design of learning experiences and the selection of materials and methods and involves the students in deciding among these options jointly.
- 11) The teacher helps the students to organize themselves (project groups, learning-teaching teams, independent study, etc.) to share responsibility in the process of mutual inquiry.
- 12) The teacher helps the students exploit their own experiences as resources for learning through the use of such techniques as discussion, role playing, case method, etc.
- 13) The teacher gears the presentation of his own resources to the levels of experience of his particular students.
- 14) The teacher helps the students to apply new learnings to their experience, and thus to make the learnings more meaningful and integrated.
- 15) The teacher involves the students in developing mutually acceptable criteria and methods for measuring progress toward the learning objectives.
- 16) The teacher helps the students develop and apply procedures for self-evaluation according to these criteria.

FROM MAXIMUM TEACHER ROLE

	INFORMATION MODEL	PROBLEM-SOLVING MODEL
Teacher Role	Teacher imparts information and skills usually by lecturing and use of drills.	Teacher presents a picture stimulus and facilitates discussion of a given concept, topic or problem.
Stimulus	Stimulus has as much information as possible leaving little or nothing for the learner himself to contribute.	Stimulus has only partial information. Student contributes from his own life experiences and gathers additional data to better understand the topic or problem.
Learner Role	Learner assimilates information like a sponge, from the teacher's mind and from texts.	Learner analyzes the concepts or problem, evaluates its importance, considers alternative solutions, decides on action, if any, and discovers skills helpful in problem solving.
Emphasis	Emphasis is on mastery of subject matter and on learning by rote.	Emphasis is on learner's use of his own mind for inquiry and problem solving.

TO MAXIMUM LEARNER ROLE

	PROJECTIVE MODEL	EXPRESSIVE/CREATIVE MODEL "SELF-ACTUALIZING"
Teacher Role	Teacher presents an open-ended story or picture-story with a fixed sequence of events. The ideas of events in the story comes from the curriculum writer.	Teacher presents only the raw materials from which stories, incidents, problem situations can be created and narrated by students. Raw materials include pictures in no fixed sequence and individual figures (flexiflans) with movable parts.
Stimulus	Stimulus has partial information both on technical problem and on the attitudes and other social, psychological and economic influences on the problem. Students supply the rest of the information needed, through discussion, interviews and consultation with specialists.	Stimulus has no information other than it relates to human beings. Students manipulate it to convey any meaning they choose. The group gets more understanding through discussion, consultation, interviews and through comparing different creative interpretations of the same stimulus.
Learner Role	The students supply the ending. They discuss the behavior and motives of the characters in the story and in so doing they may project their own feelings, values, beliefs, etc.	The student uses this raw material and his own life experiences to create a new story which the group can discuss. The words and sentences spoken by the students become the basis for literacy exercises.
Emphasis	Emphasis is on understanding the problem in an integral way with special attention to the hidden influences on the problem (socio-cultural and psychological).	Emphasis is on developing the learner's confidence, creativity, and communication abilities and on problem solving based on subject matter drawn from students' own lives.

Figure 3.1. FOUR CURRICULUM MODELS: A CONTINUUM

- Group-planned learning activities, whether formal or informal, account for only 10 to 20 percent of the total adult learning effort in this country.
- Learning for credit constitutes only a minor proportion of the educational undertakings and investment of American adults.

The adults studied in several of the investigations included in Coolican's synthesis were asked to name their preferred learning environment. The clear majority (55 percent) named their homes as the site most suitable to their needs; the job locale was a distant second choice (19 percent). Only 3.5 percent named "school" as a "most suitable place" for undertaking their learning pursuits.

Broschart (1977), in commenting on the above, noted that we find a large universe of adult learners in this country--almost everyone. Of this population, a small proportion have chosen to affiliate their learning undertaking with institutional offerings. However, most adults who regularly and consciously undertake to learn do so individually, autonomously, and idiosyncratically. Our attempts to understand the learning individual in this country must account for this majority despite definitions of adult education that would exclude them.

While a systematic categorization and examination of all subpopulations of this large universe of learners is beyond the scope of the research reported herein, some details of two particularly promising subpopulations are presented below. These subpopulations were selected for closer review because they were considered particularly promising for effective use of PSI, primarily on the basis of their having reasonably obvious, and largely unmet needs.

1. Adult Basic Education (ABE) Students

In spite of the significant progress in recent years toward providing adult basic education, a formidable challenge still is present in meeting the basic educational needs of this vast adult subpopulation. For example, one recent survey indicated that only two percent of the 308,215 undereducated adults in the State of Rhode Island were being served by the public schools (Rhode Island State Department of Education, 1973).

Of the approximately 150 million noninstitutionalized Americans 18 years old and older, over 25 million (17 percent) have received 8 years or less of schooling (Bureau of the Census, 1977). Statistical breakdowns of this group by sex, race, and Spanish origin are provided in Table 3.2. These figures indicate the inclusion of a disproportionately large percentage of Blacks and Hispanics. Even the figure of 25 million may not represent the extent of the problem of adult undereducation, since many adults who have gone to school for eight years cannot function at that grade level. In the State of North Carolina in 1978, 10 percent of all eleventh graders failed to pass a seventh grade reading test; 15 percent failed a math test on a similar level (Sitton, 1979). Perhaps 40 percent of the nation's high school graduates read below the eighth grade level (Smith, Aker, and Kidd, 1970). The social and economic impact of this undereducation is staggering. For example, adults who have not gone beyond grade school make up one-third of the unemployed, and an additional one-third of the unemployed do not have a high school diploma (Smith, Aker, and Kidd, 1970).

Table 3.2

DISTRIBUTION OF NONINSTITUTIONAL POPULATION 18 YEARS OLD
AND OLDER WITH 8 YEARS OR LESS OF SCHOOLING,
BY SEX, RACE, AND SPANISH ORIGIN

	Noninstitutional, 18 and Over Population	Number With 8 Years or Less of Schooling	Percent With 8 Years or Less of Schooling
Male	70,327,000	12,134,000	17
Female	<u>77,947,000</u>	<u>12,967,000</u>	<u>17</u>
Total	148,274,000	25,102,000	17
White	130,737,000	20,714,000	16
Black	15,076,000	3,897,000	26
Other	<u>2,461,000</u>	<u>491,000</u>	<u>20</u>
Total	148,274,000	25,102,000	17
Spanish Origin (of any race)	6,497,000	2,424,000	37
Other Than Spanish Origin	<u>141,777,000</u>	<u>22,678,000</u>	<u>16</u>
Total	148,274,000	25,102,000	17

The least literate and most alienated individuals tend to be excluded from adult education programs (Mezirow, 1975). Cross and Zusman (1977) noted that in 1975, 12.1 percent of the whites participated in some form of adult education compared to 6.9 percent of blacks. For some reason not immediately apparent, the educational opportunities represented in adult education are getting worse for blacks rather than better. In the years 1969, 1972, 1975, the participation rates of blacks were 7.8 percent, 7.4 percent, and 6.9 percent respectively. Whites, in contrast, showed increasing rates of participation, from 10.2 to 11.7 to 12.1 percent. Trend tables showed the greatest decline in part-time learning activities for blacks between 35 and 54 years of age. For that age group, the rates of participation in adult education for the three-year surveys declined from 8.8 to 6.6 to 6.4 percent, while the rates for whites rose from 11.3 to 13.1 to 13.4 percent.

For those who are committed to social justice and equal educational opportunity, the participation rate of blacks in continuing education is a matter of grave concern. Perhaps a closer look at the data will shed some light on the problem.

According to Cross and Zusman, the profile of black participants in adult education, as compared with that of whites, showed that blacks had lower levels of educational attainment (53 percent of whites and 39 percent of blacks had at least some college), had lower incomes (24 percent of whites and 44 percent of blacks had annual incomes under \$10,000), were more likely to be unemployed (4 percent for whites, 10 percent for blacks), were much more likely to live in the central city (25 percent for whites versus 60 percent for blacks), and were more likely to live in the south (27 percent for whites, 48 percent for blacks).

It is, of course, well established that socioeconomic indicators are strongly related to participation in educational activities. Low educational attainment, low job status, and low income have a great deal more relationship to educational disadvantage than race per se. If blacks and whites are equated for educational attainment, for example, differential participation rates disappear. In 1972, both blacks and whites with less than a high school diploma had a 4 percent adult education participation rate and both blacks and whites with a college degree or more had participation rates of 29 percent (NCES, 1972).

2. Adults in Correctional Institutions

Adults in correctional institutions represent another major subpopulation having significant and largely unmet learning needs. Ryan (1973) presented the following information regarding this subpopulation.

The jails, workhouses, penitentiaries and reformatories of this nation admit, control and release an estimated 3 million individuals each year. This is roughly equivalent to the combined populations of Alaska, Delaware, Hawaii, Idaho, Maine, and Vermont. On any day during the year approximately 1.3 million individuals--more than the population of any one of 15 states--are under correctional authority. The American Bar Association (1971) projected the 1975 average daily population in corrections at 1.8 million individuals.

Ryan noted that the charge to corrections is to control, support, and correct this very large segment of the nation's populace. This is far from an insignificant responsibility, especially when it is recognized that the offender population constitutes a culture unto itself--atypical in many critical dimensions of the free society. Corrections officials estimate that 95 percent of State prison inmates are school dropouts. Over one million individuals in penal institutions in the U.S. lack the educational and vocational skills for entering and maintaining gainful employment.

The American Bar Association (1971) estimated the average educational achievement of offenders at fifth to sixth grade level. The nation's prison population typically manifests distorted value systems. Most inmates are insecure, exhibit little self-discipline, and have a low self-image. Forty percent of the offenders are without previous work experience. Jaworski (1970) implied the magnitude of the responsibility of corrections in his caution that the vast majority of prison inmates eventually will be released to be a part of a society to which they have had little chance to adjust. The ABA estimated that 96 percent of those incarcerated will leave the prison system after an average stay of 2 years. With the recidivism rate generally placed at about 80 percent, the question of inmates' basic competencies for

dealing with economic and social realities is seen as a major problem of the times.

More current data indicate a continuing expansion of the prison population. A record 291,667 prisoners were held in the custody of State and Federal correctional authorities on December 31, 1977. This year-end count included 278,141 inmates, or 95 percent of the total, sentenced to a maximum term of more than 1 year. It was the third enumeration in a row to reach a new all-time high (U.S. Department of Justice, December 31, 1977).

3. Suitability of Subpopulations for PSI

There are several indications that the two above-listed subpopulations are particularly suitable for implementation of PSI. There is some evidence that PSI may be particularly effective with less advanced students, especially in the area of mathematics (Pascarella, 1977 and 1978). The need for instructional programs to address the widely varying entry levels of adults from these subpopulations likely can be addressed by PSI. Also, the self-pacing features of PSI appear particularly appropriate for these largely part-time learners. The educational needs of the two large subpopulations are essentially identical; hence, a well-developed PSI program could likely serve both groups. The PSI use of peer proctors could well be a key element in assuring that instruction meets the real needs of the students. The possibility that there may be initially higher costs (as compared with more conventional approaches) for preparing a PSI program does not present a problem when large numbers of people are served. In fact, considerable cost benefits likely would be realized by widespread use of PSI with these subpopulations. And finally, while there appears to be but few research findings to indicate that PSI has successfully served these subpopulations, there are no specific findings to indicate that PSI cannot serve such populations with the same high degree of success that it has served traditional college students.

Chapter 4

Conclusions and Suggested Development and Implementation Guidelines

This chapter first summarizes some of the conclusions that can be drawn from the discussion in the previous chapters, and then outlines some suggestions for development and implementation of a PSI program for nontraditional adult learners.

A. Conclusions

This section presents a brief list of conclusions that can be drawn relative to the research question of whether or not further investigation of the use of PSI for nontraditional adult learners is likely to be worthwhile. Since the question will be addressed more fully following the development and implementation activities discussed in Volume III, the conclusions listed here are tentative. The discussion generally follows the outline of Chapter 2 in that conclusions are grouped under the five general characteristics of PSI followed by a sixth subsection under program organization. These discussions generally support a positive answer to the research question noted above.

1. Materials in PSI

The primary requirements for PSI instructional materials are that they be permanent, transportable, affordable and available to students whenever they need them (Werner and Bono [1977]). The packaged nature of PSI materials would appear particularly supportive of the need for instruction by nontraditional adult learners who typically have varying achievement and capability levels and needs for alternative study schedules. The packaged, often self-instruction, materials also would appear particularly appropriate where teacher availability or capability is a problem. Reported research with off-campus students and testing by telephone (e.g., by Robinson [1975]) is an indication that the traditional college setting is not essential to the success of PSI.

Sherman (1972) noted that high, often prohibitive, cost of preparing PSI materials. This cost factor tends to limit development of new materials to those situations where the extensive use of the materials reduces the per unit cost to a reasonable amount. PSI, then, appears particularly appropriate for several subpopulations of nontraditional adult learners where large numbers of individuals have common needs (e.g., the need for adult basic education).

While PSI typically has not been used to teach students with minimal educational attainment, some of the reported research (e.g., VanNostrand's [1977] program to teach writing) appears to support the use of PSI with such students. A potentially negative aspect of the packaged PSI materials could be their lack of acceptance by teachers who might consider PSI to be a threat to their traditional role. This factor does not appear to have been specifically addressed in PSI research to date.

2. Mastery Requirement of PSI

Bloom (1976) suggested that by providing students with the favorable learning conditions represented by mastery learning, differences in learning rate (e.g., amount of study time required to achieve mastery) may begin to converge over time. This would appear to offer particular promise for the large subpopulation of educationally disadvantaged adults.

Some of the characteristics of many nontraditional adult learners are that they suffer from being deprived of success and from lack of self-confidence (NAPSAE, 1967), and that they have a fear of failure (Knowles, 1977). PSI appears to hold particular promise for students with these characteristics. Bloom (1979) identified improvement in self-confidence as being a major outcome of the mastery requirement of PSI. Cross (1976) summarized the educational equalization goal of mastery learning as being "to adjust the skills, experiences, and interests of all students...through instructional methods to produce elite performance, rather than to select students already demonstrating it." Hess (1977) noted that PSI's mastery requirement permits a student to experience the satisfaction of achieving an excellent performance.

Robins (1975) added a note of caution that would appear particularly applicable to nontraditional adult learners. He identified two features of PSI, the large number of unit tests and the mastery requirement, as being potentially the most disconcerting to students at the outset of a PSI course. He suggested that the sudden disruption of student expectations, by introducing unfamiliar and potentially threatening regulations, can be one cause of procrastination, heavy withdrawals, and other recurrent problems frequently encountered in PSI.

3. Self-Pacing in PSI

NAPSAE (1967) noted that adult learners typically require a longer time to perform learning tasks and that they vary greatly in levels of achievement and capability. Cross and Zusman (1977) identified the adult learner's need for alternative study schedules as a major concern. The self-pacing feature of PSI would appear to address such needs. Keller (1968) asserted that "self-pacing permits a student to move through a course at a speed commensurate with his ability and other demands upon his time."

While tradition and institutional pressures typically require that a college course be compressed into a one-semester time frame, such pressures are not so overwhelming in the typical nontraditional adult learning setting. Also, while most nontraditional adult learners have numerous other demands on their time (e.g., job, family), competing courses or classes generally are not a problem. Since most nontraditional adult learning programs meet for a certain number of hours each week even when the program is self-paced, some of the problems with procrastination noted in self-paced courses in college settings may not be applicable to a nontraditional adult PSI program. Rather, self-pacing appears to be a particularly appropriate approach to those nontraditional learners who may be forced, by external and/or internal factors, to vary their study schedule.

4. Peer-Proctors in PSI

Houle (1961) noted that many adult learners are seeking social contact and that their selection of a learning activity often is based on the amount and kind of human relationships the activity is likely to provide. Bligh (1977) also emphasized this social need, and noted that PSI was an exception to most recent educational innovations in that it included a strong social, interactive element. Sherman (1977) saw the use of peer-proctors as being a means for enhancing the social and personal aspects of the learning experience, and for decreasing student dependency on the professional authority figure by replacing this with reliance on self and peers. Since nontraditional adult students often have had unpleasant past experience with school and may have either hidden or overt feelings of hostility toward authority figures (NAPSAE, 1967), the use of peer-proctors would appear particularly applicable to this subpopulation.

5. Motivational Lectures in PSI

Since "motivational lectures" typically have been loosely defined as any supplementary or motivational activity not related to the actual delivery of essential instruction, its role with nontraditional adults could be that of providing additional needed social interactions, rewards for accomplishments, or opportunities to other student needs not typically addressed by the more formal aspects of a PSI program.

6. PSI Systems

Knowles (1977) summarized suggestions offered in the literature for providing an optimum learning climate for adults. These activities were:

- (a) Providing an optimum learning climate.
- (b) Adjusting to a heterogeneous student body.
- (c) Addressing the student's need for immediate success.
- (d) Assuring that real and perceived student needs are being met.
- (e) Reducing fear of failure.

The total PSI system, as variously described in the literature, would appear to hold promise for providing just such activities for nontraditional adult learners.

B. Suggested Development and Implementation Guidelines

This section summarizes some of the more significant points where findings regarding PSI and findings regarding adult learning appear to converge in such a manner as to suggest guidelines for development and implementation of a PSI program for nontraditional adult learners, and some possible experimental variables for consideration when conducting research regarding such a program. Only what are considered major guidelines or considerations are discussed here. For a more detailed discussion of possible experimental variables that may enhance or impede an adult educational program, Clark et al. (1978) is an excellent source.

The following discussion follows the general outline of Chapter 2 in that factors are grouped under the five general characteristics of PSI followed by a sixth subsection on program organization.

1. PSI Written Materials and Adult Learners

Since PSI traditionally has been used primarily with college students, the ability or inability of the students to read has not been a significant consideration. However, since many nontraditional adult learners have poor reading comprehension, the reading level of the PSI instructional materials must be matched carefully to the assumed reading level of the learners. For basic education, the design of PSI instructional materials becomes even more critical since the major skills to be learned may be reading skills. Also, at the basic education level, it is only with great difficulty that learning of other skills can be separated from reading skills; even if a distinction is made, it is often a forced one. This leads to an apparent requirement, if traditional PSI is used to teach basic skills, including reading skills, that self-instructional written materials or heavy emphasis on proctor assistance be utilized to teach students to read written materials.

Since the use of traditional PSI presupposes the ability to read, and since basic education typically includes instruction in improving reading skills, a minimum entry requirement for students in a PSI/basic education program would appear mandatory; that is, the students must be able to read at a predetermined minimal level. Even with this requirement, the generally low reading level of many nontraditional adult learners indicates that materials development/selection and provision of proctor assistance likely will require an unusual level of effort on the part of the program developers.

One suggested experimental variable is the introduction of substitute or supplementary modes of instruction (e.g., audio tapes, video disks) in the place of the written instruction used in traditional PSI. Such an approach might permit the use of a modified PSI approach for teaching students who cannot read or who have limited reading ability. As noted by Werner and Bono (1977), while the written word is the most common mode of presentation in PSI, the real requirement is that the materials be permanent, transportable, inexpensive, and available at whatever time the student needs them. This broad definition of "written" materials may prove essential for certain elements of PSI/ABE programs.

One aspect of the instructional materials typically used in PSI programs appears to offer some particularly attractive options for research with non-traditional adult learners. To the extent that the materials are self-instructional and the program utilizes peer proctors primarily for diagnostic testing rather than for teaching, a major unintended variable can be removed from a planned treatment. Since all students in a group or across groups can receive precisely the same instruction (or controlled variations of the instruction), other variables can be studied without fear that the results of the treatment will be flawed by unintended variations typically noted in research involving teacher-based instruction.

2. PSI Mastery Requirement and Adult Learners

Some of the debate on PSI mastery requirements (see Chapter 2, subsection C.2) appears to be confused by a lack of clarity as to the nature of the objectives to be met. For example, if one were learning to add two-digit numbers, and a unit test included 100 problems in adding two-digit numbers, would 100 percent mastery be a logical requirement? There is good reason to say that it would not. Even the most competent person might miss several problems, but this would have only a negligible reflection on that person's ability to perform the required operations. To recycle such a person through the learning materials would appear wasteful and demotivating. On the other hand, if the learning objectives required a series of activities such as those required to rescue and revive a potential victim of drowning, and if each objective had to be met in order for the potential victim to survive, 100 percent mastery would appear reasonable.

In spite of arguments by many proponents of PSI in favor of adherence to a 100 percent criterion (see Chapter 2, Section C.2), the nature of many of the objectives of instruction for nontraditional adult learners would appear to support arguments for serious consideration of alternate criteria. Research that relates variations in mastery requirements with the nature of the instructional objectives would appear to have potential for producing meaningful results. Also, instructor-determined mastery level versus individual student-determined mastery level might provide a basis for a meaningful research hypothesis.

Several typical adult learner characteristics appear to have particular significance for the mastery requirement of PSI. These are the learners' fear of failure and their need to have an ego involvement in their program of study. The successful PSI program apparently must provide a "win-win" situation and a sufficient orientation to the mastery system (e.g., assuring students that they can operate successfully within such a system). One promising approach would appear to be the avoidance of the use of "pretests" and "posttests." Instead, all tests could be "diagnostic instruments." Emphasis could be removed from whether a student passed or failed a unit test, and could be placed on providing the student and proctor with information to determine "what we should do next." This would mean that the students would not experience outright failure. At worst, they would discover that they were not progressing as rapidly as they had hoped. At best, they would find that each diagnostic test moved them ahead to totally new learning materials.

It also should be noted (and possibly made clear to the adult students) that two major factors influence any progress indicated by diagnostic instruments. One factor is student related and the other factor is program related. Less than hoped for progress on the part of the student can well reflect on the quality and appropriateness of the course materials and organization more than on the ability and effort of the student. Course revision rather than more effort on the part of the student might be needed.

3. PSI Self-Pacing and Adult Learners

Since nontraditional adult students typically present a wide range of entry behaviors and a wide range of needs, a PSI program that has no fixed beginning point or fixed ending point might be particularly effective. The

program might be designed so that a student can begin at his/her appropriate level and progress as far as his/her time, motivation, and ability permit.

While the literature (both PSI and adult learning) appears to support attempts to motivate students to progress at a reasonable pace, such efforts with nontraditional adult students should be approached with considerable care. Strict, overt efforts to maintain the speed of the self-paced learning could seem authoritarian, and could result in the adult students' resistance to such use of adult authority through their withdrawal from the learning situation.

One possible motivational aid might be to make the initial learning modules relatively short. This might serve the dual purpose of introducing the learner to success in self-pacing while at the same time relieving his/her fear of failure. Rewards, such as certificates of completion awarded upon completion of blocks of instruction, also might serve as motivational aids.

4. PSI Peer-Proctors and Adult Learners

When developing the peer proctor system for a nontraditional adult PSI program, careful attention should be given to such typical adult learner needs as:

- Nonthreatening assistance in determining real needs.
- Assistance in ascertaining present level of accomplishment (and, thus, the immediate learning needs).
- Motivation to learn.
- Assistance with learning materials.
- A sense of belonging or fitting into the learning environment.
- Learning alternatives not inhibited by resentment of authority or unpleasant memories of past schooling.
- Some social interactions:

These needs also indicate the advisability of a thorough peer proctor training program, particularly if the proctor role is to involve more than the routine administration of diagnostic instruments.

The manner in which proctors (either internal or external) are used appears to be a particularly appropriate experimental variable. While some research has been done with various proctor systems, only limited data are available regarding proctors for nontraditional adult learners. A comparison of several proctor systems for this population could prove to be an exceptionally worthwhile effort.

5. PSI Motivational Lectures and Adult Learners

Motivational activities should be considered as a resource for helping to meet such typical nontraditional adult learners needs as:

- o A desire to participate in learning activities that meet immediate needs.
- o Considerable other demands on their time and energy.
- o Widely varying achievement levels and capabilities.
- o Social as well as learning needs.

A particularly appropriate approach would appear to be to use motivational activities to address specific course objectives. The lectures could, for example, be (a) small-group activities or films designed to assist students in seeing the need for studying certain materials that do not have an obvious or immediate payback, (b) group activities directed toward improved communications and human relations, or (c) an instructor or peer presentation on developing problem-solving skills.

A primary concern regarding motivational lectures should be that they not be used "just because they are a part of the PSI approach." Motivational lectures likely can be a positive program element if student needs are carefully considered, and those needs least likely to be met by other program elements are addressed by motivational activities. One additional concern is that the term "motivational lecture" not be interpreted too literally. The literature indicates that a variety of activities may be considered legitimate means for providing this PSI feature.

6. PSI Systems and Adult Learners

The literature on PSI systems and on adult learning indicates a number of critical considerations in developing and implementing a PSI program for nontraditional adult learners. Eight particularly significant systems factors are discussed below.

a. Student Instructions Regarding Program Functioning

A number of PSI features (e.g., self-pacing, frequent testing, use of peer proctors) likely will be new to many adult learners. The students' orientation to the program operation must be planned carefully. One possibility is to prepare an introductory module (with objectives, diagnostic instrument, etc.) to introduce the program operation. This module also might serve as a motivational device and as a means for providing the learner with initial success in meeting program objectives.

b. Evaluation of Entry Behaviors

The instruments for evaluation of entry behaviors must be selected or adapted with care. It would appear essential that each student enter the PSI program at a point where he/she has mastered all prerequisite skills and knowledge and has an identified need for all subsequent skills and knowledge. Insofar as practical, the entry behavior appraisal process should lend itself to involvement of the student in the decision-making process regarding the student's program objectives.

c. Maintenance of Student Records

Appropriate student records and a system for completing and maintaining such records appear essential to a successful PSI program. Particularly in a research program regarding the suitability of PSI for teaching nontraditional adult learners, the instructional system must include means for collecting information regarding student progress, attitudes, attendance, and time on task; the nature of proctor and classroom manager interventions; and problems encountered by students, proctors, or classroom managers. These research requirements should, of course, be secondary to the primary use of classroom records: that of assisting the students in meeting the program objectives.

d. Student Grouping

Depending on the system used, and particularly on the nature of the utilization of proctors, students may need to be grouped according to entry behaviors. One possible research variable would be a comparison of homogeneous groupings with heterogeneous groupings.

e. Use of Optional Modules

Some optional instructional modules may be included in a course in an attempt to meet diverse student needs. Studying or mastery of these modules may or may not be required. Another possibility is that some modules may be made up of several "minimodules" that are selected to meet specific needs or to address unique areas of interest.

f. Evaluation of Individual Learning

Since a PSI program can minimize or eliminate a number of variables (e.g., learning materials, teacher characteristics), it presents an unusual opportunity to focus research efforts on such key concerns as how adults learn. Insofar as practical, PSI research should note individual differences and how these differences relate to such factors as student progress, attitude toward the program, use of proctors, time on task, and dropout rate.

g. Classroom Manager Training

Since some teachers appear threatened by an instructional system that does not depend directly on teacher inputs, sessions with the teachers (who will act as classroom managers for the PSI program) must be planned to emphasize the critical role that the teacher has in an effective PSI program. Insofar as the introduction of PSI represents an experiment in intervention in ongoing adult education programs, findings related to factors such as teacher-threat, program-acceptance, and consensus-planning (planning based on jointly identified objectives) will be particularly useful as guidelines for any such "interventions" that occur in the future.

h. Proctor Roles

One critical decision that must be made in developing a PSI program is the relationship between the instructional materials and the role of the proctors. Should the instructional materials be self-instructional or

should be proctors be depended upon to provide essential instruction? To the extent that the instructional materials are effective self-instructional packages, the role of the proctor is diminished to that of a test administrator. To the extent that the proctor is depended upon as a provider of instruction, the quality and content of the instruction becomes less predictable and less subject to systematic revision to improve its effectiveness.

Bibliography

- Acker, L. E. and Goldwater, B. C. Mastery performance in PSI: A goal by any other name. Teaching of Psychology, 1976, 3, 91. (ERIC Document Reproduction Service No. EJ 138 656)
- Adult Performance Level Project. Adult functional competency: A report to the Office of Education Dissemination Review Panel. Austin: University of Texas at Austin, 1976.
- Alba, E., and Pennypacker, H. S. A multiple change score comparison of traditional and behavioral college teaching procedures. Journal of Applied Behavior Analysis, 1972, 5, 121-124.
- Allen, P. S. Reinforcement using the Keller plan. Physics Education, 1976, 11, 121-124. (ERIC Document Reproduction Service No. EJ 136 741)
- American Bar Association. Marshalling citizens power against crime. Coordination Bulletin 42. Washington: Chamber of Commerce of the United States, 1971.
- Anderson, A. D. A first generation system for interactive learning, formative diagnosis, and summative evaluation utilizing macroassembly language. American Journal of Pharmaceutical Education. 1977, 41, 47-9. (ERIC Document Reproduction Service No. EJ 159 046)
- Anderson, O. T. and Artman, R. A. A self-paced, independent study, introductory physics sequence--description and evaluation. American Journal of Physics, 1972, 40, 1737-1742. (ERIC Document Reproduction Service No. EJ 068 445)
- Andrews, R. S. Customizing geology in the self-instruction mode: For example, geological oceanography. Journal of Geological Education, 1977, 25, 108-111. (ERIC Document Reproduction Service No. EJ 178 368)
- Arter, J. A. and Jenkins, J. R. Differential diagnosis--prescriptive teaching: A critical appraisal. Review of Educational Research, 1979, 49, 517-556.
- Atkins, J. A. and Lockhart, K. Flexible vs. instructor-paced college quizzing: A behavioral analysis of preference and performance. In L. E. Fraley and E. A. Vargas (Eds.), Behavior research and technology in higher education. Gainesville: University of Florida, Society for Behavioral Technology and Engineering, Psychology Department, 1976.
- Atwood, H. M. and Ellis, J. Concept of need: An analysis for adult education. In L. McKenzie and J. McKinley (Eds.), Adult education: The diagnostic procedure. Bloomington, Indiana: School of Education, Indiana University, 1973.
- Bandura, A. Self-efficacy: Toward a unifying theory of behavioral change. Educational Psychologist, 1976, 84, 196-214.
- Bart, W. M. Piagetian cognitive theory and adult education: A perspective for research. Paper presented at the Adult Education Research Conference, Minneapolis, Minnesota, April 1977. (ERIC Document Reproduction Service No. ED 138 797)

- Bell, M. E. and Anderson, L. W. Application of television to the PSI model. Educational Technology, 1978, 18, 40-42. (ERIC Document Reproduction Service No. 178 041)
- Bent, H. A. No easy way: Experience with a modified-Keller physical chemistry course. Journal of Chemical Education. 1974, 51, 661-664.
- Beyer, B. K. PSI in community and two-year colleges: Potential and limitations. Los Angeles: University of California, 1976. (ERIC Document Reproduction Service No. ED 149 834)
- Bijou, S. W., Morris, E. K., and Parsons, J. A. A PSI course in child development with a procedure for reducing student procrastination. Journal of Personalized Instruction, 1976, 1, 36-40.
- Bitgood, S. C. and Segrave, K. A comparison of graduated and fixed point systems of contingency managed instruction. In J. M. Johnston (Ed.), Behavior research and technology in higher education. Springfield, Illinois: Charles C. Thomas, 1975.
- Bligh, D. M. Are teaching innovations in postsecondary education irrelevant? In Michael J. A. Howe (Ed.), Adult learning. New York: John Wiley and Sons, 1977.
- Block, J. H. The effects of various levels of performance on selected cognitive, affective, and time variables. Unpublished doctoral dissertation submitted to the University of Chicago, 1970.
- Bloom, B. S. Human characteristics and school learning. New York: McGraw-Hill, 1976.
- Bloom, B. S. Mastery learning takes bold. Education USA, 1979, 22, 99.
- Bloom, B. S. Learning for mastery. San Diego: University of California, Center for Study of Instructional Programs, 1968. (ERIC Document Reproduction Service No. ED 053 419)
- Boltes, P. and Schaie, K. On the plasticity of intelligence in adulthood and old age. American Psychologist, 1976, 31, 720-725.
- Born, D. G. Exam performance and study behavior as a function of study unit size. In J. M. Johnston (Ed.), Behavior research and technology in higher education. Springfield, Illinois: Charles C. Thomas, 1975.
- Born, D. G., Davis, M., Whelan, P. and Jackson, D. College student study behavior in a personalized instruction course and in a lecture course. In G. Semb (Ed.), Behavior analysis and education. Lawrence: University of Kansas Support and Development Center for Follow Through, Department of Human Development, 1972, pp. 371-376.
- Born, D. G., Gledhill, S. M., and Davis, M. L. Examination performance in lecture-discussion and personalized instruction courses. Journal of Applied Behavior Analysis, 1972, 5, 33-43.

- Born, D. G. and Herbert, W. A. A further study of personalized instruction in large university classes. Journal of Experimental Education, 1971, 40, 6-11.
- Born, D. G. and Whelan, P. Some descriptive characteristics of student performance in PSI and lecture courses. Psychological Record, 1973, 23, 145-152.
- Brainard, A. J. Contemporary educational challenges. Engineering Education, 1975, 65, 386-390.
- Brainard, A. J. Teaching win-win better prepares students for subsequent experiences in life. Paper presented at the annual meeting of the American Society for Engineering Education, Ft. Collins, Colorado, June 1975. (ERIC Document Reproduction Service No. ED 118 414)
- Brock, J. F. and others. PSI + job-task analysis = effective Navy training. Educational Technology, 1975, 15, 28-31. (ERIC Document Reproduction Service No. EJ 117 938)
- Broschart, J. R. Lifelong learning in the nation's third century. A synthesis of selected manuscripts about the education of adults in the United States. (Report No. OE-76-09102). Office of Education (DHEW), Washington, D.C.: U.S. Government Printing Office, 1977. (ERIC Document Reproduction Service No. ED 149 137)
- Brown, G. Human teaching for human learning: An introduction to confluent education. New York: The Viking Press, 1971.
- Brown, G. C. and others. Self-paced introductory physics course--An eight-year progress report. American Journal of Physics, 1977, 45, 1082-1088. (ERIC Document Reproduction Service No. EJ 170 510)
- Buford, R. K. Evaluation of a reinforcement procedure for accelerating work rate in a self-paced course. Journal of Applied Behavior Analysis, 1976, 9, 208.
- Burr, C. A multi-level self-paced high school chemistry project. Australian Science Teachers Journal, 1976, 22, 41-46. (ERIC Document Reproduction Service No. EJ 151 965)
- Burt, D. W. Study and test performance of college students on concurrent assignment schedules. In J. M. Johnston (Ed.), Behavior research and technology in higher education. Springfield, Illinois: Charles C. Thomas, 1975.
- Buterbaugh, J. G. and Fuller, R. G. Personalized system of instruction (PSI): An alternative. Audio-Visual Instruction, 1975, 20, 62-65.
- Caldwell, E. C. and others. Mastery: The essential essential in PSI. Teaching of Psychology, 1978, 5, 59-65. (ERIC Document Reproduction Service No. EJ 178 564)

- Calhoun, J. F. Proctor characteristics and functioning in the personalized system of instruction. In J. M. Johnston (Ed.), Research and technology in college and university teaching. Gainesville: Society for Behavioral Technology and Engineering, University of Florida, 1975.
- Calhoun, J. F. The combination of elements in the personalized system of instruction. Teaching of Psychology, 1976, 3, 73-76. (ERIC Document Reproduction Service No. EJ 138 649)
- Carlson, J. G. and Minke, K. A. Fixed and ascending criteria for unit mastery learning. Journal of Educational Psychology, 1975, 67, 96-101.
- Carroll, J. A model of school learning. Teachers College Record, 1963, 64, 723-733.
- Carroll, J. B. Instructional methods and individual differences. In R. M. Gagné (Ed.), Learning and individual differences. Columbus, Ohio: Charles E. Merrill Books, Inc., 1967.
- Carter, R. P. and Short, V. M. (Eds.) Speaking about adults and the continuing educational process. Illinois: Northern Illinois University, Proceedings of the Adult Basic Education Workshop, 1967. (ERIC Document Reproduction Service No. ED 028 329)
- Charconnet, M. G. Development of educational methods and techniques adapted to the specific conditions of the developing countries. United Nations Educational, Scientific, and Cultural Organization, Paris (France). Division of Methods, Materials, and Techniques, 1975. (ERIC Document Reproduction Service No. ED 136 776)
- Churchill, R. and Baskin, S. Experiments on independent study. Yellow Springs, Ohio: Antioch College, 1958.
- Clark, R. E. and others. An approach to research on learning opportunities for adults. Washington, D.C.: Prepared for the Lifelong Learning Project, Office of the Assistant Secretary for Education, (DHEW), 1978.
- Cobb, E. S. A step in the direction of a science of education: The measurement of independent aural study activities generated under PSI contingencies. Personalized Instruction in Education Today, 1978, 301-308.
- Coldeway, D. O. Comparison of small-group contingency management with the personalized system of instruction and the lecture system. Paper presented at the Conference on Research and Technology in College Teaching, Chicago, Illinois, October 1974. (ERIC Document Reproduction Service No. ED 096 978)
- Coldeway, D. O. and Keys, C. B. The effect of instructor-pacing on later self-pacing. In L. E. Fraley and E. A. Vargas (Eds.), Behavior research and technology in higher education. Gainesville: University of Florida, Society for Behavioral Technology and Engineering, Psychology Department, 1976.

- Coolican, P. M. Self-planned learning: Implication for the future of adult education. An addendum to the 1974 paper, West Virginia, The University of West Virginia, 1975.
- Cox, W. F. and Dunn, T. G. Mastery learning: A psychological trap? Educational Psychologist, 1979, 14, 24-29.
- Cronbach, L. J. Processes affecting scores on "understanding of others" and "assumed similarity." Psychology Bulletin, 1955, 52, 177-194.
- Cronbach, L. J. Instructional methods and individual differences. In R. M. Gagné (Ed.), Learning and individual differences. Columbus, Ohio: Charles E. Merrill Books, Inc., 1967.
- Cronbach, L. J. and Gleser, G. C. Psychological tests and personnel decisions. Second edition. Urbana: University of Illinois Press, 1965.
- Cronbach, L. J. and Snow, R. E. Aptitudes and instructional methods. New York: Irvington Publishers, Inc., 1977.
- Cross, K. P. Years of change for community colleges: 1970 to 1974. Findings, 1975, 2, 5-8. (ERIC Document Reproduction Service No. ED 110 111)
- Cross, K. P. Accent on learning. San Francisco: Jossey-Bass, 1976.
- Cross, K. P. and Zusman, A. The needs of non-traditional learners and the responses of non-traditional programs. Berkeley, California: University of California, Center for Research and Development in Higher Education, 1977.
- Darkenwald, G. G. Some effects of the "obvious variable," Teacher's race and holding power with black adult students. Sociology of Education, 1975, 48, 420-431.
- Davidson, C. V. Training needs of instructors in Adult Basic Education programs in British Columbia. Vancouver, British Columbia: British Columbia University, 1970. (ERIC Document Reproduction Service No. ED 045 955)
- Davis, M. L. Mastery test proficiency requirements affect mastery test performance. In J. M. Johnston (Ed.), Behavior research and technology in higher education. Springfield, Illinois: Charles C. Thomas, 1975.
- Davis, M. L. Some effects of an integrated review procedure. In J. M. Johnston and G. W. O'Neill, Research and technology in college and university teaching. Gainesville: University of Florida, Society for Behavioral Technology and Engineering, Psychology Department, 1975.
- Dubin, R. and Taveggia, T. C. The teaching-learning paradox. Eugene, Oregon: University of Oregon Press, 1968.
- Dyer, S. A psychometrician views human ability. Teachers' College Record, 1960, 61, 394-403.

- Edwards, K. A. The student as a teacher. Paper presented at the annual meeting of the Rocky Mountain Psychological Association, New Mexico, May 1972. (ERIC Document Reproduction Service No. ED 066 032)
- Edwards, K. A. and Gottula, P. Stimulus control, small steps, and self-pacing in college. New Directions in Teaching. 1976, 5, 31-39. (ERIC Document Reproduction Service No. EJ 141 464)
- Edwards, K. A. and Powers, R. B. Self-pacing in a personalized system of instruction: Work patterns and course completion. Paper presented at the Association for Educational Communications and Technology National Convention, Las Vegas, Nevada, April 1973. (ERIC Document Reproduction Service No. ED 071 451)
- Eisdorfer, C. Background and theories of aging. In G. L. Maddox (Ed.), The future of aging and the aged. Atlanta: Southern Newspaper Publishers Association Foundation, 1972.
- Entwistle, N. J. Sylbs, sylfs, and ambiverts: Labelling and libelling students. Inaugural lecture, University of Lancaster, 1974.
- Farmer, J., Lachter, G. D., Blaustein, T. J., and Cole, B. K. The role of proctoring in personalized instruction. Journal of Applied Behavior Analysis, 1972, 5, 401-404.
- Fernald, P. S. and others. Systematic manipulation of student pacing, perfection requirement, and contact with a teaching assistant in an introductory psychology course. Teaching of Psychology, 1975, 2, 147-151. (ERIC Document Reproduction Service No. EJ 130 295)
- Flaherty, J. F. A study of functional education needs of New Jersey adult basic education students. New Brunswick, New Jersey: Center for Adult Development, Rutgers University, 1977.
- Flaherty, J. F. A multivariate analysis of self-perceived learning needs of undereducated adults. Dissertation submitted to the State University of New Jersey, 1978.
- Gagné, R. M. The conditions of learning. New York: Holt, Rinehart, and Winston, 1965.
- Gagné, R. M., and Paradise, N. E. Abilities and learning sets in knowledge acquisition. Psychological Monographs, Whole No. 518, 75, 14, 1961, 1-23.
- Gartner, A., Kohler, Conaway, and Riessman. Children teach children. New York: Harper and Row, 1971.
- Gazda, G. M., Asbury, F. R., Blazer, F. J., Childers, W. C., Desselle, R. E. and Walters, R. P. Human relations development: A manual for educators. Boston: Allyn and Bacon, 1973.

- Geis, G. Schizophrenia in America. In J. G. Sherman and R. M. Lazer (Eds.), Personalized instruction in higher education: Proceedings of the third national conference. Washington, D.C.: Center for Personalized Instruction, 1977.
- Gjerde, C. L. Integration of computers into a course on bio-statistics. Journal of Medical Education. 1977, 52, 687-8. (ERIC Document Reproduction Service No. EJ 164 672)
- Glaser, R. Adapting the elementary school curriculum to individual performance. In Proceeding of the 1967 Invitational Conference on Testing Problems. Princeton, N.J.: Educational Testing Service, 1968, 3-36.
- Glaser, R. Instructional technology and the measurement of learning outcomes: Some questions. In W. J. Popham (Ed.), Criterion-Referenced Measurement. Englewood Cliffs, N.J.: Educational Technology Publications, 1971, 5-16.
- Glaser, R., and Cox, R. C. Criterion-referenced testing for the measurement of educational outcomes. In R. A. Weisgerber (Ed.), Instructional Process and Media Innovation. Chicago, Ill.: Rand-McNally and Co., 1968, 545-550.
- Glaser, R., and Klaus, D. J. Proficiency measurement: Assessing human performance. In R. M. Gagné (Ed.), Psychological Principles in Systems Development. New York: Holt, Rinehart, and Winston, 1962, 419-474.
- Glick, D. M. PSI one semester later. North Country Community College, Life Science Division, 1973. (ERIC Document Reproduction Service No. ED 089 624)
- Goodall, P. PSI as viewed by an engineering student. Paper presented at the annual meeting of the Rocky Mountain Psychological Association, New Mexico, May 1972. (ERIC Document Reproduction Service No. ED 066 867)
- Goodnow, J. and Bethon, G. Piaget's tasks: The effect of schooling and intelligence. Child Development, 1966, 37, 573-582.
- Grabowski, S. M. Motivational and participation patterns. In C. Klevins (Ed.), Materials and methods in continuing education. New York: Klevins Publications, Inc., 1976.
- Green, B. A., Jr. Something like it. Personalized System of Instruction Newsletter, 1971, 1.
- Green, B. A., Jr. Physics teaching by the Keller plan at MIT. In J. L. Sayre and J. J. Knightly (Eds.), The personalized system of instruction in higher education. Oklahoma, Seminary Press, 1972.
- Gruber, H. E. and Weitman, M. Self-directed study: Experiments in higher education. Boulder, Colorado: University of Colorado, Behavior Research Laboratory Report No. 19, 1962.
- Guilford, J. P. Intellectual decline. In J. P. Guilford (Ed.), The nature of human intelligence. New York: McGraw-Hill Book Co., 1967.

- Hamachek, D. Characteristics of good teachers and implications for teacher education. Phi Delta Kappan, 1969, 50, 341-344.
- Hashway, R. M. The expanded individualized prescriptive instruction (EIPI) system. Educational Technology, 1979, 19, 33-38.
- Havighurst, R. J. Developmental tasks and education. New York: David McKay Co., 1956.
- Hedges, L. V. Personalized introductory courses: A longitudinal study. San Diego, California: University of California, 1975. (ERIC Document Reproduction Service No. ED 120 121)
- Henneberry, J. K. Proctor personality characteristics and effectiveness in a PSI course. Paper presented at the annual convention, American Psychological Association, Washington, D.C., September 1976. (ERIC Document Reproduction Service No. ED 135 750)
- Henneberry, J. K. Effects of three anti-procrastination measures in a PSI course. In B. A. Green (Ed.), Personalized instruction in higher education: Proceedings of the second national conference, Washington, D.C.: Center for Personalized Instruction, 1977.
- Hess, J. H. Large-scale individualized instruction systems: A comparison of three working models. Educational Technology, 1977, 17, 37-44.
- Hess, J. H. and Leham, G. R. PSI and the generic method of programmed instruction. Programmed Learning and Educational Technology, 1976, 13, 13-22. (ERIC Document Reproduction Service No. EJ 136 523)
- Hilgendorf, A. F. Feedback with computer-generated tests. Physics Teacher, 1978, 16, 96-7. (ERIC Document Reproduction Service No. EJ 176 315)
- Hoberock, L. L., Koen, B. V., Roth, C. H., and Wagner, G. R. Theory of PSI evaluated for engineering education. In J. L. Sayre and J. J. Knightly (Eds.), The personalized system of instruction in higher education. Oklahoma: Seminary Press, 1972.
- Horn, J. and Donaldson, G. On the myth of intellectual decline in adulthood. American Psychologist, 1976, 31, 701-719.
- Horton, L. in Mastery learning takes hold. Education USA, 1979, 22, 99.
- Houle, C. O. The inquiring mind. Madison: University of Wisconsin Press, 1961.
- Howe, J. J. A. (Ed.), Adult learning psychological research and applications. New York: John Wiley and Sons, 1977.
- Hursh, D. E. Personalized systems of instruction: What do the data indicate? Journal of Personalized Instruction, 1976, 1, 91-105.

Hursh, D. E. and others. Proctor's discussions of students' quiz performance with students in a self-paced (PSI) undergraduate course. Morganton, North Carolina: Western Carolina University, 1973. (ERIC Document Reproduction Service No. ED 088 383)

Hursh, D. E., Wildgen, J., Minkin, B., Minkin, N., Sherman, J. and Wolf, M. N. Proctors' discussions of students' quiz performance with students? In J. M. Johnston (Ed.), Behavior research and technology in higher education. Springfield, Illinois: Charles C. Thomas, 1975.

Jaworski, L. The challenge and the response. Congressional Record, United States Senate, Washington, D.C., November 19, 1970.

Johnson, K. R. and Ruskin, R. S. Behavioral instruction: An evaluative review. Unpublished manuscript, 1976.

Johnson, K. R. and Sulzer-Azaroff, B. PSI for first-time users: Pleasures and pitfalls. Educational Technology, 1975, 15, 9-17.

Johnson, M. and Bailey, J. S. Crosspage tutoring: Fifth graders as arithmetic tutors for kindergarten children. Journal of Applied Behavior Analysis, 1974, 7, 223-232.

Johnston, J. M. and O'Neill, G. W. The analysis of performance criteria defining course grades as a determinant of college student academic performance. Journal of Applied Behavior Analysis, 1973, 6, 261-268.

Johnston, J. M. and Pennypacker, H. S. A behavioral approach to college teaching. American Psychologist, 1971, 26, 219-244.

Keller, F. S. Goodbye, teacher... Journal of Applied Behavior Analysis, 1968, 1, 79-89.

Keller, F. S. A programmed system of instruction. In J. L. Sayre and J. J. Knightly (Eds.), The personalized system of instruction in higher education. Enid, Oklahoma: Seminary Press, 1972.

Kelly, E. F. and Chapman, D. W. Explaining course oriented attitude: A canonical analysis. Educational Research Quarterly, 1977, 2, 52-60. (ERIC Document Reproduction Service No. EJ 176 607)

Kindervatter, S. Learner-centered training for learner-centered programs: A workshop in materials and curriculum development for nonformal educators. Amherst, Massachusetts: University of Massachusetts, 1977. (ERIC Document Reproduction Service No. ED 143 560)

Knowles, M. S. The modern practice of adult education. New York: Association Press, 1977.

Knox, A. B. Helping adults to learn. Illinois: University of Illinois at Urbana-Champaign Continuing Education, College of Education, 1976.

Koen, B. V. Self-paced instruction for engineering students. Engineering Education, 1970, 60, 735-736. (ERIC Document Reproduction Service No. EJ 017 534)

- Koen, B. V. Determining the unit structure in a PSI course. Engineering Education, 1973, 63, 432-434. (ERIC Document Reproduction Service No. EJ 083 376)
- Kuhn, D. Relation of two Piagetian stage transitions to I.Q. Developmental Psychology, 1976, 12, 157-161.
- Kulick J. A. and Jaksa, P. PSI and other educational technologies in college teaching. Educational Technology, 1977, 17, 12-19.
- Kulik, J. A., Kulik, C., and Carmichael, K. The Keller plan in science teaching. Science, 183:379-383, 1974.
- Kulick J. A., Kulick, C. C. and Cohen, P. A. A meta-analysis of outcome studies of Keller's personalized system of instruction. American Psychologist, 1979, 34, 307-318.
- Kulick, J. A., Kulick, C. C. and Smith, B. B. Research on the personalized system of instruction. Programmed Learning and Educational Technology, 1976, 13, 23-30.
- Landsman, T. Differential changes in interests and learning abilities. In Continuing education in the later years: A report on the Twelfth Annual Southern Conference on Gerontology held at the University of Florida February 21-22, 1963 (Volume 12, Institute of Gerontology Series). Gainesville: University of Florida Institute of Gerontology, 1963.
- Lazar, G. S. Peer teaching assistants and English composition in the community college. Paper presented at the national conference on Personalized System of Instruction in Higher Education, Washington, D.C., May 1976. (ERIC Document Reproduction Service No. ED 130 725)
- Lea, C. R. and Lockhart, K. A. Behavioral analysis of forced excellence and grade choice criteria. In J. M. Johnston (Ed.), Research and technology in college and university teaching. Gainesville: University of Florida, Society for Behavioral Technology and Engineering, Psychology Department, 1975.
- Leiderker, J. The removal of time constraints. In A. J. Dessler (Ed.), Proceedings of the Keller method workshop conference at Rice University, Houston, Texas, 1972.
- Lewis, D. K. and Wolf, W. A. Keller plan introductory chemistry: Students' performance during and after the Keller experience. Journal of Chemical Education, 1974, 51, 665-667. (ERIC Document Reproduction Service No. EJ 111 485)
- Lloyd, K. E. Contingency management in university courses. Educational Technology, 1971, 11, 18-23.
- Lloyd, K. E., Garlington, W. K., Lowry, D., Burgess, H., Euler, H. A. and Knowlton, W. R. A note on some reinforcing properties of university lectures. Journal of Applied Behavior Analysis, 1972, 5, 151-155.

- Lloyd, K. E. and Knutzen, N. J. A self-paced programmed undergraduate course in the experimental analysis of behavior. Journal of Applied Behavior Analysis, 1969, 2, 125-133.
- Lloyd, L. E., McMullen, W. E., and Fox, R. A. Student-pacing and instructor-pacing of assignments in a university contingent management system. Paper presented at the fifth annual conference on Behavior Analysis in Education, Lawrence, Kansas, 1974.
- Lu, P. H. Modification of procrastinating behavior in personalized systems of instruction. Paper presented at the National Conference on Personalized System of Instruction in Higher Education, Washington, D.C., May 1976. (ERIC Document Reproduction Service No. ED 125 971)
- Ludwig, M. The PSI social science program at Cuyahoga Community College. Community College Social Science Quarterly, 1975, 5-6, 25-26, 29. (ERIC Document Reproduction Service No. EJ 129 877)
- Mack, H. and Littlejohn, S. PSI as an approach to the teaching of empirical research methods. Paper presented at the annual meeting of the Speech Communication Association, Washington, D.C., December 1977. (ERIC Document Reproduction Service No. ED 149 408)
- Maginnity, G. F. A personalized system of instruction in library use. Mexico: Instituto Tecnológico de Monterrey, 1976. (ERIC Document Reproduction Service No. ED 125 530)
- Malott, R. W. and Svinicki, J. G. Contingency management in an introductory psychology course for one thousand students. The Psychological Record, 1969, 19, 545-556.
- McGaw, D. Personalized systems of instruction. Paper presented at the annual meeting of the American Political Science Association, San Francisco, California, September 1975. (ERIC Document Reproduction Service No. ED 110 398)
- McKeachie, W. J. Teaching-learning improvement: The state of the art. Keynote address, Fourth International Conference on Improving University Teaching, Aachen, Federal Republic of Germany, July 29, 1978.
- Medsker, L., Edelstein, S., Kreplin, H., Ruyle, J., and Shea, J. Extending opportunities for a college degree: Practices, problems, and potentials. Berkeley: Center for Research and Development in Higher Education, University of California, 1975.
- Meldahl, K. E. Effects of structured and unstructured peer tutoring on the math performance of eighth grade students. Thesis submitted to University of North Carolina at Chapel Hill, 1976.
- Mezirow, J., Darkenwald, G. G., and Knox, A. B. Last gamble on education: Dynamics of adult basic education. Office of Education (DHEW), Washington, D.C., 1975 (RMQ66000). (ERIC Document Reproduction Service No. ED 112 119)

Miller, H. L. Teaching and learning in adult education. New York: The MacMillan Company, 1972.

Miller, L. K. The effects of a behaviorally engineered textbook and two traditionally designed textbooks on concept formation in university students. In J. M. Johnston and G. W. O'Neill (Eds.), Research and technology in college and university teaching. Springfield, Illinois: Charles C. Thomas, 1975.

Miller, L. K. and Weaver, F. H. The use of "concept programming" to teach behavioral concepts to university students. In J. M. Johnston (Ed.), Behavior research and technology in higher education. Springfield, Illinois: Charles C. Thomas, 1975.

Miller, L. K., Weaver, F. H., and Semb, G. A procedure for maintaining student progress in a personalized university course. Journal of Applied Behavior, 1974, 7, 87-91.

Minkin, B. L., Minkin, N., Sheldon, J., Hursh, D. E., Sherman, J. A., Wolf, M. N. and Dixsen, D. L. An analysis of student preference and performance on written and oral quizzes. In J. M. Johnston (Ed.), Research and technology in college and university teaching. Gainesville: Society for Behavioral Technology and Engineering, University of Florida, 1975.

Morgan, R. F. and Toy, T. B. Learning by teaching: A student-to-student compensatory tutoring program in a rural school system and its relevance to the educational cooperative. The Psychological Record, 1970, 20, 159-169.

National Academy of Education. Improving educational achievement. Washington, D.C.: Author, 1978.

National Association for Public School Adult Education. Adult basic education: A guide for teachers and teacher trainers. Washington, D.C.: Author, 1967.

National Center for Educational Statistics. Participation in adult education (Final Report). Washington, D.C.: U.S. Government Printing Office, 1975.

Naumes, M. The Keller plan: A method for putting the responsibility of learning upon the student. Cincinnati: University of Ohio, Institute for Research and Training in Higher Education, 1976. (ERIC Document Reproduction Service No. ED 138 545)

Neimark, E. Intellectual development during adolescence. In F. Horwitz (Ed.), Review of child development research, Volume 4. Chicago: University of Chicago Press, 1975.

Nelson, T. F. and Bennett, M. E. Unit size and progress rates in self-paced instruction. Journal of College Science Teaching, 1973, 3, 130-133.

Neves, L. P. The preferences for students for particular monitors in a PSI course. Programmed Learning and Educational Technology, 1976, 13, 54-58. (ERIC Document Reproduction Service No. EJ 136 528)

- Nitko, A. J. Measurement of instructional outcome vs. measurement for instruction: A view of IPI testing procedures. Philadelphia: Research for Better Schools, September 1968.
- Nitko, A. J. Criterion-referenced testing in the context of instruction. Paper presented at the Educational Records Bureau-National Council on Measurement in Education Symposium, "Criterion-Referenced Measures: Pros and Cons," New York, October 1970.
- Noreen, D. S. Some implications of a concept of growth motivation for adult education theory and practice. Bloomington, Indiana: University of Indiana, 1966. (ERIC Document Reproduction Service No. ED 019 543)
- O'Neill, G. W., Johnston, J. M., Walters, W. M., and Rasheed, J. A. The effects of quantity of assigned material on college student academic performance and study behavior. In J. M. Johnston (Ed.), Behavior research and technology in higher education. Springfield, Illinois: Charles C. Thomas, 1975.
- Opdahl, C. A. A procedure to establish self-pacing behaviors in academically deficient first year students. Paper presented at the annual meeting of the Midwestern Association for Behavior Analysis, Chicago, Illinois, May 1976. (ERIC Document Reproduction Service No. ED 136 157)
- Osterman, D. N. Selection and evaluation of alternative teaching methods in higher education. Paper presented at the annual meeting of the Association for Educational Communications and Technology, Miami Beach, Florida, April 1977. (ERIC Document Reproduction Service No. ED 144 587)
- Pacing yourself through college. Mosaic, 1975, 6, 24-30. (ERIC Document Reproduction Service No. EJ 116 574)
- Pascarella, E. T. Student motivation as a differential predictor of course outcomes in personalized system of instruction and conventional instructional methods. Journal of Educational Research, 1977, 71, 21-26. (ERIC Document Reproduction Service No. EJ 172 710)
- Pascarella, E. T. Interactive effects of prior mathematics preparation and level of support in college calculus. American Educational Research Journal, 1978, 15, 275-85.
- Pask, G. and Scott, B. C. E. Learning Strategies and Individual Competence. Institute of Man-Machine Studies, 1972, 4, p. 217.
- Peters, R. D. Pre-quiz monitoring of study materials improves performance in two PSI courses. In J. M. Johnston and G. W. O'Neill. Research and technology in college and university teaching. Gainesville: University of Florida, Society for Behavioral Technology and Engineering, Psychology Department, 1973.
- Phillips, T. W. and Semb, G. Quizzes, lecture attendance, and remediation procedures in a contingency-managed university course. In L. E. Fraley and E. A. Vargas (Eds.), Behavior research and technology in higher education. Gainesville: University of Florida, Society for Behavioral Technology and Engineering, Psychology Department, 1976.

- Piaget, J. The origins of intelligence in children. New York: W. W. Norton and Company, Inc., 1952.
- Powers, R. B., Edwards, K. A. and Hoehle, W. F. Bonus points in a self-paced course facilitates exam taking. The Psychological Record, 1973, 23, 533-538.
- Putt, G. D. Testing the-mastery concept of self-paced learning in physics. American Journal of Physics, 1977, 45, 472-475.
- Reiser, R. A. and Sullivan, H. J. Effects of self-pacing and instructor-pacing in a PSI course. Journal of Educational Research, 1977, 71, 11.
- Rhode Island State Department of Education. Rhode Island state plan for adult basic education. Providence, Rhode Island: Bureau of Grants and Regulations, 1973. (ERIC Document Reproduction Service No. ED 084 400)
- Riedel, R. C. and others. Unit test scores in PSI versus traditional classes in beginning psychology. Teaching of Psychology, 1976, 3, 76-78. (ERIC Document Reproduction Service No. EJ 138 650)
- Riedel, R., Harney, B., LaFief, W., and Finch, M. The effect of time as a contingency on student performance in an individualized course. In B. A. Green (Ed.), Personalized instruction in higher education: Proceedings of the second national conference. Washington, D.C.: Center for Personalized Instruction, 1976.
- Roberson, J. A. and Crowe, C. T. PSI + tel = New horizons in contingency education. Paper presented at the annual conference of the American Society for Engineering Education, Colorado State University, Ft. Collins, June 16-19, 1975. (ERIC Document Reproduction Service No. ED 124 398)
- Robin, A. L. Nonspecifics in personalized instruction. Teaching of Psychology, 1975, 2, 3-7.
- Robinson, P. Contingent systems of instruction. Paper presented at the Rocky Mountain Psychological Association Convention, New Mexico, May 1972. (ERIC Document Reproduction Service No. ED 069 704)
- Rogers, C. R. Freedom to learn. Columbus, Ohio: Charles Merrill Publishing Co., 1969.
- Roper, D. L. PSI quantum mechanics with optional lectures on video-tape cassettes. American Journal of Physics, 1977, 45, 476-484. (ERIC Document Reproduction Service No. EJ 161 007)
- Rotter, J. B. Generalized expectancies for internal versus external control of reinforcement. Psychological Monographs, 1966, 80, (1, Whole No. 609).
- Rushton, J. B. Business statistics 1--An audio-tutorial venture: Course organization, sample study guide, and grade contract. Paper presented at the annual meeting of the Audio-Tutorial Congress, San Francisco, California, November 1974. (ERIC Document Reproduction Service No. ED 098 998)

- Ruskin, R. S. and Ruskin, R. L. Personalized instruction and its relation to other instructional systems. Educational Technology, 1977, 17, 5-11.
- Ryan, T. A. (Ed.) Adult education in correctional settings: A book of readings. Honolulu: University of Hawaii Education Research and Development Center, 1973. (ERIC Document Reproduction Service No. ED 147 579)
- Saba, R. G. The effectiveness of human relations training for proctors in a mastery based educational psychology course. Paper presented at the annual meeting of the American Personnel and Guidance Association, New York, New York, March, 1975. (ERIC Document Reproduction Service No. ED 110 893)
- Schimpfhauser, F. and Richardson, K. Medical education and personalized instruction. Educational Technology, 1977, 17, 31-36.
- Scott, K. R. and Tobias, J. W. A learning hierarchy for a course in drug analysis. American Journal of Pharmaceutical Education, 1975, 40, 128-134. (ERIC Document Reproduction Service No. EJ 146 791)
- Seguin, B. R. Piagetian cognitive levels of adult basic education students related to teaching methods and materials. Paper presented at the Adult Education Research Conference, Ann Arbor, Michigan, April 1979. (ERIC Document Reproduction Service No. ED 167 829)
- Semb, G. Personalized instruction: The effects of grading criteria and assignment length on college student test performance. Journal of Applied Behavior Analysis, 1974, 7, 61-69.
- Semb, G., Conyers, D., Spencer, R., and Sanchez-Sosa, J. J. An experimental comparison of four pacing contingencies. In J. M. Johnston (Ed.), Behavior research and technology in higher education. Springfield, Illinois: Charles C. Thomas, 1975.
- Semb, G., Hopkins, B. L. and Hursh, D. E. The effects of study questions and grades on student test performance in a college class. Journal of Applied Behavior Analysis, 1973, 6, 631-643.
- Semb, G. and McKnight, P. C. Future trends in PSI research. Educational Technology, 1977, 17, 50-55.
- Semb, G., Spencer, R. E., and Phillips, T. W. The use of review units in a personalized university course. In B. A. Green (Ed.), Personalized instruction in higher education: Proceedings of the second national conference. Washington, D.C.: Center for Personalized Instruction, 1976.
- Shepherd, M. M. An automated record-keeping system for use in Keller-type courses. Journal of Educational Technology Systems, 1977, 5, 131-137. (ERIC Document Reproduction Service No. EJ 153 946)
- Sheppard, W. C. and MacDermot, H. G. Design and evaluation of a programmed course in introductory psychology. Journal of Applied Behavior Analysis, 1970, 3, 5-11.

- Sherman, J. G. PSI, a historical perspective. Paper presented at the annual meeting of the Rocky Mountain Psychological Association, New Mexico, May 1970.
- Sherman, J. G. Some permutations on an innovation. Paper presented at the annual convention of the American Psychological Association, Washington, D.C., September 1971.
- Sherman, J. G. PSI: Some notable failures. In J. L. Sayre and J. J. Knightly (Eds.), The personalized system of instruction in higher education. Oklahoma: Seminary Press, 1972.
- Sherman, J. G. PSI: An historical perspective. In J. G. Sherman (Ed.), PSI: 41 Germinal Papers. Menlo Park, California, W. A. Benjamin, 1974.
- Sherman, J. G. Individualizing instruction is not enough. Educational Technology, 1977, 17, 56-60.
- Sides, E. Testing in a personalized system of instruction. Paper presented at the meeting of the Rocky Mountain Psychological Association, Albuquerque, New Mexico, May 10-12, 1972.
- Siegfried, J. J. Is teaching the best way to learn? Paper presented to the American Economic Association, Atlantic City, New Jersey, September 1976.
- Silberman, R. The Keller plan: A personal view. Journal of Chemical Education, 1978, 55, 97-98.
- Sittón, C. Childcare dream turns political nightmare. The News and Observer, December 2, 1979, page 4.
- Sloos, I. and others. Correspondence education in the Netherlands. Leiden, Netherlands: Leidsche Onderwijsinstellingen, 1961. (ERIC Document Reproduction Service No. ED 015 389)
- Small, H. C. Effectiveness of reinforcement schedule in relation to certain adult characteristics using computer assisted instruction. Raleigh, North Carolina: North Carolina State University, Department of Adult Education, (Research monograph No. 3), 1970. (ERIC Document Reproduction Service No. ED 095 307)
- Smith, R. M., Aker, G. F., and Kidd, J. R. (Eds.) Handbook of adult education. New York: MacMillan Publishing Co., Inc., 1970.
- Snow, R. E. Individual differences and instructional theory. Educational Researcher, 1977, 6, 11-15.
- Speeth and Margulies. Techniques for maintaining student motivation. N.S.P.I. Journal, 1969, 7, 24-27.
- Spring-Hall, R. C. and Spring-Hall, N. A. (Eds.) Educational Psychology: A developmental approach. Menlo Park, California: Addison-Wesley, 1974.

- Srinivasan, L. Perspectives on nonformal adult learning. Functional education for individual, community, and national development. New York: World Education, Inc., 1977.
- State University of Nebraska (SUN) program. In J. D. Eggert, An examination of goals of potential and actual learners: University of mid-America/State University of Nebraska (Working Paper No. 1). Lincoln: University of Mid-America/State University of Nebraska, Office of Research and Evaluation, 1974.
- Stice, J. E. Expansion of Keller plan instruction in engineering and selected other disciplines: A final report. Austin, Texas: University of Texas, 1975. (ERIC Document Reproduction Service No. ED 122 723)
- Surber, C. F. and others. Self-pacing versus pacing requirements: Criterion measures, student evaluations, and retention. Paper presented at the annual meeting of the American Psychological Association, Washington, D.C., September 1977. (ERIC Document Reproduction Service No. ED 137 149)
- Sutterer, J. R. and Halloway, R. E. An analysis of student behavior with and without limiting contingencies. In J. M. Johnston (Ed.), Behavior research and technology in higher education. Springfield, Illinois: Charles C. Thomas, 1975.
- Swanson, D. H. and Denton, J. J. A comparison of remediation systems affecting achievement and retention in learning. New York: Rochester Institute of Technology, 1976. (ERIC Document Reproduction Service No. ED 131 037)
- Swenson, L. C. The effects of reinforcing self-charting of course progress on course work productivity in college courses. Paper presented at the annual Convention of the Western Psychological Association, San Francisco, California, April 1974.
- Terman, M. Personalizing the large enrollment course. Teaching of Psychology, 1978, 5, 72-75. (ERIC Document Reproduction Service No. EJ 178 566)
- Thomas, L. F. and Harri-Augstein, S. E. Learning to learn: The personal construction and exchange of meaning. In M.S.A. Howe (Ed.), Adult learning psychological research and applications. New York: John Wiley and Sons, 1977.
- Tietenberg, T. H. Teaching intermediate microeconomics using the personalized system of instruction: An evaluation. Williamstown, Massachusetts: Williams College, 1973. (ERIC Document Reproduction Service No. ED 089 570)
- Tietenberg, T. H. Is teaching the best way to learn? Paper presented at the National Convention of Allied Social Science Associations, Atlantic City, New Jersey, September 1976. (ERIC Document Reproduction Service No. ED 130 952)
- Tobias, S. Overcoming math anxiety. New York: Norton Publishers, 1978.

- Tough, A. The adult's learning projects. Toronto: Ontario Institute for Studies in Education, 1971.
- U.S. Bureau of the Census, Current Population Reports. Educational attainment in the United States (Series P-20, No. 314). Washington, D.C.: U.S. Government Printing Office, 1977.
- U.S. Department of Justice. Prisoners in State and Federal institutions. (National Prisoner Statistics Bulletin SD-NPS-PSF-5). Washington, D.C.: U.S. Government Printing Office, 1979.
- Van Nostrand, A. D. A new direction in teaching writing. Educational Technology, 1977, 17, 27-30.
- Verduin, J. R., Miller, H. G., and Greer, C. E. Adults teaching adults. Austin, Texas: Learning Concepts, 1977.
- Vournakis, J. N. A noncompetitive introductory organic chemistry course for premedical students. Journal of Chemical Education, 1974, 51, 742-744. (ERIC Document Reproduction Service No. EJ 113 155)
- Wagner, G. R. and others. Managing motivation in personalized instruction. Engineering Education, 1974, 64, 423-426. (ERIC Document Reproduction Service No. EJ 098 398)
- Wagner, G. R. and Motazed, B. H. The proctorial system of instruction combined with computer pedagogy for teaching statistics. Bureau of Engineering Teaching--Bulletin No. 4. Austin: University of Texas, 1971, pp. 43-50.
- Werner, T. J. and Bono, S. F. The applications of PSI to a second grade classroom, or, the Lone Ranger rides again. Educational Technology, 1977, 17, 20-25.
- Werner, T. J. and Bono, S. F. Workshop on PSI in higher education. West Virginia: West Virginia University, 1977.
- White, R. W. Motivation reconsidered: The concept of competency. Psychological Review, 1959, 66:297-333.
- Whitehurst, C. and Madigan, J. Slow learners in PSI courses. Do they learn less? Journal of Higher Education, 1975, 46, 55-62. (ERIC Document Reproduction Service No. EJ 112 785)
- Whitehurst, C. and Whitehurst, G. J. Forced excellence versus free choice of grades in undergraduate instruction. In J. M. Johnston (Ed.), Behavior research and technology in higher education. Springfield, Illinois: Charles C. Thomas, 1975.
- Williams, R. L. Personalized system of instruction: Where it has been and where it needs to go. Unpublished manuscript, 1976.
- Williamson, D. A., Sewell, W. K., and McCoy, J. F. Various combinations of traditional instruction and personalized instruction. Journal of Experimental Education, 1976, 45, 19-22.

Williamson, D. A. and William R. S. Various combinations of traditional instruction and personalized instruction. Journal of Experimental Education, 1976, 45, 19-22.

Wortman, C. B. and Hillis, J. M. Undergraduate taught "mini courses" in conjunction with an introductory lecture course. Teaching of Psychology, 1976, 3, 69-72. (ERIC Document Reproduction Service No. EJ 138-648)

Zeilik, M. A PSI astronomy course. American Journal of Physics, 1974, 42, 1095-1100. (ERIC Document Reproduction Service No. EJ 113 212)