A GOVERNMENT NUTRITION EDUCATION COURSE TAUGHT BY PERSONALIZED SYSTEM OF INSTRUCTION

by

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INTRODUCTION

For several decades, it generally has been assumed that how one goes about teaching makes a difference in student performance. Innovations abound. Many teaching techniques begin and end in a single classroom. Some of the more successful are imitated for a time, talked about on other campuses, reported in professional journals and then recede from public view after a few years. Later, parts of a technique may be combined with a new idea and cycled for use by other innovators.

In two companion monographs, Dublin and Taveggia[1] and Dublin and Hedley[2] summarized over 350 separate studies comparing different methods and media of college instruction which were conducted between 1924 and 1965. The unequivocal conclusion of these reviews was that there is no demonstrable difference among truly distinctive methods of college instruction when evaluated by student performance on final examinations.

In 1962 at the University of Brazilia, Fred Keller and his associates created a new method of behavioral instruction called the Personalized System of Instruction or PSI. In 1965, PSI was used at Arizona State University, and in 1968, an article, "Good-Bye, Teacher",[3] publicized the method nationally. PSI is currently used in several thousand college courses in many disciplines.[4]

In PSI, students proceed at their own pace through written material that is divided into units. Each unit must be mastered before the next unit is begun. Tests taken may be repeated without

penalty until mastery is demonstrated. Tests are corrected immediately by course assistants, called proctors, who discuss the test questions with the students. Lectures may be given occasionally but student attendance is not required.

Why has this method enjoyed success? Part of the explanation is simple: it works. When Taveggia[5] reviewed the literature between 1967 and 1974 comparing student performance in PSI courses with student performance in more conventionally taught courses he concluded that, "when evaluated by average student performance on course content examinations, PSI has proven superior to the conventional methods with which it has been experimentally compared." Other reviewers[6,7] reported similar conclusions as well as favorable student evaluations of the method.

Interest in PSI increased because of the evidence appearing in the late 1960's and early 1970's that conventional teaching was not producing the desired results. Students graduated from high schools and even colleges with severe deficiencies in their basic education. Scores on standardized tests of achievement dropped steadily.[8] A teaching method designed to produce student mastery of specific objectives was just what many teachers wanted. PSI has mastery of material as one of its basic tenets.

In the foreward to Behavioral Instruction: An Evaluative Review,[8] Kulik pointed to the effective communication skills with which master teachers Fred Keller and his associates helped to popularize PSI. "They spoke about their teaching method with

precision, clarity, wit and even charisma. They gave talks about PSI in every corner of the United States and took their message to a number of other countries as well."

It was the good fortune of the author to meet Dr. Keller soon after his move to a small southern community. He explained his teaching method to her and she became impressed with its possible application to the teaching of nutrition at the elementary, secondary and college level as well as to the community at large.

The objective of this thesis project was to prepare and teach a one credit PSI course on government nutrition education programs for Home Economics majors. Course content was based on federal legislation that is in constant flux and, therefore, no textbook exists. Since the PSI method is based on written material rather than on information conveyed through lectures, it was necessary to carefully compile a variety of concise, current articles on government nutrition education programs. The course was evaluated by a final examination and evaluation forms completed by students and proctors.

Pearson r correlations relating student achievement, aptitude, number of test attempts and test errors, and rate were calculated and are discussed. A separate control in a group experimental design was not used but it was possible to compare the correlations with others reported in the literature and thus draw conclusions from the results. Suggestions for revisions of course material are included in the thesis.

REVIEW OF LITERATURE

The Five Components of PSI

Personalized System of Instruction refers to a specific system of instruction which, according to Keller,[3] is distinguished by the following features:

1. Mastery is required for advancement to new material.
2. Course work is individually paced.
3. Course content is communicated primarily through the written word.
4. Peers are employed as course assistants, called proctors, to allow immediate individual scoring of unit tests.
5. A few lectures may be included for stimulation or motivation of students.

The Keller Plan Handbook[9] explains the purpose of the five components of PSI. The first component, the mastery requirement, sets the student performance level required. The level is usually high and all students are required to meet it. To make this possible, repeated tests must be allowed. Test errors show a need for remediation rather than failure. Most importantly, success must be rewarded. Grades must reflect final accomplishments, not the number of errors made along the way. Grading must be based on content learned rather than being competitive and comparative.

In PSI, it is assumed the students can achieve subject mastery but each will require different lengths of time to do so. Most traditional educational practices hold time constant and the resulting grade distribution indicates different levels of achievement. With the PSI method, achievement levels are held constant and time is allowed to vary. Therefore, the mastery requirement mandates the second component of PSI, the self-pacing feature.

When self-pacing is allowed, the need for the third component of the method, written material, becomes obvious. Students progressing at different rates through course material make the lecture methods unworkable. When written material becomes the major source of information it is important that text material be clear, concise, well-written and relevant. Course content must be divided into manageable units with clearly specified objectives for each. New information is presented only when the student is prepared to deal successfully with new concepts.

Given the number of students working at different speeds and dealing with a wide range of material at any point in time, it becomes apparent that the instructor needs assistance. Course assistants, called proctors, become the fourth essential component of the system. They provide individual attention to the student and give immediate and specific feedback about performance. They also benefit through learning by teaching. The proctor frees the instructor to devote his time to those individuals and problems that require his level of expertise. Keller[9] thinks the proctor is not only an essential

feature but perhaps the most valuable component of PSI, in that proctors greatly increase the interpersonal communication in a course.

The function of the fifth component of the method, the lecture, is dramatically different than in the conventional lecture course. Student attendance is not required and they are not tested on the material presented. Their role is seen as inspirational and motivational.

The first four distinguishing features, i.e., mastery, self-pacing, stress on written material, and use of proctors are essential parts of PSI. Klopfenstein[10] pointed out that while systems which do not embody these features may be effective and educationally sound, by definition, they are not PSI.

The fifth feature, the motivational lecture, is an optional part of the method. Research by Minks and Carlson[11] and Calhoun[12] on the effect of lectures on student achievement conclude that lectures do not significantly effect student performance.

Robin[6] offered a helpful overview of how the main components of PSI work together. The instructor divides the reading material into small units and provides a study guide which consists of instructional objectives, study questions, and clarification of ambiguous points. The student reads the unit material and answers the study questions. During class he may ask the instructor or proctors to explain any questions he has. When he thinks he is ready, he takes a written test based on the unit material. A proctor evaluates his answers and provides immediate feedback. If the student answers

the questions to a high level of mastery, the degree of which is set by the instructor, he can advance to the next unit. If he fails to achieve the mastery criterion, he restudies the material and retakes the test until he demonstrates the required level of mastery. Course grades are usually based on the number of units mastered, with some percentage based on midterm and/or final examinations. Proctors are typically advanced undergraduates who have recently completed the course at a high level of mastery.

PSI Research

Research on personalized instruction has concentrated in two general areas: (1) outcome studies comparing PSI and conventional teaching methods and (2) an analysis of the component parts of PSI.

Outcome Studies

In outcome studies, investigators have looked at end-of-course achievement by students, student satisfaction, and course completions and withdrawals.

The primary measure of teaching effectiveness has typically been the performance of students on course-related examinations. Early evaluations consisted of simple comparisons of letter grade distributions in PSI courses and traditionally taught courses. These descriptive reports pointed to the large number of high grades in a PSI course as evidence that it was more effective than the traditional lecture format.[13]

Taveggia[5] summarized the results of 28 comparisons between learning outcomes of PSI and conventional approaches to college teaching. All 28 comparisons favored PSI when evaluated by average student performance on course content examinations.

Robin[6] reviewed 39 comparison studies using different forms of behavioral instruction and their result on academic achievement. Twenty-seven of these studies were categorized as PSI. Twenty-two of these reported results favoring PSI in student achievement whereas four studies reported equal performance. One included two comparisons within the same study, yielding significant differences favoring behavioral instruction in one part of the study and equal performance in the other. No lecture-discussion condition produced superior performance to a PSI condition.

In reviewing comparison studies, Kulik, Kulik and Smith[7] found that in 38 of the 39 studies, exam performance was better in PSI courses than in lecture courses. In 34 of these, the performance between PSI and comparison groups was great enough to be considered statistically significant. In one case, lecture performance was slightly better than PSI performance, but the difference was not statistically significant. In a typical comparison reviewed by these authors, means on final exams of PSI courses were higher by about 2/3 of a standard deviation than for a conventional lecture course.

Reviews[6,7,13,14] of student evaluations confirm Keller's[3] initial assessment: most students like the PSI method of teaching and learning. After reviewing published reports, Kulik, Kulik, and Smith[7]

estimate that only one or two students in a typical class of fifty react negatively to the PSI format.

Several investigators have tried to specify the features of PSI which contribute most to these favorable ratings results. Hoberock et al[15] found that self-pacing and the unit mastery requirement were most valued by students in four PSI engineering courses. Students were said to readily take advantage of all the features. The motivational lectures were considered significantly less valuable, and the authors concluded that this feature could be eliminated "without serious consequences". Green[16] reported students favored self-pacing most but also frequently praised the freedom to study when and where one wishes, the proctors, the mastery criterion and immediate feedback. Nelson and Scott[17] ranked 12 features of a self-paced course in educational psychology in terms of importance to enjoyment of the course. Highest ranked was self pacing, then interaction with teaching assistants and instructor, and then small steps.

Another consistent finding from student evaluations is that PSI courses are "too much work" or "more work than most other courses". Born and Herbert[18] reported that, although students complained about the work load, they estimated spending about 60 hours on the course throughout the 10 week term, an estimate comparable to that expected in a normal lecture course. The authors concluded that for a comparable amount of time students achieved higher letter grades than they would have received in the normal lecture course. Taylor[19] also reported that students think PSI courses required a great deal of work in

comparison to their other courses. The author suspected that student underestimation of course work requirement is common, particularly among average and poor students. She speculated that, when course work requirements are explicitly defined in detailed behavioral form, students tend to work to achieve the specified level of mastery even when this requires more than their customary work for a course. Born and Davis[26] attempted to evaluate the question of the work required in PSI courses by making their course material for a PSI section and a lecture section available only in a special "study center" where study guides and reading assignments were checked out and amount of study time with materials was recorded. The authors found that a student in the PSI section spent an average 46 hours in the center compared to 30 hours for the lecture section student. However, when 20 hours lecture time was added to the time recorded for the lecture section student, the amount of course study time for PSI and lecture became nearly equal.

In spite of the generally favorable student response to PSI, many investigators have reported a much higher level of student withdrawal than would occur in a more traditionally taught course. In his 1968 paper, Keller[3] reported a withdrawal rate of about 20 percent in two classes. Robin[6] reviewed 14 comparison studies and reported that withdrawal rates in courses using behavioral instruction averaged 14 percent while lecture-discussion courses had a 10 percent withdrawal rate. Some investigators have published different results: McMichael and Corey[20] reported that the 12 percent withdrawal rate

in a PSI section of an introduction psychology course was lower than the withdrawal in two conventional sections of the course. In four PSI engineering courses described by Hoberock,[15] withdrawal rates were between five and ten percent. Of 38 students in Myer's[21] introductory statistics course, none withdrew or failed to complete the course. Born and Whelan[22] found that a fair predictor of the student who will withdraw from a PSI course is one who falls behind the normal progress rate within the first few weeks. Many students who withdraw from PSI courses also waited a long time before taking the first unit test.

Analysis of Component Parts of PSI

In the analysis of component parts of PSI, researchers have investigated numerous aspects of the four essential features: mastery, self-pacing, stress on written material and proctors.

Johnston and O'Neil[23] and Semb[24] manipulated mastery criteria within PSI courses and effectively demonstrated how closely student performance conformed to the criterion in effect at the time a given test was taken. Johnston and O'Neil evaluated student rates of correct and incorrect responding under several different mastery conditions (90 percent, 75 percent, 60 percent and none). Students with no criterion on performance exhibited the lowest exam scores. Furthermore, student performance was positively correlated with the mastery level in effect. Semb found that a high mastery criterion (100 percent) produced better test performance than a low mastery

criterion (60 percent) on both recall and application questions.

According to Bloom's Mastery Model as discussed by Kulik, Kulik and Hertzler,[25] there should be very little variation in end-of-course performance of students taught for mastery, and what little variation there is should not be related to initial student ability. However, they found final exam scores were significantly correlated (.38) with student aptitude as measured by grade point average. High-aptitude students out-performed low-aptitude students on final examinations. Other investigators[26-29] have also reported significant correlations between final exam scores and aptitude. In these four studies, the range of final exam scores - aptitude correlation coefficients is .47 to .70, the mean correlation coefficient being about .58. Nazzaro, Todorov and Nazzaro[30] reported a -.50 correlation coefficient between grade point average and the number of errors on the final exam.

Kulik, Kulik and Smith[7] reviewed four studies concerning student versus teacher-pacing and concluded that self-pacing does not seem to be related to final exam performance. Self-paced and teacher-paced students do equally well on final examinations.

Self-pacing can be a problem to students who tend to procrastinate. The consequences of procrastination, i.e. incompletes, lower grades, withdrawals, and anxieties, are usually detrimental to the student. To motivate a student in a self-paced course, early and strong positive reinforcements to student progress must be offered.[13] Robin and Graham[31] found that when minimum rates of progress were

set by the instructor, student rates were more consistent through the term. Henneberry[32] found that offering an early final with available retakes for those students finishing before the end of the term reduced procrastination by about 20 percent.

Studies show that in PSI courses the rate of student progress accelerates near end of the term.[13] Only one report gives evidence of acceleration in the middle rather than the end of the term.[13] Boyko[33] noted a high correlation between rate of progress and eventual grade earned. A greater percentage of positively accelerated responders received B's or C's than A's, while the percentage of negatively accelerated responders increased as grade level increased. Nazzaro, Todorov and Nazzaro[30] found a correlation coefficient of .30 between days required to complete the course and errors on the final exam. The rate was correlated poorly (-.04) with grade point average.

The emphasis on the written word in PSI courses has generated research in the areas of unit size, study questions, unit tests and final examinations.

Keller[3] pointed out that units for behavioral instruction courses should be short in order to facilitate detailed mastery. Semb[34] divided a course into small units of 30 pages and large units of 120 pages and found that performance on review tests at the end of each unit was 20 percent lower for the long units than during the short-unit condition. Nelson and Bennett[35] reported that by decreasing the number of pages per unit from 65 to 36, they eliminated

almost all of the last minute rush to complete the course, although this required almost twice the number of units and unit tests.

In most PSI courses the units are accompanied by study questions and/or objectives to give the students an explicit indication of the important points of information. Semb, Hopkins, and Hurst[36] demonstrated that when study questions appear on unit tests, students answered them 20 to 30 percentage points more accurately than test questions not drawn from the study questions provided with each unit. Mean performance on study question items was above 90 percent. A supplementary finding was that the more study questions provided on a given unit, the more likely students would be to answer correctly the test questions that were not drawn from the study questions.

Unit tests in a PSI course serve the purpose of evaluating students' mastery of the material contained in a unit. The content of the unit test is normally directly related to the objectives and/or study questions that are provided as part of the unit materials. Students are usually required to retake a unit test until the specific mastery criterion for the course is met. Remediation in the form of test retakes is intended to equalize performance among students of varying aptitudes. However, Kulik, Kulik and Hertzler[25] found that although remediation improved performance of low aptitude students, those who repeated tests more often did less well on the final examination than those who passed tests on the initial attempt. The number of test attempts correlated with final exam scores (-.43) and with grade point average (-.40). Murphy, McMichael and Cariello[37]

found a correlation coefficient of -.29 between number of unit tests and final examination score. Whitehurst and Madigan[38] reported on correlations between review test scores and number of tests taken in five courses. Three low negative correlation coefficients, -.04, -.08, -.11 were reported as well as two positive correlations, .324 and .737.

Hoberock et al[15] reported 1.7, 1.9, 1.5 and 1.2 tests per unit were necessary in four PSI engineering courses. Murphy, McMichael and Cariello[37] found that 1.5 tests per unit were required in their psychological statistics course.

PSI courses do not uniformly use final examinations. Sherman[9] suggested that including a final examination is wise because it gives students an opportunity to integrate all the material presented and, also, it removes pressure from the proctors. Students who must do no more than pass all units to receive an A may put pressure on proctors to let them slide through. A final exam gives the proctor a good reason to keep his grading standards consistant across tests. Keller[3] suggested 25 percent of the course grade be based on the final examination and 75 percent be based on the number of units successfully completed during the term.

Proctors in a PSI course are typically advanced undergraduates who have mastered course material in a previous term and have been selected because of their competence, interest and, hopefully, nonabrasive manner. These students are called external proctors because they are no longer taking the course. They are usually compensated for their

job as a salary or by course credit.[9] Keller[9] suggests that there should be at least one proctor for every ten students. Internal proctors are usually students within the course who are advancing rapidly through course material and who agree to proctor students less advanced.

In Personalized System of Instruction State of the Art 1976[13] the authors reviewed research and concluded that the duty of the proctor most affecting student achievement was the immediate feedback given after unit tests. Student evaluations have shown the importance of the proctor in positive student attitude toward PSI.[16,17] In two reports[15,18] students gave high ratings to proctors on qualities such as "competence", "encouraging independent thinking", "willing to listen to students' understanding of ideas and concepts", and "enthusiastic about their proctoring".

Proctors enjoy their duties as well. Hoberock et al[15] noted that, where as most of their graders in traditional courses found their work "tedious", more than half of the proctors in the four PSI engineering courses they taught volunteered to serve without pay. Edwards[39] reported that his internal proctors stated they would like to serve as external proctors in a later semester and would probably use PSI to teach their classes if they became teachers.

The PSI method of teaching has been applied to most disciplines within the traditional college curriculum as well as to vocational training and secondary and elementary education. The Personalized

System of Instruction Newsletter[40] has reported on the many varied fields of application.

Nutrition Courses Using PSI

Two studies on PSI courses in the area of nutrition have been described in the literature. Cross and Semb[41] reported on a three credit course in basic nutrition for 119 freshman-sophomore students with diverse academic backgrounds and professional interest. The first third of the course was taught by the lecture/discussion method. The other two-thirds was taught by PSI. A combination of student and instructor-pacing was used which required a minimum rate for all students but allowed students to proceed at a faster rate if they chose. Twelve external proctors received three hours of academic credit in a special topics course taught by the senior author. Students in the PSI part of the course continued to attend weekly discussion groups and were allowed to take tests at that time and at four other hours during the week. Ninety percent mastery was required. The 109 students completing the course had a mean of 77.23 percent (SD=±13.25) correct on Exam 1 following the traditional lecture/discussion procedures as compared with a mean of 83.18 percent (SD=±6.34) correct on Exam 3 following the second part of PSI sections of the course. Exam 2 was not included to obviate the possibility that the novelty of PSI procedures influenced the results. The students enrolled in the course were divided into four subgroups on the basis of their performance on Exam 1. The four subgroups were high, medium-high, medium-low and low performers. During the PSI

part of the course the low performers improved nearly two letter grades, the medium-low performers improved about a letter grade, while the students who were in the top two performance subgroups showed no difference in performance between the two conditions. The authors' conclusion was that PSI may be an effective way to improve college nutrition education, especially for students with weak academic backgrounds.

Boren and Foree[42] reported on a personalized competency-based instructional strategy used in a sophomore-junior level food and nutrition lecture-laboratory course for home economics education or food and nutrition majors. Students (N=64) were exposed to the teacher-directed traditional lecture-discussion method or the experimental (N=109) personalized instruction method. For the personalized instruction strategy, competency-based modules were constructed as a syllabus, rationale, competencies, performance objectives, learning experiences and evaluation instruments. Pre-tests were given before each cognitive (theory lecture) unit and once, at the beginning of the course, for psychomotor (laboratory) objectives. If pre-test scores were high enough, (80 percent module, 90 percent psychomotor) that module or the psychomotor section of the course could be omitted. Students progressed at their own rate through each module with the help of a variety of written and audio-visual aids, and individualized help from teachers. The students took one post-test for each module and the psychomotor section. They were not permitted to retake tests. The authors pointed out that two features of PSI, self pacing and

written materials with careful objectives, were used in the study. Mastery requirement and proctors were not employed. Data from objective pre-tests and post-tests indicated that the control and experimental teaching strategies were similar in the lecture part of the course. The experimental strategy was superior to the control method in teaching laboratory competencies. Student response to the PSI strategy was positive. When entry and exist mastery levels were compared, the personalized approach motivated more students to greater achievement levels, regardless of entry point. The authors found the use of the PSI approach increased demands on teacher time per individual student and suggested experimentation with proctors to decrease the heavy demand on teacher time.

MATERIALS AND METHODOLOGY

Student Composition and Teaching Personnel

The 24 students enrolled in a one credit government programs in nutrition education course were freshmen, sophomores, juniors, and special graduate students in the College of Home Economics. One graduate student registered to audit the course. The students represented three majors within the department, Human Nutrition and Foods, Management, Housing and Family Development, and Clothing, Textiles and Related Arts. The course was one of several critical issues courses offered that term. A minimum number of critical issues courses are required to be completed before graduation.

The teaching personnel included an instructor and three proctors. The instructor was a graduate student in the Department of Human Nutrition and Foods. The proctors were undergraduates who had completed the course material the previous quarter with grades of A or A-. One proctor was a senior majoring in Home Economics Education. Another was a sophomore Human Nutrition and Foods major who had already received a baccalaureate degree in French. The third was a sophomore whose major was Human Nutrition and Foods and who had taken one course taught by the PSI method. Three work-study students helped with filing during class hours. Each worked one hour a week.

Unit Materials

Regulations and funding for federal programs are continually changing. Because of this, no text is available for a course on government programs in nutrition. Since PSI is based on learning from the written word, it was necessary to find or write articles dealing specifically with the nutrition programs to be covered. The course subject material was divided into two introductory units and seven program units. The seven nutrition programs selected were those with the highest federal budgets. The first four programs covered were primarily food assistance programs. The last three were nutrition education programs.

The course articles ranged from 6 to 17 pages per unit in length. The pages had various formats and fonts and, therefore, could not be compared by counting pages. All units contained approximately the same amount of material.

The reading materials used in the course were purposely selected from a variety of sources to expose students to a wide range of publications on government programs.

The reading for Unit I was the introduction to a report, Nutrition and Health II,[43] which was prepared by the Select Senate Committee on Nutrition and Human Need. This introduction gives a compact summary of the nutritional health status of the people in the U.S..

Unit II consisted of three short readings. The first article, National Nutrition Policy,[44] is an issue brief prepared by the

Library of Congress Congressional Research Service. It defines a national nutrition policy, gives background and policy analysis, and summarizes legislation on this issue. The second reading, "Progress Toward a National Food Policy",[45] is a journal article which considers the relationship of the food and fuel crises, the history of American food policy, and suggests a format for a national nutrition plan. The third reading, "USDA: Built-in Conflicts", is a chapter from U.S. Nutrition Policies in the Seventies[46] and gives a view of problems within the government agency which administers food assistance programs. Also included in Unit II were a Congressional Research Service summary, titled Federal Food Assistance Programs,[47] and organization charts[48] of the Departments of Health, Education and Welfare (HEW) and Agriculture (USDA). The organizational charts were included to help students locate program agencies within the government departments.

The Food Stamp Program was explained in Unit III. The first of three readings was The Food Stamp Program,[49] a booklet compiled by the Food and Nutrition Service of the Department of Agriculture to provide information for the prospective food stamp recipient. Its reading level is easy compared to the second reading selection taken from Food Stamp Program Reform Issue Brief[50] which was prepared by the Congressional Research Service to provide congressmen with detailed legislative information on the Food Stamp Program. The third reading for Unit III was a section on nutrition education and outreach from a Senate Committee on Agriculture and Forestry publication entitled

Selected Materials Concerning Major Food Stamp Reform Legislation.[51]

Unit IV included readings on six nutrition programs that benefit children. The material in the first reading was essentially taken from a 1974 Dairy Council Digest[52] on child nutrition programs but was updated by material from various sources.[53-55] The second reading was an article, published in the Journal of Nutrition Education, that presents a keynote address given by Rep. George Miller[56] to the 1975 meeting of the Society for Nutrition Education. In the address, Mr. Miller stressed the need for child nutrition programs to justify their existance if they are to compete successfully with other programs for the Federal dollars.

The reading for Unit V was on the Special Supplement Food Program for Women, Infants and Children (WIC) and was written by the course instructor. The article detailed the legislative intent of WIC and implementation problems and included summaries of WIC medical and educational evaluations.

Unit VI covered nutrition programs for the elderly. The first reading was "Title VII of the Older Americans Act of 1965".[57] Since the course dealt with government programs, the instructor thought it appropriate that students encounter one law as it was actually written. The second reading was from a Congressional Research Service publication titled, The Older Americans Act: Summary of Major Provision, As Amended; Development of Major Provision. 1976-1975.[58] It gave a history and summary of Title VII. The third reading was a statement by Senator Hubert Humphrey[59] presented at a hearing before the Select

Senate Committee on Nutrition and Human Needs. Senator Humphrey explained the need for a national meals-on-wheels program for the elderly.

Unit VII had a reading on the Extension Service taken from the United States Government Manual, 1976-77.[48] The second reading was a condensation of EFNEP...Accomplishment and Future Needs.[60] This article presents an analysis of the Expanded Food and Nutrition Education Program.

The article for Unit VIII was titled Office of Material and Child Health, Maternity and Infant Care Projects and Children and Youth Projects and was written by the instructor. A number of references[61-66] were used in compiling the reading. The history and purpose of the Office of Maternal and Child Health are described as are two projects administered through the Office, Maternity and Infant Care Projects (M&I) and Children and Youth Projects (C&Y). Handouts for Unit VIII included organization charts drawn by the instructor, showing the flow of responsibility from the director of HEW down to the M&I and C&Y projects, and a McNelly cartoon lampooning an HEW organization chart.

The first reading for Unit IX was a brief summary of the responsibilities of the Food and Drug Administration (FDA) and the Bureau of Foods as described by the United States Government Manual, 1976-77.[48] The second reading was a journal article titled "Food Labeling".[67] The article explains food labeling regulations and FDA's reasons for making the regulations, details events and activities,

problems and solutions that surrounded the implementation of food labeling and predicts events that will affect its future success. The third reading was a short explanation of the differences between U.S. Recommended Daily Allowances (U.S.RDA) and the Recommended Dietary Allowances (RDA) and the differences between U.S.RDA and Minimum Daily Requirement (MDR).

Study guides for each of the nine units were prepared by the instructor. Each study guide included an introduction, notes for clarification and study questions.

The unit introductions were brief explanations of the source and purpose of the unit readings. The notes for clarification explained words, phases or ideas in the readings that might have been unclear to the students. For example, the notes for clarification in Unit III included a few paragraphs explaining the legislative jargon freely used in the Food Stamp Program Reform Issue Brief.(50) An average of 13 study questions were prepared for each unit. The purpose of the study questions was to point out to the students the facts and ideas to be noted and learned from the reading assignments.

Study question answer sheets for all units were prepared for the course proctors. Three tests with separate answer sheets were written for each of the nine units. The test questions were not exactly the same as the study questions but referred to the same course content. Each of the three tests for a unit tested all the areas stressed in the study questions. The tests were a combination of essay, true-false, multiple choice or fill-in questions. They were constructed to

take about 15 to 20 minutes to complete.

Each unit's material was stenciled and mimeographed on a different color paper. For example, all of Unit I was on white paper, Unit II was on blue and Unit III, orange. This was done to facilitate record-keeping and distribution of unit material.

Evaluation forms were prepared for the course. The first part of the evaluation requested students to rate the teaching method, compare PSI and the lecture method, rate subject and materials for the course, evaluate their instructor and proctor, and rate the testing and grading policy. At the end of these areas of evaluation a space was provided for additional comments. The second part of the evaluation asked students to give information about the individual units covered. They were asked which units they most liked and disliked, found most interesting and most boring. They were asked to note units that were too long or too short, too hard or too easy. The unit test which was too difficult or too easy was requested. Finally, students were asked which of the nine units they would save if they could save only one and which unit they would cut if the course were shortened by one unit. The personal student information requested on each evaluation was name (optional), age, class, major, quality credit average (QCA), expected grade, total number of credit hours carried in the quarter and reason for taking the course.

Course Policy

The instructor met with the proctors before the course began and explained their responsibilities. The proctors were required to attend the three class sessions a week, attend a weekly proctors' meeting and keep a log on student-proctor interaction. For these duties they were to receive one credit for independent study.

On the first class day, the instructor explained the PSI method and outlined course policy to the students. Two additional class hours were agreed upon. One student had a conflict with the hours chosen. She and her proctor arranged meetings immediately preceding the two selected hours.

Students were required to attend class only when they wished to take a unit test. However, students were encouraged to use the classroom as a study hall so that the instructor and proctors could help with difficulties and questions on the reading material.

All students were required to take a final examination, in which the entire term's work was to be represented. One early final was to be given approximately three weeks before the last day of class.

Students were advised that 25 percent of their final grade in the course was to be based on the final exam. The remaining 75 percent of their grade was to be based on the number of units they completed during the term. For example, if a student finished all nine units, he would carry a grade of A into the final examination; eight units - a B; seven units - a C.

The class was divided equally into three sections alphabetically, and each proctor was assigned one section of students. The students were told that the proctors' duties were (1) to read test answers and to grade them right or wrong, (2) to listen to any defense the student might wish to make of those judged incorrect, to change a grade if he was convinced the student was correct, or to appeal to the instructor for a judgement, (3) to direct the student to further study when needed, (4) to grade another form of the unit test at a later time, when the student tried again to pass it.

Students were told that only one test could be taken during a class. To pass a unit test, a grade of 90 percent had to be achieved. To facilitate this calculation, the number of points each question was worth was to be noted in parenthesis next to the question. The total number of points possible on the test and the number of points necessary to achieve the 90 percent mastery level were to be given at the top of each test.

The students were told that there were test forms A, B, and C for every unit. The test they would take would be randomly chosen from the three available forms. After successfully passing a unit test, the study guide and reading material for the next unit were to be given to the student.

The class met only once as a whole and it was necessary to have a place where notices could be posted. Students were told that the file cabinet in the classroom where they met would serve as a bulletin board for the course. They were required to check the cabinet for

notices at least once a week.

Since most of the students were unfamiliar with the PSI self-pacing feature, one deadline was imposed by the instructor: the first test was to be attempted no later than two weeks after the first day of class. To further encourage a satisfactory rate of student progress, students filled out file cards giving their name, address and phone number. This information was to be used to contact students whose rate of progress was considerably slower than the average. The two additional features, i.e. the teacher imposed deadline and the student contact cards, were innovations to the PSI method.

Students were told that they would be requested to fill out a detailed evaluation at the end of the course. They were made aware that the course was being used as a thesis project by their instructor, a graduate student.

At the completion of the first day's lecture, a written list of the course procedures and policies was given to the students. The students also received the study guide and reading assignment for Unit I.

Implementation

The classroom used for the course was large and had windows along one side. Students who were studying or preparing for tests sat in the front and middle of the room. Students taking tests sat in the row of desks next to the windows. The proctors positioned themselves in the back of the classroom. The file cabinet with the

course materials was on the right side of the room, in the back. One work-study student, serving as file clerk, was at the file cabinet. The instructor positioned herself near the file cabinet when not helping students in other parts of the room.

The top drawer of the file cabinet held a folder for each student, test answers and proctor study question answers. All tests taken by a student were put into his folder. The date, unit number, test form, test success or failure and proctor name were recorded on his folder cover. The second drawer held the three test forms for each unit. The third drawer contained the unit reading assignments and study guides and the fourth drawer, the final exams and evaluation forms. The cabinet was kept locked when class was not in session.

On an average day, about ten students would arrive in the classroom early in the hour. Most of the ten would be planning on taking a test that day, although one or two may just have come to study and ask questions. During the first 15 or 20 minutes of class they would usually study or ask their proctor or the instructor a question or two. When a student felt he was ready to take a test, he would go to the file cabinet and give his name to the clerk. She would pull his folder and check the last unit he had successfully completed and give the student one of the test forms for the next unit. If the folder showed that the last test had not been passed, the student would be given another form of the test for the same unit. The clerk would then write the date, unit number and test form letter on the cover of the folder.

The student would take the test to the row of desks next to the window and spend about 15 minutes completing it. When he was finished he would take it to his proctor. The proctor would get the answer sheet from the file cabinet and correct the test with the student looking on. The proctor and student would then discuss any mistakes that were made. Finally, the number of correct points would be totalled. If the student achieved the 90 percent mastery level, a P for pass would be put on the top of the test. If not, an NY, for not yet, would be written on it. Heading for the file cabinet again, the student would usually encounter the course instructor who would look over the test and attempt to reinforce the success by congratulating the student and commenting on a particularly well answered question. If the student had not passed the test, she made sure he knew where to find the material he had missed. At the file cabinet the student would give the test to the file clerk who would note the results and proctor's name on the folder. If the test had been completed successfully, the material for the next unit would be given to the student.

Tests were usually corrected by the student's assigned proctor. If there was a line of students waiting for a proctor, a student was free to go to one of other proctors or the instructor to have his test corrected.

At the beginning of the hour, the proctors used free time to look over the study questions for later units. At the end of the hour, they filled in a progress chart for their students. On the

chart they noted the student's name, date, unit number, test form attempted, and test outcome. These charts were then given to the instructor. Lastly, the proctors noted their interactions with students in their logs.

The instructor greeted students by name as they arrived in the classroom. She answered questions asked by students and occasionally corrected a student's test. During free time, she looked through tests the students had completed on preceding days. At the end of the period, she transferred information on proctor's progress charts to her progress chart, which included the test taking records for all students. Midway through the course, she prepared and posted a class progress chart showing how many students had completed each unit. Students' names were not used. This chart was updated daily so that students could compare their progress with other class members. The instructor also made entries in her log at the end of a class period.

One hour proctors' meetings were held weekly in the instructor's office. Any problems that proctors were having with the unit material was discussed. Proctors pointed out problems which students were encountering with particular test questions. The study questions, test questions and reading material were examined to see if any could be written more clearly to help students correctly answer the problem questions. Students' progress rate was discussed and it was decided when lagging students should be contacted by proctors. About three weeks before the final exam, the instructor sent out notes to the

slowest students, telling them how many class days were left and how many units they had yet to complete.

RESULTS AND DISCUSSION

Classroom Organization

The large classroom used worked well for the PSI format. During class hours, everyone present was busy with course activities. The instructor never found it necessary to ask for more quiet or to remind proctors or students of their purpose in being there. One proctor suggested that she would find it difficult to take tests in the same room where discussions were constantly in progress. No student complained verbally or in the written evaluation about classroom noise or activity being distracting during test taking. One student commented on the written evaluation that the relaxed atmosphere of the class helped her to cope successfully with the difficult course material.

The proctors' logs showed a number of cases in which students were nervous and uncommunicative at first but became more comfortable and participated in discussion more readily as the term progressed. The relaxed classroom atmosphere contributed to this effect but it was probably due more to developing proctor-student relationships as well as the students' growing familiarity with the PSI technique.

At the beginning of the course the instructor handled the clerical details at the file cabinet. Because the instructor was also involved with answering student questions and talking with students who had completed tests, the process of giving out tests and materials, filing

tests and recording progress was slowed. The file cabinet area of the classroom became congested and confusing. To free the instructor for teaching and to smooth the interworkings of the classroom, work-study students employed by the Human Nutrition and Foods Department took over the clerking responsibilities at the file cabinet.

Time Requirements for Teaching Personnel and Clerical Staff

The instructor required two months of research prior to the beginning of the course. These months were devoted to finding or writing text reading materials and learning about the PSI technique. During the first month of the one credit course, the instructor's time was completely taken up with writing the unit study guides and tests and attending to the working details of the course. After the first month, there were much less course demands made on her time. If she had taught the course again the next quarter, very little preparation time would have been required.

The proctors were required to be in the classroom three hours a week and to attend a weekly one hour proctors' meeting. The proctors had taken a course covering generally the same material the term before. However, the course they took did not use the same reading material and required detailed mastery of only one program, the one about which they chose to write a term paper. Therefore, the proctors found it necessary to spend an additional hour a week familiarizing themselves with unit materials. One proctor arranged to meet the one student

with a time conflict a half hour before class four different times during the quarter.

The three work-study students each spent one hour a week clerking for the course.

Primarily during the first month of the course, secretaries typed 168 stencils and reproduced 103 pages on a stencil-making machine. Forty copies of all the pages, except tests, were mimeographed. Fifteen copies of each test form were reproduced. Most of the material required collation and stapling. This clerical work could have been cut approximately in half if a textbook had been available for the course.

Unit Materials

Three students requested additional reading material during the course. One of these students made requests frequently.

The small detail of color coding the unit materials was important to the smooth working of the course according to comments and informal observation. The instructor, proctors, clerks, and students all benefited from the added organization this brought to the course. Also, the colors of more advanced units may have served as a status symbol to the students progressing more rapidly through the course.

Unit Reading Assignments

According to research reported in the literature on unit reading

assignments, [34,35] all unit readings for this course would be considered "small", having less than 30 pages per unit.

Data on student responses to the course evaluations are summarized in the appendix on the unit reading assignments. They reflected individual differences in student interest but some general conclusions can be drawn. Unit IV on the Child Nutrition Program was chosen most often as the most liked. Unit II on Government Policy on Food and Nutrition was considered the least liked, most difficult and boring, and received the most votes for being the one unit to be excluded in the future. The instructor thought that the material in this unit was important and, in the future, should be written as a single reading, eliminating the disjointed effect created by the three selections. Units I, III, and IX received the most support for being the only unit saved if eight were to be cut. Five student evaluations commented on the difficulty of reading the Title VII law in Unit VI. A number of students complained to the proctors and instructor about this difficulty at the time the students were coping with Unit VI. However, most agreed that a detailed understanding of the fine points of the law was not required and that the study questions helped them master the material. The instructor believed that this small introduction to federal law as it was written was important and should continue to be included in the course.

Unit Study Questions

There were an average of 13 study questions prepared for each

unit. Many study questions had more than one part. Students' questions and problems with unit tests underlined the fact that study questions should be clearly written and detailed. Two students summed up the class experience well when they commented after the first units that the unit tests were easy; a few units later, after failing to meet the mastery requirement on a unit, they ammended the statement. Their conclusion was that unit tests were easy if they had mastered the study questions.

Unit Tests

The unit tests included a variety of test question modes but one-third of the credits on each test came from essay questions. Essay questions proved to be less open to misinterpretation and stimulated discussion between proctor and student.

Each unit had three tests, forms A, B, and C. All covered the same material and the instructor attempted to make them equal. However, one test always was judged slightly harder or easier than the other two. That test was considered Test C. The clerks were instructed to give out either form A or B at random on a first attempt and save form C for those making a third attempt at mastery. No student required more than three attempts to master a unit.

The number of test attempts of 23 students for nine units is summarized in Table I. The 23 students required an average of ten tests to master nine units which is an average of 1.1 test per unit. One student who did not complete the course and the student auditing

Table I

Student Test Attempts

Number of Tests Taken to Complete Nine Units	Number of Students
9	9
10	8
11	2
12	2
13	2

the course took only one test and were not considered in the calculations. The 1.1 test per unit average is lower than those reported in the literature. The technical and mathematical material presented for mastery in the engineering and psychological statistics courses of Hoberock et al [15] and Murphy, McMichael and Cariello [37] may account for the higher test per unit averages they reported. The material covered in this course was simple and factual.

The number of test retakes correlated with the final examination score (-.55),(Table II). The final exam grade was considered a measure of student achievement in the course. This correlation indicates that students who repeated more tests often achieved less well than students who passed tests on the initial attempt. This negative correlation was higher than those reported by Kulik, Kulik and Hertzler [25] (-.43) and Murphy, McMichael and Coriello [37] (-.29). The highest of three negative correlation coefficients reported by Whitehurst and Madigan [38] was -.11 and they also recorded two positive correlation coefficients.

While going over students' tests the instructor noted that some students reached the 90 percent mastery criterion but consistantly scored only 90 percent. The total number of points lost on all unit tests was calculated for each student and correlated with their final examination grades. A correlation coefficient of -.69 was found, suggesting that students making fewer total mistakes on unit tests earned high final exam grades (Table 2).

Quality cummulative average (QCA) was considered a measure of

Table II

Pearson r Calculations

	Final Exam	QCA	Test Retakes	Test Errors	Rate
Final Exam		.63*	-.55*	-.69*	-.50*
QCA	.63*		-.31	-.32	-.67*
Test Retakes	-.55*	-.31			
Test Errors	-.69*	-.32			
Rate	-.50*	-.67*			

*Values are statistically significant at the $\alpha = 0.05$ level.
Note: The critical value of r at a significance level $\alpha = 0.05$ is 0.413 for 21 degrees of freedom.

overall student aptitude or ability. QCA related similarly to both test retakes ($r = -.31$) and total mistakes on unit tests ($r = -.32$) (Table 2). Kulik, Kulik and Hertzler [25] reported a similar relationship ($r = -.40$) between test retakes and grade point average.

Initially, the instructor intended each test to have ten questions of equal value; nine correct answers would have been necessary for mastery. This format proved too restrictive in preparing the first unit tests. There were an average of 13 questions on each of the 27 tests prepared. The number of points given for each question varied with the number of answers required for the question. The number of points each question was worth was noted beside that question. The total number of points required for mastery of each test was noted at the top of each test. This system for calculating mastery worked well. Students and proctors understood it and there was never any confusion over it.

Two students had to take three tests on Unit I to achieve mastery. Both were very discouraged. But one had changed her attitude about testing by the third unit. She reported that she was going to take a test for practice because she found she enjoyed and learned from taking them. The second student continued to be apprehensive about testing and it was not until the seventh unit that both the instructor's and proctor's logs reported that she smiled. The major difference noted between these students was the time they allowed themselves to finish the course. The first student came back immediately after unsuccessful attempts and finished the

course two weeks early. The second student waited three weeks after her first unsuccessful attempt to try again. By then she had markedly decreased the number of days left in which to finish nine units.

Lapses of attendance for one week after particular unit tests were counted to see if any particular unit test or unit reading assignment discouraged students. Eight week-long gaps were recorded after Unit I. These can be partially explained because the deadline for taking the first test in Unit I was set by the instructor and may not have reflected the students decision to begin the course. But it also must be recalled that Unit II was the unit least liked, most difficult and boring and the one chosen most often to be excluded in the future. Three week-long gaps were recorded after Units III and V and four week-long gaps occurred after Unit IV. Most of these gaps occurred during mid-terms when other courses required exams.

Student Rate

The course was student-paced with only one deadline imposed by the instructor. A date to have attempted the first test was set two weeks after the first class meeting. Two students did not make this deadline, but came the next class period for testing, reporting they had been sick. The second course deadline was the date for the final exam which was set for the last schedule class day by university policy. All regular students, but one, met this deadline. The auditing student did not attempt the final exam.

Student rate was limited by the rule that only one test could be taken in a class period. During the last week of the course this rule was waived to permit two students who were behind to take two tests in one day.

Rate incentives given were the scheduling of an early final three weeks before the last day of class and the posting of an anonymous rate chart at mid-term. Four students took the early final. In order to complete the nine units, two of the students accelerated their rate immediately prior to the early final examination date. The rate chart did not create much interest and few students bothered to look at it according to informal observation. Perhaps if it had been posted earlier it would have been more effective.

The proctors checked periodically with students who were slow to appear in the classroom after they attempted the first test. One month before the end of the course, the instructor sent notes through campus mail to the nine students who had six or more units to complete, reminding them of how many units they had left and how many class periods remained.

Most PSI research [13] has reported increased rate acceleration at the end of the term which is characteristic of behavior controlled by fixed-interval schedules of reinforcement. Approximately one-third of the students had dramatic acceleration in the last month of the course.

Proctors attempted to explain student absences of one week or more by asking students about them and recording answers in their

log. Most short gaps were due to other courses' demands at the time or a student illness. The long absences of the nine students who accelerated most rapidly near the end of the course were probably instances of procrastination as reported in the literature.[9,13]

Not passing a test did not slow the rate of most of the students. There was a total of 24 test retakes by students during the term. After 21 unsuccessful attempts students returned within one week to try again. In only three unsuccessful attempts did students wait for more than a week to take the second test.

Students were classified into four rate categories: early starters-early finishers (ES-EF), early starters-late finishers (ES-LF), late starters-early finishers (LS-EF), late starters-late finishers (LS-LF). Early starters began the course before the teacher imposed deadline. Late starters began the course on or after the deadline or took one test a class earlier but did not reappear for testing again for more than two weeks after the deadline. Early finishers completed the nine units at least two weeks before the final exam. Late finishers completed the course material during the last two weeks. All but one of these finished the course during the final week of the course. The data are reported in Table

The seven students categorized as early starters-early finishers had the highest average QCAs and final examination scores and the lowest number of test retakes. The 15 students who were early starters had higher average QCA's and final exam scores than the eight late starters.

Table III

Rate Categories

Rate Categories	Number of Students	QCA Average	Final Exam Average	Test Retakes Average
Early Starters-Early Finishers	7	3.0	87.8 (SD=±9.2)	.6
Early Starters-Late Finishers	8	2.7	86.2 (SD=±5.8)	1.4
Late Starters-Early Finishers	1	2.4	82.2	1.0
Late Starters-Late Finishers	7	2.1	80.0 (SD=±7.2)	1.4

Note: Rate was defined as the number of class days between the first day of class and the day a student completed the nine units of work.

A profile of a student in each category may illustrate the rate patterns of each group although these students are not entirely representative of other members of their group. B.B., an ES-EF, was the fastest student in the class and completed the nine units in ten class periods. She made only four errors on all nine tests. She had the highest QCA in the class and had the second highest final exam score. She was a quiet, reserved student who requested little help from her proctor and the instructor. She became more comfortable with her proctor as the course progressed. C.H., an ES-LF, had successfully passed two tests before the instructor-imposed deadline and finished the course material at the beginning of the last week. She had two absences of one and a half weeks. The first was unexplained and the second was due to other courses' demands. She required one test retake. She had the same QCA as the class average, 2.6, and got an 81.2 per cent on the final in which the average was 84.4 per cent. V.P., a LS-EF, took the first test on the day of the deadline, Unit II a week later and Unit III a week after that. He did not reach mastery on his first attempt on Unit IV, two class days later. After that, he came almost every class day and completed the course two weeks before the final. His QCA and final exam grade was slightly below the class average. His confidence grew noticeably as the course progressed and he went out of his way to be sure the instructor noted his success. S.C., a LS-LF, took his first test on the day of the deadline and did not come to class again until there were only eight class days left for him to complete eight units. He

volunteered that the warm spring weather had made it difficult for him to concentrate on his course work. S.C. failed Unit II. He was hostile toward his proctor that day and later asked the instructor if he could have an extra meeting so that he might finish all the units. After he had successfully completed five more units an extra day was provided. He failed the test he attempted on that day. No more exceptions were made for S.C. but an extra class hour was provided for all the late finishers and he was able to complete the nine units. He had a 2.0 QCA and got the lowest grade in the class on the final.

In summary, students who were categorized as ES-EF had the highest average final exam score and QCA and the fewest test retakes. Students in the LS-LF group had the lowest average final exam score and QCA and, along with the ES-LF group, the greatest number of test retakes. Students in the ES-LF and LS-EF groups had final exam score and QCA averages which ranged between the averages of the ES-EF and LS-LF groups. (Table 3).

In calculating rate correlations, rate was defined as the number of class days between the first day of class and the day a student completed the nine units of work. The rate correlated with the final exam score (-.50) and with QCA (-.67) (Table 2), indicating that students who worked at a faster pace generally did better on the final exam and had a higher QCA than students who worked at a slower pace. Boyko [33] reported a high correlation between rate of progress and eventual grade earned. Nazzaro, Todorov, and Nazzaro [30] found a .30 correlation coefficient between the rate and the number of errors

on the final exam. However, the latter investigators reported no correlation of rate and grade point average. More research must be published on this point before a tentative conclusion can be drawn.

Failures to Complete the Course

No student officially withdrew from the course. However, one student completed only one unit and received an F. Attempts by the proctor and the instructor to reach the student were unsuccessful A roommate reported that during the quarter the student had been ill and had had a death in her family. The student did not request an incomplete grade for the course.

Most PSI courses described in the literature[3,6,15,20] have reported between 5 and 20 per cent withdrawals or failures to complete the course. The low number of failures to complete the course (one student of 24 or 4 per cent) was probably due in part to the proctors' and instructor's calls and notes encouraging students to finish the course. This individual attention to procrastinators was possible because of the small number of students enrolled in the course.

Student Performance on the Final Exam

Both the final examination and the early final exam were made up of questions worth 100 points. To equate the two tests for statistical calculations, 77 points common to both tests were identified and the tests were regraded on the basis of the common points.

Final exam grades ranged from 96.7 percent to 63.8 percent the class average being 84.4 percent (SD = $\pm$ 8.2). The final exam scores of each proctor's students were averaged resulting in similar means of 85.1 percent (SD = $\pm$ 7.4), 84.2 percent (SD = $\pm$ 10.6), and 83.9 percent (SD = $\pm$ 7.6).

To determine whether student aptitude and ability, as measured by QCA, were related to student performance on the final exam, the correlation between QCA and final examination scores was calculated. A positive correlation of .63 was found, showing that high-aptitude students out-performed low-aptitude students on the final exam. When teaching for mastery, the ideal is that rate and remediation (retakes) may vary according to ability (QCA) but that there should be little variation between students in end-of-course performance (final exam). This investigator found rate and QCA highly correlated (-.67) and retakes the QCA less correlated (-.31) (Table 2). The degree of correlation between QCA and the final exam grade (.63) was disappointing but in general agreement with published studies [25-30] that calculated this correlation. Two studies [26,29] reported slightly higher aptitude-final exam correlations for lectures section students than for PSI section students. More comparative studies need to report aptitude-final exam correlations before it can be concluded that the PSI method decreases the relationship between QCA and final exam scores more than the lecture method.

The time elapsing between the completion of Unit IX and the final

exam was calculated for every student. There was no correlation between the time interval and the final exam scores indicating that retention as measured by the final exam grade was not affected by the time interval. No time interval was longer than 19 days.

The 23 students taking the final exam had completed nine course units. This gave all students an A for 75 per cent of the course grade. An A was designated as 95 points by the instructor. Seventy-five percent of 95 points is 71.25 points. To receive an A for the course, 90 points were necessary. One hundred percentage points were possible on each of the final examinations. Twenty-five percent of each final exam grade was calculated and added to the 71.25 points each student had already earned. The lowest final exam score which allowed the necessary 90 points for an A was 75 percent. Of the students who took the final, 22 received A's in the course and one student received a B.

Course Evaluations

The course evaluations had 27 questions requesting students to rate the teaching method, the subject and materials, the instructor and proctors, the tests and the grading policy and to compare the lecture method and PSI. The evaluation questions and responses are given in the appendix. Room for comments was provided after each category of questions. Twenty-three students completed evaluations.

When asked about the amount of student time and effort for the course, 18 felt that more was required than in the average one credit

course and five felt the requirement was about the same. None felt that less than the average amount of time and effort was required. Eleven students felt too much was required for a one credit course and 11 thought that a reasonable amount was required. None thought too little was required. Seven students filled in additional written comments about how much work was involved in the course. The student complaint of too much work is commonly reported in PSI literature. [13,18,19]

The proctors frequently asked students about how much time they spent preparing a particular unit. The proctors' logs show that no student reported spending more than two hours in preparation for a unit. This showed support for Taylor's [20] suspicion that students underestimate the amount of time course work requires. She speculated that it is the average and poor students who underestimate the most. The average QCA of the 11 students who thought the course required a reasonable amount of work was 2.95: the mean QCA for the 11 who thought it required too much work was 2.28. This suggests that the students who have done better in college are used to doing more work than those who have not done as well.

Sixteen students reported being very satisfied with the amount they learned; six were satisfied; one was somewhat unsatisfied. In regard to course structure and deadlines, 17 students thought they were about right, one student would have preferred more structure, and five students would have preferred less. The only written suggestion for a structural change was that more than one test attempt be allowed

in a class period. This could not be arranged because the classroom was available only for 50 minute periods. In that time, two tests could have been taken and corrected but no time would have been available for studying between an unsuccessful attempt and a second test on the same unit.

Seventeen students felt that they probably learned more with PSI than they would have if the course had been a lecture course and six students thought they learned about the same. None felt they learned less with PSI.

Most of the students were satisfied with the instructor-student contact during the course. Sixteen of the students indicated they probably had more contact with their instructor with the PSI format than they had in lecture courses. Only three students felt they had less.

The instructor was rated very knowledgeable in the subject material by 20 students, always available for questions by 14 students and very helpful by 22 students. Nine students felt she was usually available to answer questions.

The section on evaluation of the proctors evoked 15 written comments, more than any other subjects covered in the evaluation. Most comments were in praise of individual proctors or the proctor system in general. Fourteen students rated the proctor system as generally an excellent idea and nine students thought it was generally worthwhile. No student felt it needed improving or was generally an

undesirable system.

All but one student thought the unit tests were always or usually fair. Nineteen students indicated that unit tests always required understanding of major points of the readings and three noted that they sometimes required knowledge of unimportant details.

In evaluating the grading policy for the course, four students thought too much weight was placed on the final exam while 18 students felt the weight assigned to completing the units and the final exam was about right.

The proctors handed in written comments on the general topics covered in the student evaluation. All the proctors were happy with their proctoring experience and felt they learned the course material very well because of the opportunity to answer questions and grade tests for their students. Their evaluations and their actions throughout the course showed concern for the students assigned to them. All reported enjoying the proctor-student interactions. The three proctors commented on the fairness of the testing and liked the idea that students knew exactly what was to be learned for each unit. Two proctors thought that if they had been students in the course they would have liked more instructor-imposed deadlines.

The coalescence of opinion with actual course structure was gratifying. As a whole, the evaluations were positive and indicated a liking for the course material and the PSI method. Only one student wrote consistant comments stating that she would have preferred to take the course by the lecture method. The comment which the instructor

found most rewarding was written by a LS-LF junior with a 1.8 QCA who earned 92.1 per cent on the final exam. "Believe it or not, I have attended the university for three years and have not mastered one particular method of successful studying. Through this course, I have. The study questions helped me focus on important material in this couse and now I can do the same in other courses. It was a fantastic course and I benefited greatly. Thank you!"

Course Revisions

As the students progressed through the course material it became evident that some changes in course reading material, study questions and tests would improve the learning experience.

Student ratings of the text material have been discussed in an earlier chapter. The instructor's conclusion was that text readings were acceptable except for those assigned for Unit II which received consistant criticism in the student evaluations. Unit II should be rewritten with the same information presented in a single, comprehensive reading.

A short reading on the Food and Nutrition Service of the Department of Agriculture should be added to the course because this Service administers programs covered in Units III, IV, and V of the course and because it was not described separately. The reading could be included with Unit IV material on the Child Nutrition Programs since the readings for the unit are short. The order of

units III and IV could be reversed because the sequence is not critical.

The first reading for the course, "Eating in the Dark", (Note 1) included the initials HANES three times and once gave the wrong interpretation of the letters. A test question asked what the letters abbreviated. The last student to take the test for Unit I was the first to notice the discrepancy. This error in the reading obviously should be corrected.

There were a few words used on tests that some students did not know and, consequently, they missed the questions. Rather than change these words, the instructor suggests that a dictionary be made available during tests for such situations.

In Unit I, the questions missed most often in test forms A and B related to study question 12 which asked students to name the three recent major nutrition surveys, mentioning the shortcomings of each. The proctors agreed with the instructor that the problem did not arise from the wording of the study question or the test questions but with the way information about these surveys was handled in the unit reading. A few paragraphs on the surveys could be added to the notes for clarification to make this information more lucid.

In Unit III, some test errors stemmed from study question 7 which asked for a description of growth of the food stamp program during four different time periods. The reading material was crowded with numbers and was confusing on this point. The problem could be solved by adding the answer to question 7 given on the proctor answer sheet to the notes

for clarification for Unit III. Study question 14 of this unit did not cause many test errors but precipitated many student questions prior to the test. It asked for legislative arguments made for and against food stamp nutrition education provisions. The number of points to be learned, both for and against, should have been specified in the question. If this had been done, many student questions could have been eliminated.

Test form A of Unit IV required more retakes than any other test. Test question 2 asked students to name two groups of Americans who benefited from the school lunch program. This question was not presented directly in the study questions or the reading. The test question should be changed to ask the students to give two reasons why the National School Lunch Program was established. Also in Unit IV, a number of students failed to note that the meals offered to children through the Summer Food Service Program were free even though the test and study question clearly asked for this information. The reading states, "In FY76, the summer program reached 2.4 million children, all of whom received free lunch." However, the preceeding paragraph gives government reimbursement figures for institutions providing the meals in the summer program. Some students confused the amount the government pays to institutions with the amount the children pay. To clarify this point the study question could be changed to include a question about government reimbursement or the statement in the reading on free lunch could be underlined.

Test form B of Unit VI included two questions that the proctors and a few students thought somewhat unfair. In question 3, one of the choices given for completing "In the Title VII program" was "persons must be poor and over 60 years to participate". This was an incorrect choice because there is no need to prove economic necessity to participate in the program. However, program participants may be poor and often are living on low incomes. Part of the statement, "persons must be... over 60 years to participate", is correct. This test question could be clarified by making each part of this statement a separate choice which would allow students to concentrate more on the words "must be poor" or the phrase could be made a correct choice by changing it to read "may be poor". Question 4 was a true or false question stating "The Title VII Nutrition Program for the elderly became a national program in 1968". The program began with federal demonstration projects in 1968. It was not until 1972 that money was available to all states for the program. As written, some students interpreted "national program" in the question to mean a program that is funded by the federal government and judged it a correct statement. The instructor intended "national program" to mean a program available to all states and meant it to be a false statement. Changing "national program" to "program available to all states" would clarify the statement.

In Unit VII, the instructor misread a paragraph in the reading assignment and because of this, constructed test question 4 in test form A incorrectly. The paragraph in question described in four

sentences how the EFNEP participants were increasingly drawn from urban rather than rural populations. However, the fifth sentence explained that the terms "urban" and "rural" had been recently redefined by the Extension Service and that because of the new definition, the proportion of urban families participating was presently about 30 percent. The instructor had not noted the fifth sentence. This paragraph should be rewritten and simplified. Question 4, a multiple choice question, could easily be changed to correct the error. In the course, the first student to take test form A pointed out the error in question 4 and the incorrect choice was crossed out on the rest of the form A tests.

The most incorrect answers on tests for Unit IX were given for question 5 on form A and question 1 on form B. Both pertained to the responsibilities of the Bureau of Foods. Students incorrectly assumed that the Bureau of Foods was responsible for drugs and cosmetics as well as food. A study question could be added which asks directly whether cosmetics and drugs are under the jurisdiction of the Bureau of Foods. The unit reading gives this information and if students were specifically directed to it they would probably be able to answer the test questions correctly.

All course materials were spirally bound and are available for loan from the Virginia Polytechnic Institute and State University Library. (69)

CONCLUSIONS

Student achievement in the one credit PSI course was high. Twenty-three of 24 students mastered at least 90 percent of the material in nine units. Twenty-two students received an A in the course.

Twenty-three students and three proctors completed course evaluations. In general, the evaluations reflected positive student and proctor attitudes toward course materials and the PSI method. The student achievement and student evaluations reported by Cross and Semb,[41] Boren and Foree[42] and this investigator indicate that PSI may be an effective way to improve college nutrition education.

Four factors correlated with final exam performance: QCA, unit test retakes, total unit test errors and working rate. Students with higher QCA's and fewer unit test errors and test retakes generally did better on the final exam than students with lower QCA's and more unit test errors and test retakes. Students who began taking tests early in the term had higher final exam grades than the students who began later in the term.

LITERATURE CITED

1. Dublin, R. & T. C. Taveggia. 1968 The Teaching Paradox: A Comparative Analysis of College Teaching Methods. Center for the Advanced Study of Educational Administration. Eugene, Oregon.

2. Dublin, R. & R. A. Hedley. 1968 The Medium may be Related to the Message: College Instruction by TV. Center for the Advanced Study of Educational Administration. Eugene, Oregon.

3. Keller, F. S. 1968 Good-bye Teacher. J. Appl. Behav. Anal. 1: 79-89.

4. Keller, F. S. 1974 Ten Years of Personalized Instruction. Teach. Psychol. 1: 4-9.

5. Taveggia, T. C. 1976 Personalized instruction: A summary of comparative research, 1967-1974. Am. J. Phys. 44: 1028-1033.

6. Robin, A. L. 1976 Behavioral Instruction in the College Classroom. R. Educ. Res. 46: 313-354.

7. Kulik, J. A., C.-L. Kulik & B. Smith. 1976 Research on the Personalized System of Instruction. Prog. Learn. Educ. Tech. 13: 23-30.

8. Johnson, K. R. & R. S. Ruskin. 1977 Behavioral Instruction: An Evaluative Review. American Psychological Association, Inc., Washington, D.C.

9. Keller, F. S. & J. S. Gilmore. 1974 The Keller Plan Handbook. W. A. Benjamin, Inc., Menlo Park, Calif.

10. Klopfenstein, K. F. 1977 The Personalized System of Instruction in Introductory Calculus. Am. Math. Mo. 84: 120-124.

11. Minke, K. A. & J. G. Carlson. 1973 as reported in Keller, F. S. & B. V. Koen, (Ed.). 1976 The Personalized System of Instruction State of the Art, 1976. A report to the Alfred P. Sloan Foundation prepared by Engineering Institutes. University of Texas, Austin.

12. Calhoun, J. K. 1976 The Combination of Elements in the Personalized System of Instruction. Teach. Psychol. 3: 73-76.

13. Keller, F. S. & B. V. Koen, (Ed.) 1976 The Personalized System of Instruction State of the Art, 1976. A report to the Alfred P. Sloan Foundation prepared by Engineering Institutes. University of Texas, Austin.

14. Kulik, J. A., C.-L. Kulik & K. Carmichael. 1974 The Keller Plan in science teaching. Science 83: 379-383.

15. Hoberock, L., B. V. Koen, C. H. Roth & G. R. Wagner. 1972 Theory of PSI Evaluated for Engineering Education. IEEE Trans. Educ. E-15: 25-29.

16. Green, B. A. 1971 Physics Teaching by the Keller Plan at MIT. Am. J. Phys. 39: 764-775.

17. Nelson, T. F. & D. W. Scott 1972 Personalized Instruction in Educational Psychology. Mich. Acad., 4: 293-296.

18. Born, D. G. & E. W. Herbert. 1971 A Further Study of Personalized Instruction for Students in Large University Classes. J. Exp. Educ. 40: 6-11.

19. Taylor, P. 1975 Student Performance and Attitude in a Contingency Management Course. J. Exp. Educ. 43: 55-60.

20. McMichael, J. S. & J. R. Corey. 1969 Contingency Management in an Introductory Psychology Course Produces Better Learning. J. Appl. Behav. Anal. 2: 79-83.

21. Myers, W. A. 1970 Operant Learning Principles Applied to Teaching Introductory Statistics. J. Appl. Behav. Anal. 3: 191-197.

22. Born, D. G. & P. Whelan. 1973 Some Descriptive Characteristics of Student Performance in PSI and Lecture Courses. Psychol. Rec. 23: 145-152.

23. Johnston, J. M. & G. O'Neil. 1973 The Analysis of Performance Criteria Defining College Grades as a Determinate of College Student Academic Performance. J. Appl. Behav. Anal. 6: 261-268.

24. Semb, G. 1974 Personalized Instruction: The Effect of Mastery Criteria and Assignment Length on College Performance. J. Appl. Behav. Anal. 7: 61-69.

25. Kulik, J. A., C.-L. Kulik & E. C. Hertzler 1977 Modular College Teaching With and Without Required Remediation. J. Pers. Instr. 2: 70-75.

26. Born, D. G. & M. L. Davis. 1974 Amount and Distribution of Study in a Personalized Instruction Course and in a Lecture Course. J. Appl. Behav. Anal. 7: 365-375.

27. Wood, W. S. & R. G. Wylie. 1975 As reported in Robin, A. L. 1976 Behavioral Instruction in the College Classroom. R. Educ. Res. 46: 313-354.

28. Moore, J. W., W. E. Hauch & E. D. Gagne. 1973 Acquisition, Retention and Transfer in an Individualized College Physics Course. J. Educ. Psychol. 64: 335-340.

29. Morris, C. J. & G. McA. Kimbrell. 1972 Performance and Attitudinal Effects of the Keller Method in an Introductory Psychology Course. Psychol. Rec. 22: 523-530.

30. Nazzaro, J. R., J. C. Todorov & J. N. Nazzaro 1972 Student Ability and Individual Instruction. J. Coll. Sci. Teach. 2: 29-30.

31. Robin, A. L. & M. Q. Graham. 1974 As reported in Keller, F. S. & B. V. Koen (Ed.) 1976 The Personalized System of Instruction State of the Art, 1976. A report to the Alfred P. Sloan Foundation prepared by Engineering Institutes. University of Texas, Austin.

32. Henneberry, J. K. 1976 As reported in Keller, F. S. & B. V. Koen (Ed.) 1976 The Personalized System of Instruction State of the Art 1976. A report to the Alfred P. Sloan Foundation prepared by Engineering Institutes. University of Texas, Austin.

33. Boyko, G. 1971 As reported in Keller, F. S. & B. V. Koen (Ed.) 1976 The Personalized System of Instruction State of the Art 1976. A report to the Alfred P. Sloan Foundation prepared by Engineering Institutes. University of Texas, Austin.

34. Semb, G. 1974 Personalized Instruction: The Effects of Mastery Criteria and Assignment Length on College Student Test Performance. J. Appl. Behav. Anal. 7: 61-69.

35. Nelson, T. F. & M. Bennett. 1973 Unit Size and Progress Rates in Self-Paced Instruction. J. Coll. Sci. Teach. 3: 130-133.

36. Semb, G., B. L. Hopkins & D. E. Hurst. 1973 The Effect of Study Questions and Grades on Student Test Performances in a College Course. J. Appl. Behav. Anal. 6: 631-642.

37. Murphy, H. A., J. S. McMichael & R. P. Cariello. 1977 Correlating Unit-Quiz Retakes and Final Examination Performance. J. Pers. Instr. 2: 49-51.

38. Whitehurst, C. & J. Madigan. 1975 Slow Learners in PSI Courses. Do They Learn Less? J. Higher Educ. 46: 55-62.

39. Edwards, K. A. 1972 As reported in Keller, F. S. & B. V. Koen (Ed.). 1976 The Personalized System of Instruction State of the Art 1976. A report to the Alfred P. Sloan Foundation prepared by Engineering Institutes. University of Texas, Austin.

40. Sherman, J. G., B. A. Green, Jr. & R. S. Ruskin. (Ed.) 1971-1976 Personalized System of Instruction Newsletter. Center for Personalized Instruction, Georgetown University, Washington, D.C. 20057.

41. Cross, M. Z. & G. Semb. 1975 A Personalized University Course in Nutrition. J. Nutr. Educ. 7: 149-151.

42. Boren, A. R. & S. B. Foree. 1977 Personalized Instruction Applied to Food and Nutrition in Higher Education. J. Pers. Instr. 2: 39-42.

43. Senate Select Committee on Nutrition and Human Needs. 1976 Nutrition and Health II. U.S. Government Printing Office. Washington, D.C.

44. Forbes, S. L. 1977 National Nutrition Policy Issue Brief Number 1B74102. Library of Congress Congressional Research Service. Washington, D.C.

45. Schlossberg, K. 1976 Progress Toward a National Food Policy. J. Am. Diet. Assn. 68: 326-329.

46. Mayer, J. 1973 U.S. Nutrition Policies in the Seventies. W. H. Freeman and Company. San Francisco, Calif.

47. Michelman, K. 1976 Federal Food Assistance Programs. Library of Congress Congressional Research Service. Washington, D.C.

48. United States Government Manual 1976-1977 U.S. Government Printing Office. Washington, D.C.

49. Food and Nutrition Service. 1975 The Food Stamp Program. U.S. Department of Agriculture. Washington, D.C.

50. Richardson, J. 1976 Food Stamp Program Reform Issue Brief Number 1B75060. Library of Congress Congressional Research Service. Washington, D.C.

51. Senate Committee on Agriculture and Forestry. 1976 Selected Materials Concerning Major Food Stamp Reform Legislation. U.S. Government Printing Office. Washington, D.C.

52. National Dairy Council. 1974 Child Nutrition Programs. Dairy Council Digest. 45: 1-5.

53. Michelman, K. 1976 Child Nutrition Program Issue Brief Number 1B75045. Library of Congress Congressional Research Service. Washington, D.C.

54. Food and Nutrition Service. 1976 Annual Statistical Review of Food and Nutrition Programs, Fiscal Year 1976. U.S. Department of Agriculture. Washington, D.C.

55. 1975 Section 18: Cash Grants for Nutrition Education. Child Nutrition Act of 1966, As Amended. Government Printing Office. Washington, D.C.

56. Miller, G. 1976 Legislation for Nutrition: It Depends on You. J. Nutr. Educ. 8: 8, 10.

57. 1975 Title VII: Nutrition Program for the Elderly. Older Americans Act of 1965, As Amended. Government Printing Office. Washington, D.C.

58. Tager, E. 1976 The Older Americans Act: Summary of Major Provisions, As Amended; Development of Major Provisions, 1965-1975; Authorizations and Appropriations, 1965-1978. Library of Congress Congressional Research Service. Washington, D.C.

59. Humphrey, H. 1976 The Need for a National Meals-on-Wheels Program. Hearings before the Select Committee on Nutrition and Human Needs of the United States Senate. U.S. Government Printing Office. Washington, D.C.

60. Leidenfrost, N. B. 1975 EFNEP...Accomplishments and Future Needs. Extension Service, U.S. Department of Agriculture. Washington, D.C.

61. U.S. HEW, PHS, HSA, BCHS. 1976 Supplement to Legislative Base, Maternal and Child Health Programs. Rockville, Md.

62. U.S. HEW, PHS, HSA, BCHS. 1975 Legislative Base, Maternal and Child Health Programs. Rockville, Md.

63. U.S. HEW, PHS, HSA, MCHS. 1973 Promoting the Health of Mothers and Children. Rockville, Md.

64. U.S. HEW, PHS, HSA, BCHS. 1975 Promoting Community Health. Rockville, Md.

65. U.S. HEW, Health Services and Mental Health Administration, MCHS. 1972 The Children and Youth Projects. Rockville, Md.

66. Wallace, H. M., E. M. Gold & E. W. Lis, (Ed.) 1973 Maternal and Child Health Practices. Charles C. Thomas, Publisher. Springfield, Ill.

67. Norman, C. 1975 Food Labeling. Nutr. Today. 10: 28-30, 34, 36.

68. Beloian, A. 1973 U.S. RDA vs. MDR. FDA Consumer. September p. 16.

69. Donovan, P. (Ed.) 1977 A PSI Government Nutrition Education Course, available for loan from Virginia Polytechnic Institute and State University Library, Blacksburg, Virginia.

APPENDIX: COURSE EVALUATIONS

RATE THE PSI TEACHING METHOD.

Question	Choices	Number of Students
1. Amount of time and effort:	more than the average 1 cr. course	18
	about the same	5
	less than the average 1 cr. course	0
2. Amount of time and effort:	too much for a 1 cr. course	11
	a reasonable amount	11
	too little for a 1 cr. course	0
3. Amount learned	very satisfied	16
	satisfied	6
	somewhat unsatisfied	1
	very unsatisfied	0
4. Structure (deadlines, schedules)	would have preferred more	1
	about right	17
	would have preferred less	5
5. PSI	excellent idea	9
	generally a good idea	13
	has some drawbacks	2
	generally a poor idea	0

COMPARE THE LECTURE METHOD AND PSI.

6. Amount learned	probably learned more with PSI than I would have if this had been a lecture course	17
	probably learned about the same	6
	probably learned less with PSI	0
7. Grade	probably got a higher grade with PSI	14
	probably would have gotten the same grade with lecture	8
	probably got a lower grade with PSI	1

Question	Choices	Number of Students
8. Instructor - Student Contact	probably more with PSI	16
	probably about the same as lecture	3
	probably less with PSI	3

RATE THE SUBJECT AND MATERIALS FOR THIS COURSE.

9. Subject covered in this course	will be useful in my area of home economics	13
	may be useful sometimes in my area of home economics	5
	will probably not be useful in my area of home economics	4
	will be totally useless in my area of home economics	0
10. Generally, the reading material for this course was	almost always interesting	10
	usually interesting	13
	usually uninteresting	0
	almost always uninteresting	0
11. Generally, the reading material for this course was	relatively difficult	3
	average	16
	relatively easy	1
12. Units	too many for a 1 cr. course	10
	about right for a 1 cr. course	13
	too few for a 1 cr. course	0
13. Units	most were too long	3
	most were the right length	18
	most were too short	0
14. Unit Introductions and Notes for Clarification	helpful	20
	O.K.	3
	not helpful	0
	often didn't read them	0

RATE INSTRUCTOR AND PROCTORS.

15. The instructor	very knowledgeable in subject	20
	fairly knowledgeable in subject	3
	little knowledge of subject	0

Question	Choice	Number of Students
16. The instructor	always available to student	14
	usually available to student	9
	seldom available to student	0
17. The instructor	very helpful	22
	fairly helpful	1
	of little help	0
	I didn't need help	0
18. The instructor had the course	extremely well organized	15
	well organized	8
	some flaws in organization	0
	poorly organized	0
19. The proctors understood course material	very well	12
	fairly well	10
	poorly	1
20. When course material was unclear to me, the proctors	often helped me to understand it	15
	sometimes were helpful	6
	seldom were helpful	1
	I didn't need help	1
21. When I thought I was right, I felt free to disagree with the proctor	always	18
	usually	3
	seldom	1
	never	0
22. Proctors graded tests fairly (all students treated the same)	almost always fair	19
	usually fair	3
	often unfair	0
	almost always unfair	0
23. Proctor system	generally an excellent idea	14
	generally worthwhile	9
	could use improvement	0
	generally undesirable	0
RATE UNIT TESTS.		
24. Unit tests	always very fair (based on study questions)	12
	usually fair	9
	sometimes fair	1
	usually not fair	0
	not fair	0

Question	Choice	Number of Students
25. Unit tests	almost always required understanding of major points of readings	19
	sometimes required knowledge of unimportant details	3
	depended largely on knowledge of unimportant details	0
26. Mastery requirement on unit tests	always too high (required too many points for success)	1
	usually too high	3
	sometimes too high	7
	always, about right	8
	usually, about right	4
RATE GRADING POLICY.		
27. The grading policy (75% of grade on units completed, 25% on final exam)	too much weight on units completed	0
	too much weight on final exam	4
	about right	18

Unit Number	Unit "Most Liked" Number of Students	Unit "Most Disliked" Number of Students	Unit "Too Difficult" Number of Students
I	1	1	0
II	0	3	3
III	4	0	0
IV	8	1	1
V	5	1	0
VI	3	1	1
VII	3	1	0
VIII	1	1	0
IX	6	0	0

Unit Number	Unit "Too Long" Number of Students	Unit "Too Short" Number of Students	Unit "Too Easy" Number of Students
I	0	0	0
II	4	0	0
III	1	0	2
IV	0	1	0
V	0	0	0
VI	0	0	0
VII	0	0	0
VIII	1	0	0
IX	0	0	0

Unit Number	Unit "Most Boring" Number of Students	Unit "Most Interesting" Number of Students	Unit "Cut" Number of Students
I	0	0	4
II	6	0	9
III	0	6	1
IV	0	6	0
V	0	4	0
VI	2	4	1
VII	0	1	3
VIII	0	0	1
IX	0	4	1

Unit Number	Unit Test "Too Difficult" Number of Students	Unit Test "Too Easy" Number of Students	Unit "Saved" Number of Students
I	0	0	5
II	1	0	0
III	0	0	5
IV	2	0	4
V	0	0	1
VI	2	0	1
VII	1	0	2
VIII	0	0	1
IX	0	0	5

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A GOVERNMENT NUTRITION EDUCATION COURSE TAUGHT BY PERSONALIZED SYSTEM OF INSTRUCTION

by

Patricia Ryan Donovan

(ABSTRACT)

Materials for and implementation of a course in government nutrition education programs taught by personalized system of instruction (PSI) is described. Twenty-four students learned by progressing through nine units of written objectives, reading assignments and tests at their own pace. Ninety percent mastery was required to pass unit tests and tests were retaken without penalty until the criterion was met. Three course assistants, called proctors, provided immediate individualized scoring of unit tests.

Twenty-two students received an A for the course; one student, a B; one student completed only one unit and received an F. Course evaluations reflected positive student and proctor attitudes toward course material and the PSI method.

Four factors correlated with final exam performance: quality cummulative average (QCA), the number of unit test retakes, total unit test errors and working rate. High ability students out-performed low ability students on the final exam. Students with fewer test retakes and errors generally did better on the final exam than students who took more tests to achieve the 90 percent mastery criterion or who made more test errors. Those who began taking tests early in the term had higher final exam grades than those who began later in the term.