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ABSTRACT

A Personalized System of Instruction (PSI) program for nontraditional adult learners was developed, implemented, and evaluated. The study objective was to determine if further investigation of use of PSI was worthwhile. From a review of literature and practice of PSI and adult learning, conclusions were drawn regarding major factors to consider when developing and implementing a PSI program for nontraditional adult learners. Suggestions were related to five basic elements of PSI: materials, mastery requirement, self-pacing, peer proctors, and motivational lectures. Two large subpopulations of nontraditonal adult learners were identified as needing the educational assistance PSI offers--persons needing adult basic education and adults in correctional institutions. Three adult basic education classes of a public continuing education institution were selected for implementation of a PSI program; two other classes served as comparison groups. Twenty-five PSI students mastered 48 language and 69 mathematics units. They showed average gains of almost one grade level in reading comprehension and more than one grade level in arithmetic computation and problem solving. No gains were indicated for comparison students. Areas for research were identified for the five elements of PSI. (YLB)

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FINAL REPORT

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

Volume I

Executive Summary

by

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Prepared for

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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.

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Executive Summary

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

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 on 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 PSI program for nontraditional adult learners.[1] The methodology and findings of this research are described in three volumes: this volume, Volume I, is an executive summary; 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 steps in the research were to: (1) review the literature and practice of PSI with particular attention to implications for the use of PSI with nontraditional adult learners; (2) review literature on adult learning with emphasis on describing student characteristics and on identifying populations likely to allow a fruitful adaptation of PSI; (3) draw some conclusions regarding major factors that should be considered when developing and implementing a PSI program for nontraditional adult learners; (4) develop a PSI program for teaching reading comprehension and mathematics to adult students; (5) implement and evaluate this program with three groups of students; and (6) use the collected information to address the research objectives listed above.

A. Suggestions Based on the Review of Literature and Current Practices

The review of literature and practice of PSI and the review of literature on adult learning led to several suggestions regarding the suitability of PSI for teaching nontraditional adult learners, and for developing and implementing such a program. Following is a summary of the more critical of these.

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[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.

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. The packaged nature of PSI materials would appear particularly supportive of the instructional needs of nontraditional adult learners who typically have varying achievement and capability levels, and needs for alternative study schedules. The packaged, often self-instructional, materials also would appear particularly appropriate where teacher availability or capability is a problem. Reported research with off-campus students and testing by telephone indicates that the traditional college setting is not essential to the success of PSI.

The high, often prohibitive, cost of preparing PSI materials 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 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.

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.

2. Mastery Requirement of PSI

Many nontraditional adult learners suffer from being deprived of success and from lack of self-confidence, and they have a fear of failure. PSI appears to hold particular promise for such students. The literature identified improvement in self-confidence as a major outcome of the mastery requirement of PSI. One of the goals of mastery learning was summarized 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."

The research literature added a note of caution that would appear particularly applicable to nontraditional adult learners. The large number of PSI unit tests and the requirement for mastery of those tests were identified as being potentially disconcerting to students at the outset of a PSI course. The sudden disruption of student expectations, by introducing unfamiliar and potentially threatening regulations, was suggested as one cause of procrastination, heavy withdrawals, and other problems frequently encountered in PSI.

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 "post-tests." 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.

3. Self-Pacing in PSI

The self-pacing feature of PSI would appear to permit students to move through a course at speeds commensurate with their abilities and other demands upon their time. Since nontraditional 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. Such a program would permit a student to begin at his/her appropriate level and progress as far as his/her time, motivation, and ability permitted.

While both the PSI and adult learning literature appear 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 students' resistance to such use of adult authority through 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. Peer-Proctors in PSI

The appropriate use of peer proctors would appear to be one of the most promising contributions to success in a PSI program for nontraditional adult learners. The adult learner typically needs: (a) nonthreatening assistance in determining needs; (b) assistance in ascertaining present level of accomplishment (and, thus, the immediate learning needs); (c) motivation to learn; (d) assistance with learning materials; (e) a sense of belonging or fitting into the learning environment; (f) learning alternatives not inhibited by resentment of authority or unpleasant memories of past schooling; and (g) social interactions. The use of peer proctors appears promising as one method of helping to address these needs.

5. Motivational Lectures in PSI

Since the "motivational lecture" typically has 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 needed social interactions, rewards for accomplishments, or opportunities to meet other needs not typically addressed by the more formal aspects of a PSI program.

6. PSI Systems

Suggestions offered in the literature for developing and implementing instructional programs for nontraditional adult learners were summarized as follows:

- 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.

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

7. Description of Two Selected Subpopulations

Two large subpopulations of nontraditional adult learners were identified as particularly in need of educational assistance of the type that might be offered by PSI. Following is a brief description of these groups.

Persons in need of adult basic education constitute a vast subpopulation. 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. Statistical breakdowns of this group by sex, race, and Spanish origin 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, for example, 10 percent of all eleventh graders failed to pass a seventh grade reading test; 15 percent failed a math test on a similar level. Perhaps 40 percent of the nation's high school graduates read below the eighth grade level. 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.

Adults in correctional institutions represent another major subpopulation having significant and largely unmet learning needs. The nation's jails, workhouses, penitentiaries and reformatories admit, control, and release an estimated 3 million individuals each year. On any day during the year, approximately 1.3 million individuals are under correctional authority. 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 estimated the average educational achievement of offenders at the fifth to sixth grade level: 40 percent of the offenders are without previous work experience. The magnitude of the responsibility of corrections was implied by the 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.

B. Program Development

Three adult basic education (ABE) classes of a public continuing education institution (hereinafter referred to as the cooperating institution) were selected for implementation of a PSI program. The selected classes were an on-campus day class, a day-class held in the laundry room of a housing project, and a prison site. Two additional classes, an on-campus night class and a day community center class, were selected for use as comparison groups. Each of these classes supposedly had an average enrollment of 10-15 students who met twice each week for two-to-three hour sessions. The students were stated to be over the age of 18 and to function at between the fourth and eighth grade level in reading, mathematics, and oral and written communication. The students were predominantly black and approximately 90 percent were females (except in the prison setting where all students were males).

The following sequence of activities was planned for the program.

- Provide training to the classroom managers (the teachers assigned to the PSI classes were intended to serve as classroom managers).
- Provide instruction to proctors.
- Administer placement/assessment instruments.
- Provide students with an introduction to PSI.
- Provide instruction in reading comprehension and mathematics.
- Provide for student demonstration of mastery of each unit of instruction.
- Provide motivational activities.
- Administer end-of-treatment assessment instruments.

The following products were selected or developed for use in the program.

Classroom manager instruction. No formal classroom instructions were prepared since a formal training session was planned. However, an outline of some of the major points to be covered in the training, particularly points the classroom manager might need to review later, was developed.

Proctor instructions. Since the use of internal proctors was planned (i.e., any student who had demonstrated mastery of a particular unit of instruction would be eligible to serve as proctor for that unit), no formal training was anticipated. A booklet was prepared that outlined for the proctors their responsibilities and how they should fulfill them. A copy of this booklet was intended to be made available for review by any student who was qualified to be a proctor.

Placement/assessment instruments. The Adult Basic Learning Examination (ABLE)[2] was selected to determine if students had the knowledge necessary for entry into the PSI program and to provide a measure of achievement gains resulting from participation in the program. To minimize administration time, only the reading, computation, and problem-solving tests were used. One of the alternate forms of the Level II battery (for grades 5-8) was used for a pre-treatment test. The Tennessee Self-Concept

[2] Harcourt, Brace, Jovanovich, Inc.

Scale[3] was selected for pre-treatment and post-treatment assessment of student self-concept. A new answer sheet was prepared because of the extreme difficulty of following the order of items on the provided answer sheets.

Student introduction to PSI. A self-instructional unit was prepared to introduce the students to PSI. The general format of the unit was identical to the format used for the language and mathematics materials.

Instructional materials. Thirty units of reading comprehension instruction were prepared. Twenty-five of these units were based on the Steck-Vaughn Adult Reading Program[4] 2100-2800 series (for grades 4-8). These materials were extensively modified, primarily by repackaging the materials as individual units and by providing instructions as to how to proceed through the materials. Five of the lessons were based on selected portions of Scott, Foresman's adult reading comprehension series.[5] Twenty-five units from Level D of the Individualized Mathematics Program[6] were selected for instruction in mathematics. The Level D was selected primarily because it is more suitable for adults than are the other levels.

Mastery demonstration instruments. At least two mastery demonstration instruments were provided for each unit of instruction. One instrument was included in the instructional package as a practice mastery demonstration to permit the student to check his/her mastery level before attempting the formal mastery demonstration. Instruments for the reading units were adaptations of the publishers' tests and newly-developed tests. The mathematics tests (three forms) were used as provided by the publishers.

Motivational activities. Several motivational films[7] were selected for presentation. These were intended to be followed by discussions led by the classroom manager.

End of treatment assessment instruments. The alternate form of the Level II ABLE reading, computation, and problem solving tests; and the Tennessee Self-Concept Scale were used as end-of-treatment assessment instruments.

As was noted previously, 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

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[3] Counselor Recordings and Tests, Box 6184, Acklen Station, Nashville, Tennessee 37212.

[4] Steck-Vaughn Company Publishers, P.O. Box 2028, Austin, Texas 78768.

[5] Scott, Foresman Lifelong Learning Division, 1900 East Lake Avenue, Glenview, Illinois 60025.

[6] EdITS Publishers, P.O. Box 7234, San Diego, California 92107.

[7] "Climb" (22 minutes, color), Churchill Films, 662 North Robertson Blvd., Los Angeles, California 90069, and "It Couldn't Be Done" (53 minutes, color), Films, Inc., 1144 Wilmette, Illinois 60091.

potentially fruitful areas for further investigation. To address these objectives, a case study approach was planned. While some comparison data were to be collected, the primary emphasis was intended to be upon collection of observational data at the three implementation sites.

No rigid rules were established for the collection of on-site observational information. Instead the intent was to prepare a list of critical events based on observation (rather than tailor the observation to fit a predetermined list of anticipated events). This orienting framework for observational data collection was, in general, based upon the following:

Student reactions to:	Proctor reactions to:	Teacher reactions to:
other students	students	students
proctors	other proctors	proctors
teacher	the instructional system	the instructional system
the instructional system	the instructional materials	the instructional materials
the instructional materials		

Several forms were provided to the classroom managers for recording student activity and opinion information, and for noting significant classroom observations: (1) a form to record each student's activities, (2) charts to record the names of students who qualified as proctors for different units, (3) a form for the classroom managers' use in recording students' opinions about each lesson and the assistance they received with it, and (4) a loose-leaf notebook for the classroom manager to record general observations and comments.

Classroom observations were intended to be made primarily by the classroom manager. However, the researchers also visited each of the PSI classes at least once a week. The resultant observational data were intended to be summarized by site, and factors pertinent to the research questions highlighted. Because of the largely unstructured nature of the observational data collection activity and the uncertainty as to the exact nature of the information to be collected, no specific plans for analysis or reporting were made.

Plans were made to collect specific objective data that were considered to be measures of class and individual student progress. However, because of the very small number of classes and students, no generalization of findings was intended. Four specific types of objective data were to be collected: number of units mastered; pre- and post-treatment self-concept measures; pre- and post-treatment achievement measures; and attendance records.

C. Program Implementation and Results

Just prior to the beginning of the PSI program implementation, certain internal difficulties at the cooperating institution (including the loss of a considerable amount of its anticipated funding) resulted not only in the discharge of the cooperating institution's entire ABE administrative staff, but also minimized other expected support services. Teacher assignments were delayed; until several days prior to the first class sessions, there was considerable doubt as to whether the ABE programs would operate at all.

Because of this delay, teacher training was limited to one thirty-minute session with one teacher.

The assigned teacher of one of the PSI classes became ill the day prior to the beginning of classes and was replaced by a teacher who was new to the cooperating institution and who had no teaching experience with ABE students. The teacher responsible for the prison setting planned for inclusion as one of the three PSI classes was disturbed at the idea of introducing PSI into the prison class; and was adamant in his insistence that a structured approach would be untenable. The researchers had no alternative but to drop the prison class and select an alternate setting. Another of the cooperating institution's housing project classes, this one a night class meeting in a recreation room, was selected as the replacement.

Actual enrollment in the ABE classes was considerably lower than expected. Also, the entry performance level of the students was considerably lower than expected, with 36 percent of the students scoring below the fourth grade level in reading comprehension, 44 percent scoring below the fourth grade level in mathematics computation, and 83 percent scoring below the fourth grade level in mathematics problem solving.

The on-campus day class met from 9:00 to 11:00 a.m. two days a week. Classes were held in a regular classroom in one of the main campus buildings. The summer quarter began on July 10, 1980 and ended on September 25 (a total of 22 class sessions). The teacher, a young black male, had an undergraduate degree in business administration. He had had no previous teaching training or teaching experience.

The teacher showed considerable enthusiasm for the PSI program. He was particularly pleased that a structured program was available that would permit him to begin immediately with his classroom responsibilities. Since he was not familiar with teaching ABE students, the already-planned PSI program relieved him of the responsibility for selecting materials, determining an instructional approach, etc. This was particularly important to him since he was not being paid for extra time to plan a program.

Initial student enrollment in this class was eight. An additional seven students enrolled at other times during the quarter. The students were predominantly black (14 of the 15) and predominantly female (13 of the 15). On the Tennessee Self-Concept Scale, five of the eight tested students scored below the fiftieth percentile and three scored above. Of the eight initial students who took the ABLE tests, two scored below the fourth grade level in reading comprehension, three below the fourth grade level in arithmetic computation, and six below the fourth grade level in arithmetic problem solving. Based on these scores, six of the students began immediately on the PSI program. The two students who scored at below the third grade level in reading comprehension were provided with remedial instruction and intensive tutoring by the teacher until he considered their reading level to be sufficiently high to enter the program. As the quarter progressed, seven new students enrolled. Two of these were pretested and entered into the PSI program. The other five, because of their short period of enrollment and limited attendance, were not pretested and were not entered into the PSI program.

During the first quarter, the students appeared to be exceptionally enthusiastic and made considerable progress in completing the instructional units. The peer proctor system worked well; the students seemed to like the idea of students helping students. Competition was keen between several of the students to complete lessons so they could be the first to serve as proctor for that lesson. Many of the students obviously were doing a considerable amount of studying outside of class. Several students completed a module (five math units or six language units) and were presented with completion certificates, which proved to be excellent motivators. The teacher was able to spend virtually full-time tutoring the few slow students. He initially prepared reasonably detailed notes of his classroom observations, and his enthusiasm was obvious. He emphasized that students were becoming more open, more willing to ask for and give assistance, and more anxious to fully utilize all of the class time. His primary negative comment was that some students appeared to have more difficulty with the reading comprehension than their ABLE test scores would have indicated. Also, he commented that several students had difficulty mastering the initial language or mathematics unit. These students apparently had not grasped the concept of mastery; that is, they had not accepted the idea that they really had to know the materials in one unit before they would be permitted to move on to the next unit. Once a student had mastered the first unit, however, this problem largely ceased to exist for that student.

These optimistic results began to moderate during the last weeks of the quarter. Several entries in the teacher's notes are indicative of the change. One entry noted that the teacher used the class session to "review materials already covered in PSI lessons." Another entry notes that "students are classroom oriented, and tend to lean more to the instructor-student relationships vs. proctor-student." Often, when the researchers visited the class, the students were not involved in individual activities but were passively observing a teacher lecture-demonstration. When the teacher was questioned about such activities, he attempted to assure the researchers that such incidents were exceptions to the rule, and that the PSI program was being implemented as planned most of the time.

Enrollment in the class for the second quarter (October 2 through December 18) was 18. One-half of these were students continuing from the first quarter. Only two of the nine new students' reading levels were found to be sufficiently high to permit entry into the PSI program.

As the second quarter progressed, the class more and more became a conventional classroom. On November 24, the teacher gave up all pretense of conducting a PSI class by stating that he was discontinuing the use of the PSI materials except for providing them as required for students to use outside of class. The teacher also documented this in a letter to the coordinator of the ABE program. He gave two basic reasons for the change. First, he stated that the PSI materials were too difficult for the students and that the materials could be mastered only after "regular classroom instruction, by way of blackboard use, and visual aids." The second, somewhat contradictory, reason was that many of the students had learned so much that they should be taught the pre-GED test so that they could be transferred to the GED program. (The GED program apparently is funded separately from the ABE program with the cooperating institution receiving more funding for GED students.)

By this time only six class sessions remained in the quarter, and plans already had been made for three of these sessions (one session for another motivational film, and two sessions for posttesting). Therefore, no action was taken by the researchers other than expressing their concern, to both the teacher and the ABE coordinator, regarding the seeming lack of consistency in the reasons for the change and the apparent breaking of a commitment to the researchers.

The class held in the laundry room of a housing project met from 10:00 to 12:00 a.m. twice a week. The teacher, a black female, worked full time as a social worker and had earned a master's degree in sociology. She also had taught ABE part time for several years. The initial enrollment was four middle-aged black females. Three additional black females enrolled during the first month. Of the four pretested students, three were reading at above the fourth grade level; one was reading at below the third grade level. The self-concept scale scores showed one of the three tested students to have a relatively high self-concept and two to have quite low self-concepts.

As with the students in the on-campus class, these students made reasonable progress with the instructional materials. The students seemed initially to be quite docile. The teacher referred to them as her "babies" and treated them accordingly. However, the peer proctor system worked exceptionally well, particularly considering the small size of the class. The students established firm friendships with other class members and frequently studied together in each other's homes between classes. They also frequently telephoned each other for assistance.

The teacher resigned at the end of the first quarter and was replaced by a young black male attorney. He had had no previous ABE teaching experience but indicated his belief in the value of such programs. He proved to be a competent and dedicated teacher, and the students seemed to prosper in the absence of the former mothering environment. They became visibly more assertive and several of them began a strong but friendly competition to see who could make the most progress. One negative aspect of this assertiveness and competitiveness was that students began to attempt to demonstrate mastery without first thoroughly studying the related unit. Records for the second quarter showed 14 instances of students attempting to demonstrate mastery from 2 to 5 times before succeeding.

The class held in a housing project recreation room met from 6:00 p.m. to 8:00 p.m. twice weekly. This class was chosen for PSI implementation as a replacement for the originally-planned prison site. The teacher, a black female, had a teaching certificate and worked full-time in the Headstart program as a teacher. Her primary area of training and interest was in teaching grades K-3. She also had had several years' experience as a part-time ABE teacher.

The room in which the class met appeared no longer to be used as a recreation room. The building was in a poor state of repair. Most of the ceiling had collapsed as a result of a leaky roof, many of the windows were boarded up, the lighting was poor, and there was no heat. The six initially-enrolled students were young black adults (in their late teens or early twenties). Two additional students enrolled during the first quarter. Pretest scores for the four students who were tested indicated performance in language and mathematics

at about the fifth grade level. The Tennessee Self-Concept Scale scores for three of the students were above the fiftieth percentile; one score was below the fiftieth percentile.

The students had no particular difficulty with the PSI materials; also, the peer proctor system appeared to function well. Unfortunately, however, the students did very little studying. Students typically were late for class and often left early. The students spent very little time on tasks, but instead talked about social matters, took naps, or simply sat and did nothing. Two students appeared to have slept through the motivational film shown by the researchers. The teacher was pessimistic and discouraged, and frequently told the students that she was going to quit if they did not show more interest. Her comments to the researchers were that this was typical of the class behavior for the year that she had been teaching there.

Four weeks into the second quarter, the administrative staff at the cooperating institution informed the teacher that since all but one of her students were also attending high school, they no longer could be enrolled in the ABE program. The class was abruptly cancelled and the teacher was given two weeks to either recruit a new class or be discharged. The teacher immediately recruited 15 new students (according to the enrollment/attendance records) and continued with the new class. Two weeks before the expected end of the second quarter, the teacher was told by the administration to discontinue classes immediately since she already had "used all of her contact hours." No posttest data were collected due to this early termination of the class. Also, due to unusually poor attendance on the part of the new students, practically no additional work was done on PSI lessons.

One of the comparison classes was an on-campus night class of nine students (ten students for the second quarter). The students were black, ages 18 to 76 and, unlike the other classes, about 75 percent were males. Students functioned at from below the third grade level to the eighth grade level. The teacher was a black female who had had four years' experience as a high school teacher. The instructional approach could be described as traditional, with the teacher attempting to address the needs of the average student and hoping the above-average and below-average students also would profit. Much of the class time was spent in teacher explanation and blackboard work. To the extent practical, individual work was provided to students and limited time spent with each student to assist him/her with particular problems or concerns.

The other comparison class was a housing project class with an enrollment during the first quarter of four students. Only two of these students attended class more than six times. Classes met from 12:30 to 2:30 p.m. twice weekly. The teacher for the first quarter was the same teacher responsible for the housing project laundry room PSI class. However, in this class, she used a conventional classroom approach except that she was able to provide more individual attention because of the very limited enrollment. At the beginning of the second quarter, another community class with equally low enrollment was combined with this class. The new class had an enrollment of eight. The new teacher, a black female, had an undergraduate degree in political science. This was her first teaching experience, and she used the same conventional teaching approach as noted for the first quarter.

The PSI program results, as reflected by data such as number of instructional units completed, pretest and posttest scores on the ABLE and on the Tennessee Self-Concept Scale, and student attendance, were as follows:

Twenty-five PSI students mastered a total of 48 language units and 69 mathematics units. Five of these students completed all or most of the language units on word meaning analysis skills, and six students completed the mathematics unit on computation skills. Five students also completed at least one mathematics unit on fractions. With about ten percent of the mastered units, students indicated that they had received help from a proctor in studying the unit. With about six percent of the mastered units, students indicated that they had received help from persons outside of the class. These percentages do not reflect the full extent of the proctoring activities, however, since much of this effort was directed toward assisting students who were not yet studying the PSI materials.

The ABLE tests in reading comprehension, arithmetic computation, and arithmetic problem solving were administered to 36 students near the beginning of their enrollment. The alternate forms of the same tests were administered to 21 students near the end of the PSI implementation period. However, because of dropouts and poor attendance, only 15 students were both pretested and posttested (10 PSI students and 5 students from the comparison groups). While no particular gains were indicated for the comparison students, the PSI students showed average gains of almost one grade level in reading comprehension and more than one grade level in both arithmetic computation and arithmetic problem solving. Several limitations of these data, other than such obvious ones as the small sample size and absence of random assignment of students, should be noted. First, the test data are for students who were the "survivors"; that is, they were present at the beginning of the PSI implementation period and still present at the end. Also, the general academic entry level of the comparison group students was lower than that of the PSI students; therefore, the two groups of students cannot be said to represent the same population of students.

The Tennessee Self-Concept Scale was administered to 23 students (15 PSI students and 8 comparison group students) at the beginning of the implementation period and to 21 students (12 PSI and 9 comparison group students) at the end of the period. As expected, the students' self-concepts were low with the average score being at about the 30th percentile. The scores of the PSI students and control group students were basically identical. Both pre- and post-treatment data were obtained for seven PSI students and five comparison group students. While a slight increase in self-concept was indicated for the PSI students, and a slight decrease was indicated for the comparison group students, these data should not be interpreted as evidence that the PSI program contributed to increased self-concept. The data can, however, be interpreted as one indication that PSI did not contribute to any major lowering of the students' self-concepts.

The average student attendance for the combined PSI classes for both quarters was 71 percent as compared to an average student attendance for the combined comparison groups for both quarters of 69 percent.

The student dropout rate was computed for all students enrolled in the three PSI classes and the two comparison classes during the first month of the

first quarter. Of a total of 24 such students in the PSI classes, 21 percent dropped out before the end of the second quarter. The dropout rate for the seven similarly enrolled comparison class students was 57 percent.

D. Conclusions

This section discusses some conclusions regarding the research questions based upon the synthesis of research findings on PSI and on adult learning, and upon the developmental and implementation activities summarized above.

The synthesis of previous research findings provided considerable evidence that PSI might be a particularly effective approach to teaching nontraditional adult learners. For example, the mastery requirement and self-pacing feature of PSI appear particularly suitable for nontraditional adult students who may be lacking in self-confidence and thus need an opportunity to succeed, and who need to work at their own pace because of varying levels of achievement, capability, and competing demands on their time. The use of peer proctors in PSI appears to be an excellent approach to providing the social, interactive element typically sought by nontraditional adult students.

The implementation activities and results also indicate that PSI may have the potential for effective teaching of nontraditional adult learners. In the implemented program, the students did learn. They were enthusiastic about the program, and they readily adapted to the idea of students helping students.

The answer to the research question regarding whether or not further investigation of the use of PSI for nontraditional adult learners is likely to be worthwhile is an emphatic "yes." PSI appears to hold considerable promise for combining some of the best features of recent technological developments with sound educational principles and practices into a program for addressing needs such as those of adults who lack the basic skills for functioning in a modern technological society.

The current research activities not only indicate a potential role for PSI in teaching nontraditional adult learners, but also indicate a need for further research to define that role. Following is a list of potentially fruitful areas for such research. This list is based upon the researchers' interpretation of the findings of the current research and suggestions from various reviewers[8] of this report. The questions are considered by the researchers to represent, at a minimum, examples of the types of issues that should be addressed to ensure that the potential of PSI for teaching nontraditional adult learners is realized. While each question is reasonably independent of the others, some overlap exists.

(1) Questions Related to PSI Materials

- What PSI instructional materials are needed for specific potential implementations (e.g., for ABE students)? What should be the objectives to be met by the instruction (e.g., to what extent should the emphasis in an ABE program be on teaching "life skills" as opposed to teaching the traditional 3Rs)? How does

[8] See Preface and Acknowledgements.

a "good" teacher teach? Can significant teacher activities that result in superior learning be "packaged" for use in PSI?

- What PSI instructional materials are available for meeting what objectives? To what extent have these materials been validated? Under what conditions were they validated?
- How can the gap (if one is found to exist) between instructional material needs and material availability most effectively and efficiently be narrowed?
- To what extent should reliance be placed upon self-instructional materials as the primary source of instruction as opposed, for example, to reliance on peer proctors?
- What is the role in PSI of packaged instruction other than printed materials (e.g., audio tapes for teaching reading)?
- What choices as to instructional content can best be left to the individual student?
- What is the role in PSI of diagnosis and description? What instruments and procedures work best?
- What would be the results in PSI of minimizing instruction as a distinctive element, and maximizing testing (i.e., using extensive testing as the primary method of teaching)? (NOTE: Several research activities reported in Volume II, Chapter 2 indicated that students who routinely took mastery tests before thoroughly studying the materials generally ended up mastering the materials anyway. This raises a question as to what extent traditional instructional materials are essential to learning.)
- What is the nature of the cognitive skills[9] employed by students in the acquisition of new knowledge, problem solving, and reasoning? What instructional materials and strategies can aid students in improving their cognitive skills?

(2) Questions Related to the Mastery Requirement of PSI

- What are the effects of various rewards for mastery (e.g., certificate of completion, field trip) on student performance?
- What are the effects of various mastery requirements (e.g., 100 percent requirement, 80 percent requirement, student-determined requirement) on student performance? How do these effects vary with the nature of the instructional objectives?
- How can students best be introduced to PSI so that frequent testing and the mastery requirement result in positive learning experiences?

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[9] Cognitive skills are defined here as a set of heuristics or methods that a person employs to regulate internal processes associated with problem solving, learning, memory, and/or reasoning (cf. Bruner, Goodnow, and Austin, 1956; Gagné, 1975; Newell and Simon, 1972).

(3) Questions Related to Self-Pacing

- To what extent is student pacing based upon student ability as opposed to student motivation (or procrastination)?
- What is the effect of scheduled study time on time on task? How does fixed scheduling compare to flexible scheduling?
- How can students be motivated to spend more time on task?

(4) Questions Related to the Use of Peer Proctors

- What are the relative advantages and disadvantages of internal proctors (i.e., proctors who also are students in the class) vs. external proctors (i.e., proctors who are not students in the class)?
- What are the advantages to the proctor of serving as an internal proctor? What are the advantages and disadvantages of various reward systems?
- What training should be provided to internal proctors? To external proctors?
- What evidence can be found of successful proctoring? What factors appear to contribute to proctor "success"? To what extent should the proctor be a "teacher"? A motivator? A social contact?

(5) Questions Related to Motivational Lectures

- Do motivational lectures make a difference in student performance? Under what conditions?
- What are some effective motivational lecture options (e.g., movies, social events, sessions on communications and human relations)?

(6) Questions Related to the PSI System

- What are optimum classroom characteristics (e.g., class size, class groupings, meeting time and location, resources)?
- What effects do various student, proctor, teacher, and system characteristics have on short-term and long-term student behaviors?
- What is the legitimate role of the teacher in PSI? How can this role be enhanced so as to meet the teacher's personal and professional needs?
- What are the positive and negative outcomes of PSI? How can these outcomes be measured?
- How can the cost effectiveness of PSI be determined? How cost effective is PSI as compared to other teaching approaches?